

ANNUAL REPORT 2002 - 2003



All India Coordinated Research Project on Spices



INDIAN INSTITUTE OF SPICES RESEARCH

(Indian Council of Agricultural Research)

Calicut - 673012, Kerala

ALL INDIA COORDINATED RESEARCH PROJECT ON SPICES

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(Indian Council of Agricultural Research)

CALICUT – 673 012, KERALA, INDIA

Published by

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परियोजना समन्वयक की रिपोर्ट

अखिल भारतीय समन्वित मसाला अनुसंधान परियोजना (ए आई सी आर पी एस) देश के मसाला अनुसंधान का सबसे बड़ा नेटवर्क होता है। अखिल भारतीय समन्वित मसाला अनुसंधान परियोजना 1971 (IV योजना) में मसाले और काजू की संयुक्त परियोजना के रूप में शुरू हुआ। यह दो अलग परियोजना के रूप में विभाजित किया जिनमें एक मसाले और काजू दोनों के लिए 1985 में शुरू हुआ तब से भारतीय मसाला फसल अनुसंधान संस्थान (आई आई एस आर), कालिकट को मुख्यालय बनाकर एक पूर्णकालिक समन्वयक के साथ ए आई सी आर पी एस चालू हो गया।

ए आई सी आर पी एस के अन्तर्गत अब 15 राज्यों में व्याप्त 15 कृषि विश्व विद्यालय के आधार पर 19 केन्द्र चालू हो रहे हैं। इसके अलावा आठ सहकारी/स्वेच्छा से आये केन्द्र, जिसमें बड़ी इलायची के लिए आई सी ए आर रिसर्च काम्प्लेक्स, गोआ भी शामिल है, इस परियोजना के साथ सहयोगी कार्य कर रहे हैं। ए आई सी आर पी एस का कुल स्टाफ 83 होता है जिसमें 51 वैज्ञानिक तथा 32 तकनीकी/सहकारी स्टाफ होते हैं। प्रत्येक केन्द्र का 75% व्यय भारतीय कृषि अनुसंधान परिषद से तथा बचे हुए 25% व्यय संबन्धित राज्य कृषि विश्व विद्यालय से दिया जाता है।

इस परियोजना का अधिदेश निम्नांकित द्वारा राज्य में मसालों का उत्पादन क्षेत्र, उत्पादन और उत्पादकता में वृद्धि लाना है।

- i विभिन्न कृषि पारिस्थितिक दशाओं के लिए उचित गुणवत्तावाले कीट या रोग सहाय उच्च उपजवाले किस्मों को विकसित करना।
- ii विभिन्न कृषि - जलवायु की दशाओं के अन्तर्गत आनेवाले मसाला फसलों के लिए कृषि प्रविधियों को मानकीकृत करना।
- iii मूल्य प्रभावित एवं कीट और रोगों के लिए कुशल प्रबन्धन तरीकों को विकसित करना।
- iv राज्य कृषि विश्व विद्यालय, आई आई एस आर एवं आई सी ए आर के बीच अन्तराफलक के रूप में काम करना।

ए आई सी आर पी एस के विभिन्न केन्द्रों में 12 मसाला फसलों के 110 अनुसंधान परियोजनाएँ चालू हो रही हैं तथा वर्ष 2002-03 में इन परियोजनाओं की बड़ी देन भी होती है।

फसल सुधार

फसल सुधार में 35 कार्यक्रम के साथ 59 परियोजनाएँ चालू हो रही हैं। ए आई सी आर पी एस केन्द्रों ने मसाला फसलों के जननिक संसाधनों को प्रबल बना दिया तथा विभिन्न प्राचल के लिए जर्मप्लासम का मूल्यांकन किया और प्रत्येक फसल के आशाजनक अक्सरशनों की पहचान भी की गयी। ए आई सी आर पी एस के विभिन्न केन्द्रों के जर्मप्लासम में अब काली मिर्च - 650, इलायची - 369, अदरक - 644, हल्दी - 1307, वृक्ष मसाले - 228, और बीज मसाले - 3901 आदि उपलब्ध हैं। प्रस्तुत काल में नये केंद्रीय प्रजाति परीक्षण (CVTs)/केंद्रीय उपजता परीक्षण की शुरुआत की गयी।

पन्त्रियूर में उच्च उपजवाली प्रजातियों को विकसित करने के लिए काली मिर्च में, अन्तर प्रजाति संकरण चालू हो रहा है। आशाजनक किस्मों का चयन करके भिन्न स्थानीय परीक्षण किया जाता है। पन्द्रह अन्तर संकरों को बना दिया और बीज भी उपलब्ध हुआ। सोलह जर्मप्लासम अक्सरशनों के बीजों को OP संतति मूल्यांकन के लिए प्रोया गया। आशाजनक काली मिर्च प्रजातियों के अन्तर विशिष्ट संकरजों को पाइपर कोलुब्रिनम के साथ मूल्यांकन किया जा रहा है। अम्बलवयल में पंचमी, पन्त्रियूर - 4, पन्त्रियूर - 3, अक्सरशन - 2445, अक्सरशन - 2426 और पन्त्रियूर - 5 आदि को केरल के उच्चतर क्षेत्रों के लिए आशाजनक देखा गया। इलायची अक्सरशन जैसे CL - 730, CL - 692 और D - 237 आदि को आशाजनक देखा जाता है और उन्हें मडिकेरी के प्रजाति मूल्यांकन परीक्षण में जोड़ दिया।

अदरक में, पोटांगी के V_1S_1 -8 (28.25 टन/हेक्टर) में उच्चतम स्वच्छ राइजोम उपजता अंकित की। इसके अतिरिक्त, वांछनीय गुणवत्ता प्राचलों सहित अदरक अक्सशनों की पहचान की गयी। अदरक अक्सशनों के शुष्क घटकों में 13.00 से 22.50% अन्तर होता है। ओलिओरसिन और सुगन्धित तेल की मात्राओं में क्रमशः 4.00 से 9.67% और 0.25 से 2.00% भिन्नता होती है तथा कच्चा रेशा में 3.93 से 5.95% तक का अन्तर होता है। हल्दी में, उच्चतम स्वच्छ राइजोम उपजता पोटांगी के प्रारंभिक मूल्यांकन परीक्षण के अन्तर्गत PTS - 39 (26.62 टन/हेक्टर) में अंकित की। सोलन में, पांच संग्रह जैसे, ST - 365, BDJR - 1244, CIs - 29, PTSS - 24 और DKH - 26 में पहले की 17.64 से 32.62% की तरह उपजता में वृद्धि दिखाई पड़ी।

वांछनीय विशेषताओं के समावेशन के लिए बीज मसालों में संकरण किया जाता है। जीरा के सफल संकरण के लिए सबोरे 10 बजे से पूर्व हल्के चुभाने और बन्द कली में विपुसन किया जाना चाहिए और विपुसन के बाद सबोरे 11 बजे से रात को 7 बजे के अन्दर अगले दिन या दूसरे और तीसरे दिन (दो बार) परागण किया जाना चाहिए। मेथी अक्सशनों में, HM - 444 (23.9 क्विंटल/हेक्टर), एक हरे बीज आवरण उत्परिवर्ती और HM - 372 और HM - 376, पीले बीज आवरण उत्परिवर्ती उच्चतम बीज उपजता (क्रमशः 33.85 और 32.65 क्विंटल/हेक्टर) दी जाती है। इनमें HM - 444 डाउनी मिल्ड्यू और पाउडरी मिल्ड्यू दोनों रोगों का प्रतिरोधक होता है। जोपन्नर में, RTP - 4 अपनी उपजता 1518.33 कि ग्राम/हेक्टर द्वारा उच्चतम दक्षता साबित की जिसके बाद आता है RTP - 8 (1477.67 कि ग्राम/हेक्टर) और RTP - 9 (1471.33 कि ग्राम/हेक्टर), जिसका केन्द्रीय प्रजाति परीक्षण के अन्तर्गत मूल्यांकन किया जाएगा। इसके अलावा केन्द्रीय प्रजाति परीक्षण/ केन्द्रीय उपजता परीक्षण द्वारा उपजता और गुणवत्ता के लिए कई प्रजातियों/ किस्मों की पहचान की गयी।

ए आई सी आर पी एस के विभिन्न केन्द्रों में पहचान किये मसाले फसलों की आशाजनक प्रजातियाँ/किस्में

| फसल | केन्द्र | प्रजाति/ किस्म | उपजता |
|------------|---------------|----------------|-----------------------------------|
| काली मिर्च | दापोली | पन्नियूर -1 | 970.50 ग्राम/बेल |
| | | पन्नियूर - 3 | 638.00 ग्राम/बेल |
| | पन्नियूर | कल्चर - 1558 | 3.0 कि ग्राम/बेल (स्वच्छ) |
| | | कल्चर - 5128 | 2.9 कि ग्राम/बेल (स्वच्छ) |
| | अम्भ्रालवयल | पंचमी | 0.801 किग्राम/जीवनस्तर (स्वच्छ) |
| | येरकाड | पन्नियूर - 3 | 6.2 कि ग्राम/बेल (स्वच्छ) |
| | पाम्पाडुमपारा | पन्नियूर - 5 | 906.5 ग्राम/बेल (स्वच्छ) |
| इलायची | पाम्पाडुमपारा | M - 1 | 373.98 कि ग्राम/हेक्टर (शुष्क) |
| | | PV - 1 | 321.78 कि ग्राम/हेक्टर (शुष्क) |
| | मुडिगरे | CL - 692 | 139.60 कि ग्राम/हेक्टर (शुष्क) |
| | सकलेशपुर | SKP - 169 | 30.00 कि ग्राम/हेक्टर (शुष्क) |
| अदरक | पुंडिबारी | गोरुबातन | 8.87 कि ग्राम/3 मीटर बेड (स्वच्छ) |
| | पोटांगी | V_1E_8 - 2 | 26.61 टन/हेक्टर (स्वच्छ) |
| | | V_1S_1 - 8 | 24.44 टन/हेक्टर (स्वच्छ) |

| | | | |
|---------|-------------------|-------------------|---------------------------|
| | चितापल्ली | आई आई एस आर -वरदा | 25.50 टन/हेक्टर (स्वच्छ) |
| हल्दी | चितापल्ली | PTS - 55 | 17.50 टन/हेक्टर (स्वच्छ) |
| | पुंडिबारी | TCP - 2 | 28.38 टन/हेक्टर (स्वच्छ) |
| | | TCP - 11 | 26 56 टन/हेक्टर (स्वच्छ) |
| | | TCP - 1 | 24 00 टन/हेक्टर (स्वच्छ) |
| | जगतियाल | RH - 5 | 34 50 टन/हेक्टर (स्वच्छ) |
| दालचीनी | पोट्टागी | PTS - 11 | 27 08 टन/हेक्टर (स्वच्छ) |
| | | PTS - 39 | 24 93 टन/हेक्टर (स्वच्छ) |
| | कोयंबतोर | सुगुणा | 39 69 टन/हेक्टर (स्वच्छ) |
| | येरकाड / पेचिपराई | CV - 7 | 980 कि ग्राम/हेक्टर (छाल) |
| | धोली | UD - 446 | 1830 कि ग्राम/हेक्टर |
| धनिया | | RD - 336 | 1730 कि ग्राम/हेक्टर |
| | जोबनर | RCr - 41 | 1183 कि ग्राम/हेक्टर |
| | कुमारगज | UD - 743 | 2668 कि ग्राम/हेक्टर |
| | जगुदान | J Coll - 283 | 1734 कि ग्राम/हेक्टर |
| | हिसार | DH - 246 | 2180 कि ग्राम/हेक्टर |
| जीरा | | DH - 234 | 2060 कि ग्राम/हेक्टर |
| | कोयंबतोर | JCO - 283 | 705 कि ग्राम/हेक्टर |
| | राइगढ | JCO - 360 | 1628 कि ग्राम/हेक्टर |
| | जोबनर | UC - 223 | 386 कि ग्राम/हेक्टर |
| | | UC - 310 | 385 कि ग्राम/हेक्टर |
| सौंफ | | RZ - 19 | 302 कि ग्राम/हेक्टर |
| | जगुदान | JC - 2000-72 | 1126 कि ग्राम/हेक्टर |
| | जगुदान | JF - 303 | 3142 कि ग्राम/हेक्टर |
| | जोबनर | UF - 178 | 1677 कि ग्राम/हेक्टर |
| | कुमारगज | JF - 210 | 2113 कि ग्राम/हेक्टर |
| मेथी | गुंटूर | JF - 210 | 1091 कि ग्राम/हेक्टर |
| | जोबनर | JF - 204 | 1382 कि ग्राम/हेक्टर |
| | | UM - 351 | 1806 कि ग्राम/हेक्टर |
| | कुमारगज | JF - 210 | 2222 कि ग्राम/हेक्टर |
| | | JF - 195 | 2189 कि ग्राम/हेक्टर |
| | धोली | HM - 350 | 196 कि ग्राम/हेक्टर |
| | | RMt - 70 | 1630 कि ग्राम/हेक्टर |
| | हिसार | हिसार सोनाली | 2080 कि ग्राम/हेक्टर |
| | जगुदान | जे फेनु - 244 | 2049 कि ग्राम/हेक्टर |

गुणवत्ता प्राप्ति के लिए पहचान किये आशाजनक किस्में

| फसल | केन्द्र | किस्म/प्रजाति | प्राप्त गुणवत्ता |
|------------|---------------|---------------|----------------------|
| काली मिर्च | पाम्पाडुमपारा | कल्चर - 5128 | बाष्पशील तेल 5.06% |
| इलायची | सकलेशपुर | MCC - 1 | बाष्पशील तेल 6.9% |
| | | MCC - 21 | बाष्पशील तेल 6.8% |
| हल्दी | कोयंबतोर | CL - 67 | कुरकुमिन 6.04% |
| | | CL - 18 | कुरकुमिन 6.00% |
| | | JTS - 2 | सूखे प्राप्ति 24.01% |
| | | Acc - 360 | कुरकुमिन 5.21% |
| | पोटागी | रोमा | सूखे प्राप्ति 26.00% |
| धनिया | जोबनर | DH - 234 | बाष्पशील तेल 0.55% |
| जीरा | जाबनर | UC - 310 | बाष्पशील तेल 5.0% |
| | | JC - 2000-22 | बाष्पशील तेल 4.58% |
| सौफ | जोबनर | HF - 116 | बाष्पशील तेल 2.50% |
| | | UFF - 177 | बाष्पशील तेल 2.42% |

फसल प्रबन्धन

अच्छे कर्षण प्रक्रियाओं की पहचान के लिए फसल प्रबन्धन में 11 कार्यक्रमों में इक्कीस परियोजनाएँ चालू होती जा रही हैं। सिरसी में काली मिर्च और सुपारी का मिश्रित फसलन रीति से प्रति मोल के लिए प्रति दिन 20 लिटर के दर में सिचाई तथा NPK उर्वरक की मात्रा में 100:40:140 ग्राम प्रति बेल के दर में लगाने पर उच्चतम उपजता (2.69 कि ग्राम/बेल) अंकित की। पन्नीयूर में काली मिर्च के लिए ड्रिप सिचाई का परीक्षण करने पर प्रति दिन 2 लिटर सिचाई करने पर उपजता में वृद्धि (1.74 कि ग्राम/बेल) हुई और इन्हीं प्रजातियों में पन्नीयूर - 5 अच्छी निष्पत्ती प्रस्तुत की और उच्चतम उपजता (2.08 कि ग्राम/बेल) अंकित की।

मसाले फसलों के उत्पादन की गुणवत्ता में वृद्धि लाने के लिए अजैव उर्वरकों के प्रादले जैव उर्वरकों को लगाने की सिफारिश की। सिरसी में काली मिर्च में अजैव उर्वरक नाइट्रोजन 75% + अजोस्फिरिल्लम 50 ग्राम + FYM 10 ग्राम लगाने से उच्चतम उपजता 6.41 कि ग्राम/बेल अंकित की। काली मिर्च पर किये ओरगानिक फार्मिंग परीक्षण में FYM 10 कि ग्राम अ जले हुए मिट्टी 10 कि ग्राम/ बेल के दर में लगाने पर सिरसी में उच्चतम उपजता प्राप्त हुई। इलायची में भी, अजोस्फिरिल्लम 50 ग्राम अ कृष्ण 10 कि ग्राम लगाने पर उच्चतम उपजता (490.8 ग्राम/पौधे) अंकित की।

उसी प्रकार अजोस्फिरिल्लम और कृष्ण मिश्रण के साथ अजैव नाइट्रोजन लगाने से अदरक में उच्चतम उपजता (22.03 टन/हेक्टर) प्राप्त हुई। हल्दी में नाइट्रोजन 100% अ अजोस्फिरिल्लम 50 ग्राम + FYM 5 कि ग्राम लगाने पर पोटागी, कुमारगंज और राइगाढ केन्द्रों में स्वच्छ राइजोम की उच्चतम उपजता अंकित की जबकि, कोयंबतोर केन्द्र में यह अजैव नाइट्रोजन 50% + अजोस्फिरिल्लम 5 कि ग्राम/हेक्टर लगाने पर प्राप्त होता है।

धनिया में अजैव नाइट्रोजन 100% + अजोस्फिरिल्लम अ FYM 5 टन/हेक्टर लगाने पर जोबनर केन्द्र में अधिकतम बीज उपजता अंकित की जबकि, इतनी उपजता कोयंबतोर में अजैव नाइट्रोजन 50% + अजोस्फिरिल्लम 1.5 कि ग्राम/हेक्टर लगाने पर प्राप्त हुई है। लेकिन कुमारगंज में अधिकतम बीज उपजता FYM 5 कि ग्राम + अजोस्फिरिल्लम 50 ग्राम लगाने पर प्राप्त हुई है। जोबनर में जीरा की अधिकतम बीज उपजता 3.20 क्विन्टल/हेक्टर

नाइटोजन 100% + अजोस्फिरिल्लम + FYM 5 टन/हेक्टर के दर में लगाने पर प्राप्त होते अंकित की।

जोबरन में नाइटोजन 100% + अजोस्फिरिल्लम + FYM 5 टन/हेक्टर लगाने पर सौंफ की अधिकतम बीज उपजता अंकित की जबकि कुमारगंज केन्द्र में FYM 10 टन/हेक्टर + अजोस्फिरिल्लम 50 ग्राम लगाने पर प्राप्त होता है। मेथी में अजैव नाइटोजन 100% + अजोस्फिरिल्लम 1.5 कि ग्राम/हेक्टर बीज उपचार के रूप में लगाने के साथ FYM 5 टन/हेक्टर लगाने पर कोयंबतोर में उच्चतम उपजता जैसे 732 कि ग्राम/हेक्टर प्राप्त हुई लेकिन, कुमारगंज में FYM 10 कि ग्राम + अजोस्फिरिल्लम 50 ग्राम लगाने पर अधिकतम प्रीज उपजता 18 76 ग्राम/हेक्टर प्राप्त हुई।

अदरक के फसल उत्पादन बढ़ाने में सूक्ष्मपोषण का स्थान स्थापित किया। बीज बोने के 45 और 55 दिन के बाद 1% फेरस सल्फेट दो बार छिड़कने से तथा 10 0 कि ग्राम/हेक्टर दर में सिक सल्फेट मिट्टी में लगाने पर धोली में अदरक उपजता में वृद्धि हुई। धनिया में भी कोप्पर सल्फेट 12 5 कि ग्राम/हेक्टर दर में मृदा उपचार तथा 0.25% पर्ण छिड़काव करने पर कुमारगंज में अधिकतम बीज उपजता 20.03 क्विन्टल/हेक्टर प्राप्त हुई।

वृक्ष मसालो में सोफ्ट वुड ग्राफ्टिंग एक सफल प्रविधि होता है। धापोली में, अक्तूबर से मार्च तक जायफल में सोफ्ट वुड ग्राफ्टिंग करने के लिए अधिक अनुकूल देखा गया विशेषकर, जनवरी में करने से उच्चतम सफलता (68.33%) प्राप्त होता है।

फसल संरक्षण

फसल संरक्षण में 9 कार्यक्रमों के अन्दर्गत इक्कीस परियोजनाएँ चालू हो रही हैं। अति उद्भासित (सोलाराइस्ड) मृदा में काली मिर्च कतरन का रोपण करने पर अंकुरण, मूल की संख्या और मूल की लंबाई में महत्वपूर्ण वृद्धि हुई। इसके अतिरिक्त, अति उद्भासित मृदा ट्राइकोडरमा हर्जियानम और VAM के साथ मजबूत करने पर फाइटोफथोरा रोग का कम आपतन और अधिकतम अंकुरण अंकित किया। पाम्पाडुमपारा और सिरसी केन्द्रों में काली मिर्च के खुर गलन रोग नियन्त्रण में मेटालक्सिल गोल्ड MZ और टी हर्जियानम का मिश्रण लगाने पर अत्यन्त प्रभावी देखा गया।

इलायची में कारबोफुरान (100 ग्राम/पौधे) लगाने के बाद इमिडाक्लोप्रिड 0.5 मि लि/लिट्र लगाने पर मूल सूँड़ी की संख्या कम कर सकी और उपजता में वृद्धि भी ला सकी।

संचयन में राइजोम को SAAF + टी हर्जियानम उपचार करके रखने पर कवग रोग के कारण आनेवाला नाश कम (13.0%) होने के साथ स्वस्थ राइजोम की उच्चतम प्राप्ति (84.5%) भी होती है। कुमारगंज में राइजोम को 51°C के गरम पानी में 10 मिनट उपचार करके टी हर्जियानम और नीम केक मिश्रण में रखने पर राइजोम गलन रोग का आपतन कम होने के साथ अधिकतम उपजता भी प्राप्त होती है।

हल्दी के पर्ण रोग जैसे पर्ण चित्ती और पर्णदाग को मानकोसेब + कारबनडासिम बीज उपचार के रूप में लगाने तथा पर्णों पर छिड़कने से प्रभावी रूप से नियन्त्रित कर सकते हैं। जगतियाल में टी विरिडे + पी फलूरोसन्स 12 5 कि ग्राम/हेक्टर के दर के साथ FYM पौधों के तल पर लगाने पर तथा उसके बाद टी विरिडे + पी फलूरोसन्स 4 ग्राम/कि ग्राम बीज के दर के साथ FYM बीज पर लगाकर शीर्ष उपचार करने पर 25.0 कि ग्राम/हेक्टर के रूप में हल्दी का राइजोम गलन 37 86% तक कम कर सकते हैं। लेकिन कोयंबतोर में क्रमशः NPK 125: 60:90 कि ग्राम/हेक्टर अ FYM 10 टन/हेक्टर अ टी विरिडे अपी फलूरोसन्स 4 ग्राम/कि ग्राम बीज उपचार के रूप में लगाने के साथ टी विरिडे + पी फलूरोसन्स 12.5 कि ग्राम/हेक्टर के दर में पौधों के तल पर मिट्टी में लगाने पर तथा 25.0 कि ग्राम/हेक्टर शीर्ष उपचार करने पर क्रमशः राइजोम गलन के निम्नतम आपतन के साथ उच्चतम उपजता भी अंकित की है।

धनिया में, टी हर्जियानम बीज उपचार एवं मृदा पर लगाने से जोबनर में, म्लानी आपतन कम होने के साथ उपजता में वृद्धि भी होती है जबकि, कोयंबतोर में, नीम के बीज गरी का अर्क (NSKE) 5% तीन बार छिड़कना रोग कम करने तथा उपजता में वृद्धि लाने के लिए प्रभावी देखा गया। जोबनर में टी हर्जियानम कारबनडासिम के साथ या उसके बिना और नीम केक मृदा पर लगाने पर जीरा की म्लानी आपतन कम कर सकते हैं। जिस प्लॉट में टी हर्जियानम बीज उपचार + मृदा द्वारा लगाने के साथ 0.3% मानकोसेब छिड़कते हैं उस प्लॉट में म्लानी आपतन कम होते (15.0%) तथा अनाज उपजता 229 ग्राम/प्लॉट तक मिलते अंकित की। जगुदान में टी हर्जियानम के साथ मृदा और बीज उपचार करना म्लानी और बलाइट दोनों रोगों के लिए प्रभावी देखा गया। जीरा के एफिड का नियन्त्रण करने के लिए, दो बार मोनोक्रोटोफोस और असिफेट छिड़कना अधिक प्रभावी देखा गया। कारबनडासिम बीज उपचार के रूप में खुद या मृदा ड्रिफ्टिंग के साथ लगाना मेथी में मूल गलन रोग के प्रति अधिक प्रभावी साबित किया। कोयंबतोर में टी विरिडे (5 कि ग्राम/हेक्टर) + नीम केक (150 कि ग्राम/हेक्टर) मृदा पर लगाने से रोग आपतन कम होता है।

इसके अतिरिक्त, मसाला फसलों के प्रमुख कीट और रोगों के प्रतिरोधी जर्मप्लासम अक्ससनों/प्रजातियों की पहचान की गयी।

कीट और रोगों के प्रतिरोधकता/सह्यता का स्रोत

| फसल | केन्द्र | कीट/ रोग | प्रजाति/किस्म | प्रतिक्रिया |
|-------|----------|-------------------|---|------------------|
| हल्दी | कोयंबतोर | पर्ण चित्ती : दाग | CL - 32, CL - 34, CL - 54 & CL - 55 | प्रतिरोधक |
| | धोली | पर्ण दाग | कोहिनूर | उच्चतम प्रतिरोधक |
| | | | जी एल पुरम राजेन्द्र सोनिया, | |
| | | | RH - 5 & RH - 24 | प्रतिरोधक |
| | जगतियाल | राइजोम गलन | GS, JTS - 303, CLI - 370, JTS - 604, JTS - 308, PTS - 9, PTS - 10, CLI - 325, CLI - 330, PCT - 10, CLI - 320, PCT - 7, PCT - 14 | प्रतिरोधक |
| | | पर्ण चित्ती | JTS - 606 | प्रतिरोधक |
| धनिया | राइगढ | पर्ण दाग | Acc - 360, 361, 585, 126 & T4 - 11 | प्रतिरोधक |
| | | पर्ण चित्ती | सुदर्शन और RRTS - 1 | प्रतिरोधक |
| | जोबनर | तना पित्त | Rcr - 41, UD - 435 & UD - 436 | उन्मुक्त |
| | | मूल गांठ गोलकृमि | RCr - 41, UD - 262, UD - 446, UD - 751 | प्रतिरोधक |
| मेथी | जाबनर | मूल गांठ गोलकृमि | UM - 34, UM - 127, UM - 304 & UM - 305 | प्रतिरोधक |
| | | पाउडरी मिल्ड्यू | UM - 303 & UM - 305 | उन्मुक्त |

PROJECT COORDINATOR'S REPORT

The All India Coordinated Research Project on Spices (AICRPS) is the largest network in the country in the spices research. The AICRP on Spices was started in 1971 (IV Plan) as a combined project on spices and cashew. It was bifurcated in to two separate projects, one each for spices and cashew in 1985 and since then the AICRPS started functioning with a full time Coordinator with headquarters at Indian Institute of Spices Research (IISR), Calicut.

At present 19 centres spread over in 15 states, based at 15 Agricultural Universities are functioning under AICRPS. In addition, eight co-operating/voluntary centres including ICAR Research Complex, Gangtok for large cardamom are collaborating with this project. The total staff strength of AICRPS is 83, which includes 51 scientists and 32 technical/auxiliary staff. The ICAR is meeting 75% expenditure of each centre while 25% of the expenditure is met by the respective State Agricultural Universities (SAUs). The budget of the project for the year 2002-2003 is Rs. 209.329 lakhs with Rs. 157.00 lakhs as ICAR share.

The mandate of the project is to increase area, production and productivity of spices in the country through:

- i) Evolving high yielding varieties with quality attributes, tolerant/resistant to pests and diseases for various agro-ecological situations
- ii) Standardizing agro-techniques for spice crops under different agro-climatic conditions
- iii) Evolving cost effective and efficient pest and disease management practices
- iv) Working as interface between SAUs, IISR and ICAR.

About 110 research projects covering 12 spice crops are being operated at various centers under AICRPS and during the year 2002-03, the project made several achievements.

CROP IMPROVEMENT

In crop improvement, 59 projects with 35 programmes are being operated. The AICRPS centers strengthened the genetic resources of spice crops and the germplasm for different parameters was evaluated and promising accessions in each crop were identified. At present, the germplasm holdings of AICRPS centers consist of black pepper - 650, cardamom - 369, ginger - 644, turmeric - 1307, tree spices - 228 and seed spices - 3901. New CVTs/CYT were initiated during the period.

In black pepper, inter-varietal hybridization to evolve high yielding varieties is being carried out at Panniyur. The promising lines are selected and advanced to multilocal trials. Fifteen cross combinations were made and the seeds were obtained. Seeds of sixteen germplasm accessions were sown for OP progeny evaluation. Inter-specific hybrids of promising black pepper varieties with *Piper colubrinum* are being evaluated. At Ambalavayal, black pepper accessions, Panchami, Panniyur - 4, Panniyur - 3, Acc - 2445, Acc - 2426 and

Panniyur - 2 were found promising for the high range region of Kerala. Cardamom accessions, CL - 730, CL - 692 and D - 237 are found promising and included in varietal evaluation trials at Mudigere.

In ginger, highest fresh rhizome yield was recorded in V_3S_1 - 8 (28.25 t ha⁻¹) at Pottangi. Besides, ginger accessions with desirable quality parameters were identified. The dry matter content of ginger accessions varied from 13.00 to 22.50%. The oleoresin and essential oil content ranged between 4.00 to 9.67% and 0.25 to 2.00%, respectively and crude fibre varied from 3.93 to 5.95%. In turmeric, highest fresh rhizome yield was recorded in PTS - 39 (26.62 t ha⁻¹) under initial evaluation trail at Pottangi. At Solan, five collections viz., ST - 365, BDJR - 1244, CIs - 29, PTSS - 24 and DKH - 26 showed increase in yield to the extent of 17.64 to 32.62% over the check.

Hybridization in seed spices is taken up for incorporation of desirable traits. For successful hybridization in cumin, emasculation should be done before 10 AM in slightly pink and unopened flower bud and pollination on the next day or third day or second and third day (twice) after emasculation between 11 AM to 7 PM. Fenugreek accessions, HM - 444 (23.9 q ha⁻¹), a green seed coat mutant and HM - 372 and HM - 376, yellow seed coat mutants gave highest seed yield (33.85 and 32.65 q ha⁻¹, respectively). Among them, HM - 444, is also resistant to both downy mildew and powdery mildew diseases. At Jobner, RTP - 4 proved its superior performance by yielding 1518.33 kg ha⁻¹ followed by RTP - 8 (1477.67 kg ha⁻¹) and RTP - 9 (1471.33 kg ha⁻¹), which will be evaluated under CVT. Besides, several varieties/lines were identified for yield and quality attributes through CVT/CYT.

Promising varieties/lines of spice crops identified at different AICRPS centers

| Crop | Center | Variety/line | Yield |
|--------------|--------------|----------------|---|
| Black pepper | Dapoli | Panniyur - 1 | 970.50 g vine ⁻¹ |
| | | Panniyur - 3 | 638.00 g vine ⁻¹ |
| | Panniyur | Culture - 1558 | 3.0 kg vine ⁻¹ (fresh) |
| | | Culture - 5128 | 2.9 kg vine ⁻¹ (fresh) |
| | Ambalavayal | Panchami | 0.801 kg standard ⁻¹ (fresh) |
| | Yercaud | Panniyur - 3 | 6.2 kg vine ⁻¹ (fresh) |
| Cardamom | Pampadumpara | Panniyur - 5 | 906.5 g vine ⁻¹ (fresh) |
| | | M - 1 | 373.98 kg ha ⁻¹ (dry) |
| | | PV - 1 | 321.78 kg ha ⁻¹ (dry) |
| | Mudigere | CL - 692 | 139.60 kg ha ⁻¹ (dry) |
| | Sakleshpur | SKP - 169 | 330.00 kg ha ⁻¹ (dry) |
| Ginger | Pundibari | Gorubathan | 8.87 kg 3m ² bed ⁻¹ (fresh) |
| | Pottangi | V_1E_8 - 2 | 26.61 t ha ⁻¹ (fresh) |
| | | V_3S_1 - 8 | 24.44 t ha ⁻¹ (fresh) |
| | Chintapalle | IISR - Varada | 25.50 t ha ⁻¹ (fresh) |

| | | | |
|-----------|--------------------|----------------|----------------------------------|
| Turmeric | Chintapalle | PTS - 55 | 17.50 t ha ⁻¹ (fresh) |
| | Pundibari | TCP - 2 | 28.38 t ha ⁻¹ (fresh) |
| | | TCP - 11 | 26.56 t ha ⁻¹ (fresh) |
| | | TCP - 1 | 24.00 t ha ⁻¹ (fresh) |
| | Jagtial | RH - 5 | 34.50 t ha ⁻¹ (fresh) |
| | Pottangi | PTS - 11 | 27.08 t ha ⁻¹ (fresh) |
| | | PTS - 39 | 24.93 t ha ⁻¹ (fresh) |
| | Coimbatore | Suguna | 39.69 t ha ⁻¹ (fresh) |
| Cinnamon | Yercaud/Pechiparai | CV - 7 | 980 kg ha ⁻¹ (bark)* |
| Coriander | Dholi | UD - 446 | 1830 kg ha ⁻¹ |
| | | RD - 366 | 1730 kg ha ⁻¹ |
| | Jobner | RCr - 41 | 1183 kg ha ⁻¹ |
| | Kumarganj | UD - 743 | 2668 kg ha ⁻¹ |
| | Jagudan | J.Cori - 283 | 1734 kg ha ⁻¹ |
| | Hisar | DH - 246 | 2180 kg ha ⁻¹ |
| | | DH - 234 | 2060 kg ha ⁻¹ |
| | Coimbatore | JCO - 283 | 705 kg ha ⁻¹ |
| | Raigarh | JCO - 360 | 1628 kg ha ⁻¹ |
| Cumin | Jobner | UC - 223 | 386 kg ha ⁻¹ |
| | | UC - 310 | 385 kg ha ⁻¹ |
| | | RZ - 19 | 302 kg ha ⁻¹ |
| | Jagudan | JC - 2000 - 72 | 1126 kg ha ⁻¹ |
| Fennel | Jagudan | JF - 303 | 3142 kg ha ⁻¹ |
| | Jobner | UF - 178 | 1677 kg ha ⁻¹ |
| | Kumarganj | JF - 210 | 2113 kg ha ⁻¹ |
| Fenugreek | Guntur | JF - 210 | 1091 kg ha ⁻¹ |
| | Jobner | JF - 204 | 1382 kg ha ⁻¹ |
| | | UM - 351 | 1806 kg ha ⁻¹ |
| | Kumarganj | JF - 210 | 2222 kg ha ⁻¹ |
| | | JF - 195 | 2189 kg ha ⁻¹ |
| | Dholi | HM - 350 | 1960 kg ha ⁻¹ |
| | | RMt - 70 | 1630 kg ha ⁻¹ |
| | Hisar | Hisar Sonali | 2080 kg ha ⁻¹ |
| | Jagudan | J. Fenu - 244 | 2049 kg ha ⁻¹ |

Promising lines identified for quality attributes

| Crop | Center | Line/variety | Quality attribute |
|--------------|--------------|----------------|---------------------|
| Black pepper | Pampadumpara | Culture - 5128 | Volatile oil 5.06% |
| Cardamom | Sakleshpur | MCC - 1M | Volatile oil 6.9% |
| | | CC - 21 | Volatile oil 6.8% |
| Turmeric | Coimbatore | CL - 67 | Curcumin 6.04% |
| | | CL - 18 | Curcumin 6.00% |
| | | JTS - 2 | Dry recovery 24.01% |
| | | ACC - 360 | Curcumin 5.21% |
| | Pottangi | Roma | Dry recovery 26.00% |
| Coriander | Jobner | DH - 234 | Volatile oil 0.55% |
| Cumin | Jobner | UC - 310 | Volatile oil 5.0% |
| | | JC - 2000-22 | Volatile oil 4.58% |
| Fennel | Jobner | HF - 116 | Volatile oil 2.50% |
| | | UFF - 177 | Volatile oil 2.42% |

CROP MANAGEMENT

Twenty one projects are being operated in 11 programmes in crop management to identify good agronomic practices (GAP). In black pepper-arecanut mixed cropping system, irrigation with 20 l vine⁻¹ day⁻¹ and a fertilizer dose of NPK 100:40:140 g vine⁻¹ recorded the highest yield (2.69 kg vine⁻¹) at Sirsi. In a drip irrigation trial in black pepper at Panniyur, irrigation at 2 l day⁻¹ increased the yield (1.74 kg vine⁻¹) and among the varieties, Panniyur - 5 responded positively and recorded the highest yield (2.08 kg vine⁻¹).

Biofertilizers are being recommended to substitute inorganic fertilizers and to improve the quality of the produce in spice crops. Inorganic N 75% + *Azospirillum* 50 g + FYM 10 kg recorded the highest yield of 6.41 kg vine⁻¹ in black pepper at Sirsi. In an

organic farming experiment on black pepper, application of FYM 10 kg + burnt earth 10 kg vine⁻¹ has given the highest yield at Sirsi. In cardamom also, highest yield (490.8 g plant⁻¹) was recorded with the application of *Azospirillum* 50 g + FYM 10 kg.

Similarly higher yield (22.03 t ha⁻¹) in ginger was obtained by applying inorganic nitrogen in combination with *Azospirillum* and FYM. Highest yield of fresh rhizome in turmeric was recorded with the application of N 100% + *Azospirillum* 50 g + FYM 5 kg at Pottangi, Kumarganj and Raigarh centers, while at Coimbatore center it was with inorganic N 50% + *Azospirillum* 5 kg ha⁻¹.

In coriander, application of inorganic N 100% + *Azospirillum* + FYM 5 t ha⁻¹ recorded maximum seed yield by Jobner centre, while it was with the application of inorganic

N 50% + *Azospirillum* 1.5 kg ha⁻¹ at Coimbatore. However, Kumarganj obtained maximum seed yield by applying FYM 5 kg + *Azospirillum* 50 g. At Jobner, maximum seed yield of 3.20 q ha⁻¹ was recorded in cumin with the application of N 100% + *Azospirillum* + FYM 5 t ha⁻¹.

Maximum seed yield of fennel was recorded with the application of N 100% + *Azospirillum* + FYM 5 t ha⁻¹ at Jobner, while at Kumarganj centre with FYM 10 t ha⁻¹ + *Azospirillum* 50 g. In fenugreek, application of inorganic N 100% + *Azospirillum* 1.5 kg ha⁻¹ as seed treatment + FYM 5 t ha⁻¹ produced the highest yield of 732 kg ha⁻¹ at Coimbatore, whereas at Kumarganj, FYM 10 kg + *Azospirillum* 50 g gave maximum seed yield of 18.76 g ha⁻¹.

The role of micronutrients in increasing the crop production was established in ginger. Two sprays of ferrous sulphate 1% at 45 and 55 days after sowing and soil application of zinc sulphate 10.0 kg ha⁻¹ increased the yield in ginger at Dholi. In coriander also, maximum seed yield of 20.03 q ha⁻¹ was obtained with soil application of copper sulphate 12.5 kg ha⁻¹ and 0.25% foliar spray at Kumarganj.

Soft wood grafting is a successful technique in tree spices. At Dapoli, October to March was found to be the most congenial period for softwood grafting in nutmeg, particularly January month with highest success (68.33%).

CROP PROTECTION

Twenty-one projects are being operated under 9 programmes in crop protection. Black pepper cuttings planted in

solarized soil significantly increased sprouting, number of roots and length of roots. Further, solarized soil fortified with *Trichoderma harzianum* and VAM recorded minimum incidence of the *Phytophthora* disease with maximum sprouting. Metalaxyl Gold MZ and *T. harzianum* combination was found to be highly effective in controlling the foot rot disease of black pepper at Pampadumpara and Sirsi centers.

Population of root grubs was reduced significantly with the application of carbofuran (100 g plant⁻¹) followed by imidacloprid 0.5 ml l⁻¹ and increased the yield in cardamom.

The loss due to fungal diseases was low (13.0%) in rhizomes treated with SAAF + *T. harzianum* in the storage with highest recovery (84.5%) of healthy rhizomes. Rhizomes treated with hot water at 51°C for 10 minutes and *T. harzianum* mixed with neem cake resulted in minimum incidence of rhizome rot disease with maximum yield at Kumarganj.

Foliar diseases like leaf spot and leaf blotch in turmeric could be effectively controlled by application of mancozeb + carbendazim as seed treatment and foliar spray. At Jagtial, rhizome rot of turmeric was reduced by 37.86% by application of FYM with *T. viride* + *P. fluorescence* @ 12.5 kg ha⁻¹ as basal and 25.0 kg ha⁻¹ as top dressing followed by application of FYM with *T. viride* + *P. fluorescence* to seed @ 4 g kg⁻¹ seed. However at Coimbatore, application NPK 125:60:90 kg ha⁻¹ + FYM 10 t ha⁻¹ + *T. viride* + *P. fluorescence* 4 g kg⁻¹ as seed treatment + *T. viride* + *P. fluorescence* applied to soil

@ 12.5 kg ha⁻¹ as basal and 25.0 kg ha⁻¹ as top dressing, respectively recorded the lowest incidence of rhizome rot with highest yield.

In coriander, *T. harzianum* when used both as seed treatment and soil application reduced wilt incidence significantly and increased the yield at Jobner, while at Coimbatore, three sprays with neem seed kernel extract (NSKE) 5% was found effective in reducing the disease and increasing the yield. *T. harzianum* with and without carbendazim and neem cake as soil application reduced the incidence of wilt in cumin at Jobner. Lowest incidence of wilt (15.0%) with grain yield of 229 g plot⁻¹ was recorded in plots where *T. harzianum* was

applied through seed treatment + soil application along with mancozeb 0.3% spray. Soil and seed treatment with *T. harzianum* was also found significantly effective for both wilt and blight diseases at Jagudan. For the control of aphids in cumin, two sprays of monocrotophos and acephate were found more effective. Carbendazim as seed treatment alone or along with soil drenching proved highly effective against root rot in fenugreek. Soil application of *T. viride* (5 kg ha⁻¹) + neem cake (150 kg ha⁻¹) also reduced the disease incidence at Coimbatore.

Besides, several germplasm accessions/ varieties resistant to important pests and diseases in spice crops were identified.

Source of resistance/tolerance to pests and diseases

| Crop | Center | Pest/disease | Varieties/lines | Reaction |
|-----------|------------|--------------------|---|------------------|
| Turmeric | Coimbatore | Leaf spot & blotch | CL - 32, CL - 34, CL - 54 & CL - 55 | Resistant |
| | Dholi | Leaf blotch | Kohinoor G. L. Puram Rajendra Sonia, RH - 5 & RH - 24 | Highly resistant |
| | Jagtial | Rhizome rot | GS, JTS - 303, CLI - 370, JTS - 604, JTS - 308, PTS - 9, PTS - 10, CLI - 325, CLI - 330, PCT - 10, CLI - 320, PCT - 7, PCT - 14 | Resistant |
| | | Leaf spot | JTS - 606 | Resistant |
| | Raigarh | Leaf blotch | ACC - 360, 361, 585, 126 & T4 - 11 | |
| | | Leaf spot | Sudarshan and RRTS - 1 | Resistant |
| Coriander | Jobner | Stemgall | RCr - 41, UD - 435 & UD - 436 | Immune |
| | | Root knot nematode | RCr - 41, UD - 262, UD - 446, UD - 751 | Resistant |
| Fenugreek | Jobner | Root knot nematode | UM - 34, UM - 127, UM - 304 & UM - 305 | Resistant |
| | | Powdery mildew | UM - 303 & UM - 305 | Immune |

TECHNICAL PROGRAMMES

| Project Code | Title | Centers |
|----------------------------|---|---|
| a) Ongoing projects | | |
| BLACK PEPPER | | |
| PEP/CI/1 | Genetic Resources | |
| PEP/CI/1.1 | Germplasm collection, characterization, evaluation and conservation | Panniyur, Sirsi, Yercaud, Chintapalle, Pundibari and Dapoli |
| PEP/CI/2 | Hybridization Trial | |
| PEP/CI/2.1 | Inter-varietal hybridization to evolve high yielding varieties | Panniyur |
| PEP/CI/3 | Coordinated Varietal Trial (CVT) | |
| PEP/CI/3.1 | CVT 1987 – Series III | Dapoli and Sirsi |
| PEP/CI/3.2 | CVT 1991 – Series IV | Panniyur, Yercaud and Ambalavayal |
| PEP/CI/3.3 | CVT 2000 – Series V | Pampadumpara, Panniyur, Sirsi, Chintapalle and Ambalavayal |
| PEP/CM/1 | Irrigation Trial | |
| PEP/CM/1.1 | Irrigation-cum-fertilizer requirements for black pepper and arecanut in a mixed cropping system | Sirsi |
| PEP/CM/2 | Nutrient Management Trial | |
| PEP/CM/2.1 | Efficacy of biofertilizer using <i>Azospirillum</i> on black pepper | Panniyur, Yercaud, Sirsi, Thadiyankudisai and Ambalavayal |
| PEP/CM/2.2 | Efficacy of biofertilizer using P-solubilizer on black pepper | Panniyur, Sirsi, Yercaud, Thadiyankudisai and Ambalavayal |
| PEP/CM/2.3 | Organic farming in black pepper | Panniyur, Sirsi, Yercaud, Thadiyankudisai and Ambalavayal |
| PEP/CP/1 | Disease Management Trial | |
| PEP/CP/1.2 | Biological control of <i>Phytophthora</i> foot rot of black pepper – nursery trial | Pampadumpara, Chintapalle and Ambalavayal |

| | | |
|-----------------|--|--|
| PEP/CP/1.4 | Control of <i>Phytophthora</i> disease of black pepper in farmers' field – observational trial | Panniyur, Mudigere, Sirsi and Ambalavayal |
| PEP/CP/1.5 | <i>Phytophthora</i> foot rot incidence in black pepper under different densities in an arecanut garden | Panniyur and Sirsi |
| PEP/CP/1.6 | Incidence, epidemiology and management of anthracnose disease of black pepper | Pampadumpara, Mudigere, Chintapalle and Dapoli |
| PEP/CP/2 | Pest Management Trial | |
| PEP/CP/2.2 | Survey for the incidence of insect- pests on black pepper at high altitudes | Pampadumpara |

CARDAMOM

| | | |
|-----------------|---|--|
| CAR/CI/1 | Genetic Resources | |
| CAR/CI/1.1 | Germplasm collection, characterization, evaluation and conservation | Pampadumpara and Mudigere |
| CAR/CI/2 | Hybridization and Selection | |
| CAR/CI/2.1 | Evaluation of synthetics and OP progenies | Mudigere |
| CAR/CI/3 | Coordinated Varietal Trial | |
| CAR/CI/3.2 | CVT 1991/1998 –Series III with Malabar Types | Mudigere and Sakleshpur |
| CAR/CI/3.3 | CVT 1991/1998 –Series III with Mysore Types | Mudigere and Sakleshpur |
| CAR/CI/3.4 | CVT 2000- Series IV | Pampadumpara, Mudigere, Myladumpara and Sakleshpur |
| CAR/CI/4 | Varietal Evaluation Trial (VET) | |
| CAR/CI/4.1 | Yield evaluation of open pollinated seedling progenies (VET-I) | Mudigere |
| CAR/CI/4.2 | Yield evaluation of promising cardamom selection (VET-II) | Mudigere |
| CAR/CI/4.3 | Yield evaluation of promising cardamom selection (VET-III) | Mudigere |
| CAR/CI/4.4 | Yield evaluation of promising cardamom selection (VET-IV) | Mudigere |
| CAR/CI/5 | Quality Evaluation Trial | |
| CAR/CI/5.1 | Screening cardamom clones for abiotic stress | Mudigere |

CAR/CM/1 Nutrient Management Trial

| | | |
|------------|---|---|
| CAR/CM/1.3 | Integrated nutrient management in cardamom | Mudigere |
| CAR/CM/1.4 | Efficiency of bio-fertilizer using <i>Azospirillum</i> on cardamom | Pampadumpara, Mudigere, Myladumpara, and Sakleshpur |
| CAR/CM/1.5 | Efficiency of biofertilizer using <i>P. solubilizers</i> on cardamom | Pampadumpara, Mudigere, Myladumpara and Sakleshpur |
| CAR/CM/1.6 | Effect of neem cake on productivity, pest and disease incidence in cardamom | Pampadumpara, Mudigere, Myladumpara and Sakleshpur |

CAR/CP/2 Pest Management Trial

| | | |
|------------|---|---------------------------|
| CAR/CP/2.1 | Evaluation of plant based insecticides for the control of thrips and fruit borers in cardamom | Mudigere |
| CAR/CP/2.2 | Management of root grub of cardamom | Pampadumpara and Mudigere |
| CAR/CP/2.3 | Bioecology of natural enemies of major pests of cardamom | Pampadumpara and Mudigere |
| CAR/CP/2.4 | Estimation of quantitative and qualitative losses due to thrips damage in cardamom | Mudigere |

GINGER**GIN/CI/1 Genetic Resources**

| | | |
|------------|---|--|
| GIN/CI/1.1 | Germplasm collection, characterization, evaluation and conservation | Solan, Pottangi, Dholi, Kumarganj, Pundibari and Raigarh |
|------------|---|--|

GIN/CI/2 Coordinated Varietal Trial

| | | |
|------------|---------------------|---|
| GIN/CI/2.2 | CVT 2000 – Series V | Chintapalli, Solan, Pottangi, Pundibari and Raigarh |
|------------|---------------------|---|

GIN/CI/3 Varietal Evaluation Trial

| | | |
|------------|--------------------------------------|-----------------------------|
| GIN/CI/3.1 | Comparative yield trial (CYT-I & II) | Solan, Pottangi and Raigarh |
| GIN/CI/3.2 | Initial evaluation trial (IET) | Solan and Pottangi |
| GIN/CI/3.3 | Comparative yield trial (CYT-III) | Raigarh |

GIN/CI/4 Quality Evaluation Trial

| | | |
|------------|-------------------------------------|-------|
| GIN/CI/4.1 | Evaluation of germplasm for quality | Solan |
|------------|-------------------------------------|-------|

GIN/CM/1 Nutrient Management Trial

| | | |
|------------|---|---|
| GIN/CM/1.1 | Effect of biofertilizer using <i>Azospirillum</i> on ginger | Solan, Pottangi, Pundibari, Ambalavayal and Raigarh |
| GIN/CM/1.2 | Organic farming in ginger | Solan, Pottangi, Dholi, Raigarh and Ambalavayal |

| | | |
|-----------------|---|--|
| GIN/CM/1.3 | Micronutrient on ginger | Dholi |
| GIN/CP/1 | Disease Management Trial | |
| GIN/CP/1.1 | Integrated management on rhizome rot of ginger | Solan, Dholi and Pundibari |
| GIN/CP/1.2 | Biocontrol studies on rhizome rot of ginger | Pottangi, Dholi, Kumarganj, Pundibari Ambalavayal and Raigarh |
| GIN/CP/1.4 | Integrated management of <i>Pythium</i> , <i>Fusarium</i> and <i>Ralstonia</i> on ginger | Pundibari, Dholi and Solan |
| TURMERIC | | |
| TUR/CI/1 | Genetic Resources | |
| TUR/CI/1.1 | Germplasm collection, characterization, evaluation and conservation and Coimbatore | Jagtial, Solan, Pottangi, Dholi, Kumarganj, Pundibari, Raigarh |
| TUR/CI/2 | Coordinated Varietal Trial | |
| TUR/CI/2.2 | CVT 2000 - Series V | Coimbatore, Chintapalle, Jagtial, Pottangi, Kumarganj, Pundibari and Raigarh |
| TUR/CI/3 | Varietal Evaluation Trial | |
| TUR/CI/3.1 | Comparative yield trial (1999-2000) | Jagtial, Pottangi, Pundibari and Raigarh |
| TUR/CI/3.2 | Initial evaluation trial | Solan and Pottangi |
| TUR/CI/4 | Quality Evaluation Trial | |
| TUR/CI/4.1 | Quality evaluation of germplasm | Coimbatore and Solan |
| TUR/CI/4.2 | Impact of environment on quality of turmeric | Coimbatore and Pottangi |
| TUR/CM/1 | Nutrient Management Trial | |
| TUR/CM/1.1 | Efficacy of biofertilizer using <i>Azospirillum</i> on turmeric | Coimbatore, Pottangi, Kumarganj, Solan, Raigarh, Ambalavayal and Pundibari |
| TUR/CM/1.2 | Organic farming in turmeric | Pottangi, Raigarh, Pundibari and Bhavanisagar |
| TUR/CP/1 | Disease Management Trial | |
| TUR/CP/1.1 | Survey and identification of disease causing organisms in turmeric and screening of turmeric germplasm against diseases | Coimbatore, Jagtial, Dholi, Pundibari and Raigarh |

| | | |
|------------|--|---|
| TUR/CP/1.2 | Chemical control measures against leaf blotch disease of turmeric | Pundibari |
| TUR/CP/1.3 | Effect of seed treatment on leaf spot and leaf blotch diseases of turmeric | Dholi, Kumarganj, Raigarh and Pundibari |
| TUR/CP/1.4 | Investigations on the causal organism of rhizome rot of turmeric and screening of biocontrol agents for its management | Coimbatore, Jagtial and Pundibari |

TREE SPICES

TSP/CI/1 Genetic Resources

| | | |
|------------|---|-------------------------------|
| TSP/CI/1.1 | Germplasm collection, characterization, evaluation and conservation of clove, nutmeg and cinnamon | Yercaud/Pechiparai and Dapoli |
|------------|---|-------------------------------|

TSP/CI/2 Coordinated Varietal Trial

| | | |
|------------|----------------------|---|
| TSP/CI/2.1 | CVT 1992 in clove | Yercaud/Pechiparai |
| TSP/CI/2.2 | CVT 1992 in cinnamon | Yercaud/Pechiparai and Ambalavayal |
| TSP/CI/2.3 | CVT 2001 in nutmeg | Dapoli, Sirsi, Yercaud/Pechiparai and Ambalavayal |
| TSP/CI/2.4 | CVT 2001 in cassia | Dapoli, Sirsi, Yercaud/Pechiparai and Ambalavayal |

TSP/CM/1 Propagation/Multiplication Trial

| | | |
|------------|--|--------------------|
| TSP/CM/1.1 | Vegetative propagation in nutmeg, clove and cinnamon | Yercaud/Pechiparai |
|------------|--|--------------------|

TSP/CM/2 Irrigation Trial

| | | |
|------------|-------------------------------------|--------------------|
| TSP/CM/2.1 | Drip irrigation in clove and nutmeg | Yercaud/Pechiparai |
|------------|-------------------------------------|--------------------|

TSP/CP/1 Disease Management Trial

| | | |
|------------|---|--|
| TSP/CP/1.1 | Survey for disease incidence in tree spices | Yercaud/Pechiparai, Dapoli and Ambalavayal |
|------------|---|--|

CORIANDER

COR/CI/1 Genetic Resources

| | | |
|------------|--|---|
| COR/CI/1.1 | Germplasm collection, description, characterization, evaluation, conservation and screening against diseases | Coimbatore, Guntur, Jobner, Jagudan, Hisar, Dholi and Kumarganj |
|------------|--|---|

COR/CI/2 Coordinated Varietal Trial

| | | |
|------------|----------------------|-----------------------|
| COR/CI/2.1 | CVT 1993 – Series II | Kumarganj and Raigarh |
|------------|----------------------|-----------------------|

| | | |
|-----------------|--|--|
| COR/CI/2.2 | CVT 1996 – Series III | Dholi and Kumarganj |
| COR/CI/2.3 | CVT 1998 – Series IV | Guntur and Kumarganj |
| COR/CI/2.4 | CVT 2001 – Series V | Coimbatore, Guntur, Jobner, Jagudan, Hisar, Dholi, Raigarh and Kumarganj |
| COR/CI/3 | Varietal Evaluation Trial | |
| COR/CI/3.2 | Initial evaluation trial | Dholi, Guntur, Jobner, Jagudan and Hisar |
| COR/CI/4 | Quality Evaluation Trial | |
| COR/CI/4.1 | Quality evaluation in coriander | Jobner |
| COR/CM/1 | Nutrient Management Trial | |
| COR/CM/1.1 | Response of coriander to micronutrients | Kumarganj |
| COR/CM/1.2 | Efficacy of biofertilizer using <i>Azospirillum</i> on coriander | Coimbatore, Guntur, Jobner and Kumarganj |
| COR/CP/1 | Disease Management Trial | |
| COR/CP/1.1 | Survey to identify the disease incidence, collection and identification of causal organisms | Dholi |
| COR/CP/1.2 | Management of wilt and powdery mildew diseases in coriander | Coimbatore, Jobner, Jagudan, Dholi, Raigarh and Kumarganj |
| CUMIN | | |
| CUM/CI/1 | Genetic Resources | |
| CUM/CI/1.1 | Germplasm collection, characterization, evaluation conservation and screening against diseases | Jobner and Jagudan |
| CUM/CI/2 | Hybridization Trial | |
| CUM/CI/2.1 | Mutation studies and hybridization programme in cumin | Jagudan |
| CUM/CI/3 | Coordinated Varietal Trial | |
| CUM/CI/3.2 | CVT 1999-Series IV | Jobner |
| CUM/CI/3.3 | CVT 2001-Series V | Jagudan |
| CUM/CI/4 | Varietal Evaluation Trial | |
| CUM/CI/4.1 | Initial evaluation trial | Jagudan |
| CUM/CI/5 | Quality Evaluation Trial | |
| CUM/CI/5.1 | Quality evaluation in cumin | Jobner |

CUM/CM/1 Nutrient Management Trial

CUM/CM/1.1 Efficacy of biofertilizer using *Azospirillum* on cumin Jobner and Jagudan

CUM/CP/1 Disease Management Trial

CUM/CP/1.2 Epidemiological study of *Alternaria* blight of cumin Jobner

CUM/CP/2 Pest Management Trial

CUM/CP/2.1 Integrated management of pests and disease of cumin Jobner and Jagudan

FENNEL**FEL/CI/1 Genetic Resources**

FNL/CI/1.1 Germplasm collection, characterization, evaluation, conservation and screening against diseases Jobner, Jagudan, Hisar, Kumarganj and Dholi

FNL/CI/2 Hybridization Trial

FNL/CI/2.1 Mutation studies and crossing programme in fennel Jagudan

FNL/CI/2.2 Inter-varietal hybridization for evolving high yielding varieties Jobner

FNL/CI/3 Coordinated Varietal Trial

FNL/CI/3.1 CVT 1994 – Series –III Jobner

FNL/CI/3.2 CVT 2001– Series –IV Jobner, Jagudan, Hisar and Kumarganj

FNL/CI/4 Varietal Evaluation Trial

FNL/CI/4.1 Initial evaluation trial Jagudan , Hisar and Jobner

FNL/CI/4.2 Comparative yield trial Dholi

FNL/CI/5 Quality evaluation trial

FNL/CI/5.1 Quality evaluation in fennel Jobner

FNL/CM/1 Nutrient Management Trial

FNL/CM/1.2 Efficacy of biofertilizer using *Azospirillum* on fennel Jobner and Kumarganj

FENUGREEK**FGK/CI/1 Genetic Resources**

FGK/CI/1.1 Germplasm collection, characterization, evaluation conservation and screening against diseases Guntur, Jobner, Jagudan, Hisar, Dholi and Kumarganj

FGK/CI/2 Hybridization Trial

FGK/CI/2.1 Evolving varieties resistant to powdery mildew

Jagudan and Jobner

FGK/CI/3 Coordinated Varietal Trial

FGK/CI/3.1 CVT 1995 – Series III

Guntur and Kumarganj

FGK/CI/3.2 CVT 1999 – Series IV

Kumarganj and Dholi

FGK/CI/3.3 CVT 2001 – Series V

Coimbatore, Guntur, Jobner, Jagudan, Hisar, Dholi and Kumarganj

FGK/CI/4 Varietal Evaluation Trial

FGK/CI/4.1 Comparative yield trial

Dholi

FGK/CI/4.2 Initial evaluation trial

Hisar, Jobner, Dholi and Jagudan

FGK/CI/5 Quality Evaluation Trial

FGK./CI/5.1 Quality evaluation in fenugreek

Coimbatore, Jobner, Guntur, Jagudan, Hisar, Dholi and Kumarganj

FGK/CM/2 Nutrient Management Trial

GK/CM/2.2 Efficacy of biofertilizers using *Azospirillum* and *Rhizobium* on fenugreek

Coimbatore, Guntur, Jagudan, Kumarganj and Jobner

FGK/CP/1 Disease Management Trial

FGK/CP/1.1 Biocontrol of root rot in fenugreek

Coimbatore

b) Closed projects**BLACK PEPPER**

PEP/CI/3.2 CVT 1991 – Series IV

Chintapalle

PEP/CM/1.2 Drip irrigation in black pepper

Panniyur

PEP/CM/3.1 Rapid multiplication of black pepper on soil mound

Dapoli

PEP/CP/1.1 Control of *Phytophthora* foot rot disease of black pepper

Sirsi

PEP/CP/2.1 Control of scale-insects in black pepper

Pampadumpara

CARDAMOM

CAR/CI/3.1 CVT 1998 – Series II
(Relay out of CVT 1991 - Series)

Pampadumpara

CAR/CM/1.3 Integrated nutrient management
in cardamom Pampadumpara

TURMERIC

TUR/CI/2.2 CVT 2000 - Series V Dholi

TUR/CI/3.1 Comparative yield trial (1999-2000) Dholi

TREE SPICES

TSP/CM/1.1 Vegetative propagation in nutmeg,
clove and cinnamon Dapoli

CORIANDER

COR/CI/2.2 CVT 1996 – Series III Hisar

COR/CI/2.3 CVT 1998 – Series IV Jagudan, Hisar, Jobner and
Dholi

CUMIN

CUM/CI/3.2 CVT 1999-Series IV Jagudan

FENNEL

FNL/CI/3.1 CVT 1994 – Series –III Jagudan and Hisar

FENUGREEK

FGK/CI/3.2 CVT 1999 – Series IV Jobner and Hisar

ACRONYMS

PEP : Black pepper

CAR : Cardamom

GIN : Ginger

TUR : Turmeric

TSP : Tree Spices

COR : Coriander

CUM : Cumin

FNL : Fennel

FGK : Fenugreek

CI : Crop Improvement

CM : Crop Management

CP : Crop Protection

PROGRESS OF WORK AND ACHIEVEMENTS

BLACK PEPPER

PEP/CI/1 Genetic Resources

PEP/CI/1.1 Germplasm collection, characterization, evaluation and conservation

(*Panniyur, Sirsi, Chintapalli, Dapoli, Yercaud and Pundibari*)

The objective of this project is to collect, maintain, evaluate, characterize and catalogue the germplasm of pepper. Morphological characteristics, yield and yield attributing traits, tolerance to pests and diseases and other durable traits are being evaluated to identify promising accessions and also to utilize them in the breeding programmes.

Panniyur

Black pepper germplasm (147) consisting of cultivated and wild related

species are being maintained at this centre. Data on yield and yield attributing characters of a few promising accessions evaluated during the year are given in Table 1.

The accession Valiyaramundi recorded the maximum green berry yield of 6.87 kg vine⁻¹ followed by TMB - X (5.70 kg vine⁻¹). The maximum number of spikes vine⁻¹ was also recorded in Valiyaramundi (1936) followed by TMB - (1700).

The number of developed berries spike⁻¹ was maximum in Perumunda (51) followed by Valiyaramundi (45). The maximum spike length was recorded in Cul - 406 (16.42 cm) followed by Uthirankotta - II (13.77 cm). Accessions, Nilgiris and Uthirankotta - II recorded the highest 100 berry weight of 20 g and 19 g, respectively.

Table 1. Yield and yield attributing characters of promising germplasm lines (2002-2003) – Panniyur

| Cultivar | Green berry wt (g vine ⁻¹) | No. of spikes vine ⁻¹ | Spike length (cm) | No. of developed berries spike ⁻¹ | 100 berry wt (g) |
|--------------------|--|----------------------------------|-------------------|--|------------------|
| Valiyaramundi | 6.87 | 1936 | 6.01 | 45 | 13 |
| TMB - X | 5.70 | 1700 | 10.21 | 38 | 13 |
| TMB - IV | 4.50 | 1476 | 11.21 | 31 | 13 |
| Karimunda - III | 4.17 | 1477 | 8.31 | 26 | 11 |
| Cul - 406 | 4.09 | 1532 | 16.42 | 20 | 12 |
| Balankotta | 3.38 | 972 | 10.98 | 28 | 16 |
| Kalluvally | 1.29 | 413 | 8.07 | 35 | 15 |
| Nilgiris | 1.35 | 602 | 10.81 | 15 | 20 |
| Uthiranitotta - II | 1.10 | 553 | 13.77 | 15 | 19 |
| Perumunda | 0.46 | 115 | 8.92 | 51 | 13 |

Sirsi

The trial was started during 1988-89. During the year 2002-03 twelve new accessions were added to the existing 109 collections. Accessions 110 and 115 identified and collected from farmers field have potential of producing long spikes (20 - 25 cm) with medium bold berries and are growing well under shaded situation in arecanut garden. These two Karimalligesara accessions have high seed setting.

Chintapalle

The project was initiated at Chintapalle center during 1987. A total of 58 varieties/hybrids including 11 collections made during 2002-03 (Col - 1041, PRS - 17, PRS - 21, PRS - 22, Cul - 5308, Cul - 5489, HP - 34, HP - 105, HP - 1411, HP - 813, Karimunda O.P.) are being maintained.

Performance of 22 varieties/hybrids/ accessions in black pepper was studied during 2002-03 and the data are presented in Table 2. Narayakodi and Thevarmundi recorded 150% and 100%, increase in yield, respectively over check (Panniyur - 1). During 2002-03 there was a severe drought at the time of flower initiation and as such flowering was very low (30%). However, Narayakkodi recorded highest yield of 5 kg vine⁻¹ (dry) followed by Thevarmundi (4 kg vine⁻¹). Panniyur - 1 consistently performed well recording an average yield of 2.0 kg vine⁻¹ (dry).

The number of spikes vine⁻¹ was also maximum in Thevaramundi (2795) followed by Narayakkodi (2650), whereas the recovery percentage was highest in Kuthirvalley. The spike length is maximum in Panniyur - 1 whereas the number of berries per spike is more in Narayakkodi.

Table 2. Performance of black pepper accessions – Chintapalle

| Variety | No. of spikes vine ⁻¹ | Spike length (cm) | No. of berries spike ⁻¹ | Berry girth (mm) | Wet weight of berries (kg vine ⁻¹) | Dry weight (kg vine ⁻¹) | Recovery (%) |
|---------------|----------------------------------|-------------------|------------------------------------|------------------|--|-------------------------------------|--------------|
| Neelamundi | 480 | 9.3 | 79 | 4.7 | 2 | 0.5 | 25 |
| Thevarmundi | 2795 | 9.1 | 85 | 4.3 | 12 | 4.0 | 33 |
| Aimpiryan | 1020 | 10.2 | 92 | 4.5 | 4 | 1.0 | 25 |
| Vellanamban | 250 | 12.0 | 60 | 4.0 | 0.7 | 0.2 | 30 |
| Narayakkodi | 2650 | 9.6 | 104 | 5.0 | 15 | 5.0 | 33 |
| Uddaghere | 315 | 10.0 | 78 | 4.0 | 0.7 | 0.2 | 30 |
| Kureilmundi | 905 | 11.5 | 65 | 5.0 | 2.5 | 0.7 | 27 |
| Permabramundi | 730 | 13.0 | 60 | 5.2 | 3.2 | 1.0 | 31 |
| Malamundi | 445 | 11.0 | 75 | 4.8 | 1.7 | 0.5 | 30 |
| Kottanadan | 1105 | 10.0 | 60 | 4.7 | 4.6 | 1.2 | 26 |
| Panniyur - 1 | 885 | 16.0 | 88 | 4.8 | 6.2 | 2.0 | 32 |
| Karimunda | 440 | 8.2 | 80 | 4.8 | 1.5 | 0.4 | 27 |

| | | | | | | | |
|--------------|------|------|----|-----|-----|-----|----|
| Kuthirvally | 300 | 9.0 | 60 | 5.0 | 1.2 | 0.4 | 35 |
| Arakulmundi | 1090 | 8.5 | 61 | 5.8 | 3.1 | 0.9 | 29 |
| Balankottai | 300 | 10.5 | 47 | 6.0 | 1.4 | 0.5 | 33 |
| Kalluvally | 100 | 9.0 | 50 | 4.6 | 0.7 | 0.2 | 25 |
| Punjarimunda | 875 | 8.5 | 60 | 4.6 | 3.0 | 0.9 | 30 |
| Srekara | 325 | 8.5 | 60 | 4.6 | 0.7 | 0.2 | 29 |
| Subhakara | 155 | 8.0 | 65 | 4.5 | 0.4 | 0.1 | 32 |
| Panniyur - 2 | 400 | 12.0 | 72 | 4.6 | 1.1 | 0.3 | 27 |
| Panniyur - 3 | 570 | 14.0 | 87 | 5.1 | 3.1 | 0.8 | 28 |
| Panniyur - 5 | 165 | 10.5 | 55 | 4.6 | 0.9 | 0.3 | 35 |

Dapoli

Eleven different types of black pepper accessions were collected from the forest areas at Dongarwadi Pune, Chandepadi Raigad, Phansad Forest Murud Raigad and are being multiplied.

Yercaud

The project was initiated during 1998-99 at this center and maintains 106 germplasm accessions. In the year 2003 berry set and yield were observed in 33 accessions. Among these accessions, Panniyur - 5 recorded the yield of 8.6 kg and 2.4 kg green and dry, respectively.

Pundibari

Nine improved varieties of black pepper (Panniyur - 1, 2, 3, 4 & 5, Sreekara, Subhakara, Pournami and Panchami) were collected from IISR, Calicut during 2000. One genotype (Kottanadan) was collected from CPCRI, Mohitnagar, in the year 2002. Planting materials are being produced for further multiplication and evaluation.

PEP/CI/2 Hybridization Trial

PEP/CI/2.1 Inter-varietal hybridization to evolve high yielding varieties

(*Panniyur*)

Panniyur

The project was started in 1972 to evolve high yielding black pepper varieties with resistance to pests and diseases and other durable traits. Progenies obtained from open pollinated and hybrid seeds are primarily screened for vegetative characters. These are later evaluated for berry, spike and yield characters. The promising lines are selected and advanced to multilocal trials.

Evaluation of open pollinated progenies is in progress. Fifteen cross combinations were made during the year. Seeds of sixteen germplasm accessions were sown for OP progeny evaluation. Among the hybrids planted during 2000, KM III X Panniyur - 5 is found to be promising with regard to number of laterals and spikes, early spiking and compact setting of berries. Inter species hybrids of promising pepper varieties with *Piper colubrinum* were planted in the field and the hybrids are being evaluated.

PEP/CI/3 Coordinated Varietal Trial (CVT)

PEP/CI/3.1 CVT 1987 Series – III

(*Sirsi* and *Dapoli*)

Sirsi

The trial was initiated in 1992-93 with 11 released varieties and promising cultivars.

During the year 2002-03 Panniyur - 1 has recorded highest fresh berry yield (Table 3).

All the varieties were susceptible to *Phytophthora* foot rot disease.

Table 3. Performance of promising cultures of black pepper (2002-03) - *Sirsi*

| Cultivar/variety | Average spike length (cm) | No. of developed berries spike ⁻¹ | Mean fresh berry yield (kg vine ⁻¹) | Dry recovery (%) |
|---------------------|---------------------------|--|---|------------------|
| Karimalligesara | 7.41 | 61.20 | 2.17 | 33.31 |
| Uddakare | 7.98 | 62.30 | 2.33 | 31.28 |
| Pannniyur - 1 | 11.88 | 108.66 | 4.17 | 26.45 |
| Cul - 812 | 10.12 | 74.53 | 2.95 | 30.00 |
| Cul - 331 | 11.35 | 81.30 | 2.98 | 32.05 |
| Cul - 239 | 11.22 | 79.60 | 3.75 | 32.20 |
| Cul - 856 | 9.32 | 63.11 | 2.79 | 31.25 |
| KS - 88 | 6.50 | 56.22 | 2.11 | 30.33 |
| KS - 14 (Sreekara) | 6.88 | 53.83 | 2.05 | 31.80 |
| KS - 27 (Subhakara) | 7.05 | 55.16 | 1.92 | 32.20 |
| Cul - 141 | 8.10 | 54.10 | 1.89 | 31.50 |

Dapoli

The morphological characters and yield obtained during the year 2002-2003 from different black pepper accessions are presented in Table 4. Panniyur - 1 recorded highest yield (dry 970.50 g plant⁻¹) followed

by Panniyur - 2 (638.00 g plant⁻¹) which was planted in 1996. The lowest yield was recorded in Sreekara (158.50 g plant⁻¹). Though date of planting is not same for all the accessions, Panniyur - 1 seems to be suitable for growing in this locality.

Table 4. Growth and yield of promising lines of black pepper - *Dapoli*

| Cultivar | Date of planting | Vine length (m) | Yield (dry, kg plant ⁻¹) |
|--------------|------------------|-----------------|--------------------------------------|
| Panniyur - 1 | September 96 | 4.48 | 970.50 |
| Panniyur - 2 | September 96 | 4.86 | 523.00 |
| Panniyur - 3 | September 96 | 4.62 | 638.00 |
| Panniyur - 4 | September 96 | 2.75 | 447.00 |

| | | | |
|--------------|--------------|------|--------|
| Panniyur - 5 | September 96 | 3.45 | 448.50 |
| Panchami | March 97 | 2.50 | 289.00 |
| Pournami | March 97 | 1.98 | 187.50 |
| Sreekara | July 98 | 2.03 | 158.50 |
| Subhakara | July 98 | 2.40 | 182.00 |
| P - 24 | May 2000 | 1.96 | — |
| Cul - 141 | May 2000 | 2.00 | — |

(Karimunda)

PEP/CI/3.2 CVT 1991- Series IV*(Panniyur, Ambalavayal, Chintapalle and Yercaud)**Panniyur*

The experiment was laid out at Pepper Research Station, Panniyur during the year 1993 to evaluate the performance of promising cultures of black pepper along with the released varieties. The design of the experiment was RBD with 14 treatments replicated thrice.

Among the fourteen cultures evaluated for green berry yield from 1998-2002, Panniyur cultures namely, Cul -1558 and Cul - 5128 recorded the maximum yield of 2.438 kg vine⁻¹ and 1.858 kg vine⁻¹ respectively. Among the varieties tested, the highest mean yield was in Panniyur - 4 (2.234 kg vine⁻¹) followed by Panniyur - 5 (2.163 kg vine⁻¹). However the top yielder, Cul -1558 was statistically on par with Panniyur - 4, Panniyur - 5, Cul - 5128, Kottanadan (2445), Panchami, Panniyur - 2 and Panniyur - 3. (Table 5).

Table 5. Yield (kg vine⁻¹) of black pepper varieties and cultures (1997–2001) - Panniyur

| Culture/Variety | 1997-98 | 1998-99 | 1999-2000 | 2000-01 | 2001-02 | Mean |
|-------------------|---------|---------|-----------|---------|---------|-------|
| Sreekara | 0.24 | 1.40 | 0.78 | 0.550 | 0.406 | 0.676 |
| Subhakara | 0.48 | 2.26 | 0.65 | 2.350 | 1.835 | 1.516 |
| Panchami | 0.27 | 4.21 | 1.50 | 1.500 | 1.045 | 1.706 |
| Pournami | 0.16 | 0.99 | 0.46 | 0.250 | 0.150 | 0.402 |
| Kottanadan (2426) | 0.54 | 3.00 | 1.17 | 11.250 | 1.171 | 1.427 |
| Kottanadan (2445) | 0.47 | 4.30 | 0.91 | 2.150 | 1.016 | 1.769 |
| Panniyur - 1 | 0.95 | 1.89 | 1.46 | 2.150 | 0.443 | 1.379 |
| Panniyur - 2 | 0.16 | 3.55 | 1.81 | 2.200 | 0.575 | 1.660 |
| Panniyur - 3 | 0.66 | 2.33 | 1.40 | 1.900 | 1.920 | 1.642 |
| Panniyur - 4 | 0.66 | 4.31 | 1.78 | 2.750 | 1.665 | 2.234 |
| Cul - 1558 | 0.87 | 4.98 | 2.33 | 3.350 | 0.659 | 2.438 |
| Cul - 5128 | 0.22 | 3.30 | 1.35 | 3.450 | 0.970 | 1.858 |
| Cul - 239 (P - 5) | 1.05 | 3.84 | 2.79 | 2.450 | 0.681 | 2.163 |
| Karimunda | 0.42 | 1.93 | 0.73 | 1.250 | 1.515 | 1.170 |
| CD (5%) | 0.43 | 2.18 | 0.85 | NS | 498.74 | 0.802 |

During the year 2002-03, Cul -1558 recorded the highest green berry yield of 3 kg vine⁻¹, followed by Cul - 5128 (2.9 kg vine⁻¹). The number of spikes vine⁻¹ was maximum for Panchami (835) followed by Panniyur - 4 (705) and Cul - 1558 (685). The maximum number of berries/spike was recorded in Panniyur - 1 (55) followed by Cul - 239 (45). The spike length was maximum Cul - 1558 (16.60 cm) followed by Panniyur - 1 (15.50 cm). The 100 berry weight was maximum in Cul - 5128 (17 g) (Table 6).

Table 6. Yield and yield attributing characters of black pepper lines (2002-2003) – Panniyur

| Culture/Variety | Yield (fresh, kg vine ⁻¹) | No. of spikes vine ⁻¹ | Spike length (cm) | No. of developed berries spike ⁻¹ | 100 berry wt. (g) |
|-------------------|---|--|-------------------------|--|----------------------|
| Sreekara | 0.50 | 210 | 8.25 | 21 | 10.00 |
| Subhakara | 2.15 | 590 | 8.60 | 25 | 11.50 |
| Panchami | 1.45 | 835 | 8.95 | 22 | 10.50 |
| Pournami | 0.30 | 150 | 8.30 | 29 | 13.50 |
| Kottanadan (2426) | 1.50 | 505 | 9.35 | 35 | 11.50 |
| Kottanadan (2445) | 2.25 | 480 | 9.85 | 37 | 12.00 |
| Panniyur - 1 | 2.50 | 340 | 15.50 | 55 | 14.00 |
| Panniyur - 2 | 2.30 | 515 | 9.45 | 31 | 14.50 |
| Panniyur - 3 | 1.95 | 385 | 13.50 | 38 | 13.50 |
| Panniyur - 4 | 2.50 | 705 | 9.85 | 32 | 11.50 |
| Cul - 1558 | 3.00 | 685 | 16.60 | 37 | 13.00 |
| Cul - 5128 | 2.90 | 300 | 13.30 | 30 | 17.00 |
| Cul - 239 (P - 5) | 2.65 | 445 | 14.05 | 45 | 11.00 |
| Karimunda | 1.50 | 505 | 7.90 | 29 | 11.00 |
| CD (5%) | 1.28 | 271.33 | 3.49 | 8.59 | 2.98 |

Chintapalle

The trial was started during 1996-97 with 14 varieties/hybrids/cultures viz., Sreekara, Acc - 2426, Acc - 2445, Subhakara, Panchami, Pournami, Panniyur - 1, Panniyur - 2, Panniyur - 3, Panniyur - 4, Panniyur - 5, Malligesara, Cul - 1558 and Cul - 5128 in RBD with 3 replications.

During 1998-99 significantly higher yield per vine (0.4 kg fresh and 0.14 kg dry) was recorded in Malligesara, whereas during 1999-2000, Sreekara gave 1.0 kg dry pepper, which was significantly superior to others. The trial continued for 3 years and subsequently 80% of the vines were removed as the vines were severely affected by stunt disease.

Ambalavayal

The trial was started in 1992 with 14 lines replicated thrice in RBD. Over the five years, pepper cultivars showed significant differences for all the characters studied. Panchami (0.801 kg) Panniyur - 4 (0.584 kg), Acc - 2445 (0.514 kg), Panniyur - 3 (0.469 kg) and Acc - 2426 (0.399 kg) were significantly superior to other cultivars with respect to yield (green). Panchami (0.254 kg), Panniyur - 2 (0.180 kg), Panniyur - 4 (0.166 kg), Panniyur - 3 (0.165 kg), Acc - 2445 (0.162 kg), Panniyur - 1 (0.138 kg), Acc - 12426 (0.127 kg) and Cul - 239 (0.126 kg) showed their superiority over other cultivars in the yield (dry). Panchami (189.43), Panniyur - 4 (147.53), Acc - 2445 (125.12) and Panniyur - 2 (112.35) were significantly superior to other cultivars for the number of

spikes vine⁻¹. Spike length showed significant variation among the cultivars and Panniyur - 5 (9.69 cm), Panniyur - 3 (9.31 cm), Panniyur - 1 (9.22 cm), Panchami (9.21 cm), Cul - 1558 (8.77 cm), Acc - 2426 (8.34 cm) and Acc - 2445 (8.28 cm) were significantly superior to other cultivars. With respect to the number of berries per spike, Panchami (62.15), Panniyur - 3 (58.34), Acc - 2426 (53.36) and Panniyur - 4 (51.42) were on par and superior to other cultivars. Cul - 5128 (170.56 g, 144.38 cc) and Panniyur - 1 (146.76 g, 124.38 cc) showed their superiority over other cultivars with respect to 1000 berry weight and volume.

The results indicated that Panchami, Panniyur - 4, Panniyur - 3, Acc - 2445, Acc - 2426 and Panniyur - 2 were found promising for the high range region of Kerala (Table 7).

Table 7. Biometric and yield characteristics of black pepper cultivars (Mean of five years) – Ambalavayal

| Entry | Wet weight of berries (kg vine ⁻¹) | Dry weight of berries (kg vine ⁻¹) | No. of spikes vine ⁻¹ | Spike length (cm) | No. of berries spike ⁻¹ | 1000 berry weight (g) | 1000 berry volume (cc) |
|-------------------------|--|--|----------------------------------|-------------------|------------------------------------|-----------------------|------------------------|
| Sreekara | 0.176 | 0.077 | 63.41 | 6.86 | 35.32 | 101.57 | 91.81 |
| Subhakara | 0.088 | 0.042 | 33.62 | 6.40 | 33.59 | 110.44 | 101.05 |
| Panchami | 0.801 | 0.254 | 189.43 | 9.21 | 62.15 | 123.96 | 110.93 |
| Pournami | 0.206 | 0.078 | 53.85 | 7.81 | 37.95 | 113.89 | 102.26 |
| Kottanadan (Acc - 2426) | 0.399 | 0.127 | 101.99 | 8.34 | 53.36 | 123.83 | 110.15 |
| Kottanadan (Acc - 2445) | 0.514 | 0.162 | 125.12 | 8.28 | 46.69 | 130.96 | 112.11 |
| Panniyur - 1 | 0.295 | 0.138 | 66.51 | 9.22 | 47.54 | 146.76 | 124.38 |

| | | | | | | | |
|--------------|-------|-------|--------|------|-------|--------|--------|
| Panniyur - 2 | 0.481 | 0.180 | 112.35 | 8.22 | 44.46 | 129.77 | 118.75 |
| Panniyur - 3 | 0.469 | 0.165 | 83.56 | 9.31 | 58.34 | 135.88 | 120.52 |
| Panniyur - 4 | 0.584 | 0.166 | 147.53 | 8.20 | 51.41 | 121.78 | 106.64 |
| Cul - 1558 | 0.153 | 0.048 | 52.89 | 8.77 | 40.98 | 85.60 | 81.38 |
| Cul - 5128 | 0.308 | 0.105 | 56.10 | 8.03 | 43.38 | 170.56 | 144.38 |
| Panniyur - 5 | 0.340 | 0.126 | 73.66 | 9.69 | 45.59 | 125.24 | 118.19 |
| Karimunda | 0.127 | 0.061 | 47.46 | 6.95 | 36.81 | 99.44 | 94.19 |
| CD (5%) | 0.433 | 0.141 | 78.71 | 1.41 | 13.27 | 24.05 | 22.72 |

Yercaud

All the accessions yielded during the year 2002-2003. Among the accessions,

Panniyur - 3 performed well with mean yield of 6.2 kg of green berry and 1.8 kg dry berry per vine, respectively (Table 8).

Table 8. Performance of black pepper entries (2002-03) - Yercaud

| Entry | Spike length (cm) | No. of berries spike ⁻¹ | Yield (kg vine ⁻¹ fresh) | Yield (kg vine ⁻¹ dry) |
|--------------|-------------------|------------------------------------|-------------------------------------|-----------------------------------|
| Sreekara | 10.3 | 55.0 | 3.3 | 1.00 |
| Subhakara | 10.8 | 56.0 | 2.9 | 0.95 |
| Panchami | 9.6 | 62.0 | 2.2 | 0.60 |
| Acc - 856 | 10.3 | 64.0 | 3.2 | 0.82 |
| Acc - 2426 | 9.8 | 63.0 | 1.9 | 0.45 |
| Acc - 2445 | 9.5 | 58.0 | 3.2 | 0.85 |
| Panniyur - 1 | 10.6 | 71.0 | 4.5 | 1.20 |
| Panniyur - 2 | 8.9 | 59.0 | 2.9 | 0.74 |
| Panniyur - 3 | 12.8 | 74.0 | 6.2 | 1.80 |
| Panniyur - 4 | 1.6 | 70.0 | 2.2 | 0.48 |
| Acc - 239 | 10.9 | 65.0 | 2.8 | 0.63 |
| Cul - 1558 | 8.9 | 70.0 | 3.3 | 0.70 |
| Cul - 5128 | 10.4 | 64.0 | 3.2 | 0.70 |
| Karimunda | 8.8 | 55.0 | 3.8 | 1.10 |

PEP/CI/3.3 CVT 2000 - Series V

(*Pampadumpara*, *Sirsi*, *Panniyur*, *Chintapalle* and *Ambalavayal*)

Pampadumpara

The trial with 13 entries, replicated thrice in RBD was started during June 2002. The survival was 66 to 100% among 13 genotypes. During 2002-03 there was no

significant difference among the genotypes for number of leaves and infestation of marginal gall thrips. More number of leaves was observed in HP - 1041 (34.76) followed by Karimunda OP (34.66). Highest infestation of marginal gall thrips was observed in HP - 105 (19.65%) and PRS - 17 (19.34%), whereas it was least in HP - 34 (4.27%). (Table 9).

Table 9. Growth and pest infestation in black pepper (2002-03) - Pampadumpara

| Genotype | Survival (%) | No. of leaves | Infestation of marginal gall thrips(%) |
|--------------|--------------|---------------|--|
| HP - 34 | 100 | 21.66 | 4.27 |
| HP - 105 | 83 | 12.32 | 19.65 |
| HP - 813 | 66 | 12.70 | 16.63 |
| Coll - 1041 | 88 | 34.76 | 13.37 |
| OP Karimunda | 66 | 34.66 | 9.34 |
| PRS - 17 | 83 | 9.54 | 19.34 |
| HP - 1411 | 66 | 9.65 | 10.07 |
| PRS - 21 | 83 | 13.09 | 15.98 |
| PRS - 22 | 83 | 15.44 | 13.54 |
| Cul - 5308 | 94 | 18.33 | 16.84 |
| Cul - 5489 | 77 | 16.88 | 10.59 |
| Panniyur - 1 | 88 | 10.66 | 14.23 |
| Karimunda | 83 | 22.00 | 16.40 |
| CD (5%) | - | NS | NS |

Sirsi

The experiment was initiated during September 2002 with 14 entries replicated twice in RBD and it is in progress.

crop is satisfactory. Preliminary observations on growth were recorded.

*Ambalavayal**Panniyur*

The trial was started during 2001 with 13 genotypes. Since the vines were affected by *Phytophthora* foot rot disease gap filling was done during 2002 and the stand of the

The trial was started in 2001 with 13 entries. Among the entries tested, Panniyur - 1 recorded the maximum vine height (109.13 cm) and number of leaves (16.8) (Table 10).

Table 10. Biometric characters of black pepper cultures (2002-03) – Ambalavayal

| Entry | Vine height (cm) | No. of leaves |
|--------------|------------------|---------------|
| PRS - 17 | 92.87 | 16.3 |
| PRS - 21 | 51.25 | 7.5 |
| PRS - 22 | 58.90 | 6.6 |
| Cul - 5308 | 56.55 | 12.7 |
| Cul - 5489 | 69.05 | 10.0 |
| HP - 34 | 118.15 | 9.3 |
| HP - 105 | 45.10 | 9.03 |
| HP - 813 | 36.37 | 8.60 |
| HP - 1411 | 68.23 | 13.7 |
| Coll - 1041 | 54.06 | 9.5 |
| Karimunda OP | 70.84 | 9.0 |
| Panniyur - 1 | 109.13 | 16.6 |
| Karimunda | - | - |

Chintapalle

Twelve entries viz., Coll - 1041, PRS - 17, PRS - 21, PRS - 22, Cul - 5308, Cul - 5489, HP - 34, HP - 105, HP - 1411, HP - 813, Karimunda O.P. and Panniyur - 1 were planted during 2002-2003. Out of 12 entries, PRS - 22, PRS - 17 and Coll - 1041 could not establish in the field due to severe infestation by *Phytophthora* foot rot disease.

PEP/CM/1 Irrigation Trial**PEP/CM/1.1 Irrigation-cum-fertilizer requirement for arecanut and pepper mixed cropping system**

(Sirsi)

Sirsi

The trial was laid out during 1992-93 in arecanut – black pepper mixed cropping system with 3 levels of irrigation as main plot and 4 levels of fertilizer as sub-plot treatments with two varieties of black pepper. Irrigation with 20 l vine⁻¹ day⁻¹ and fertilizer dose of NPK 100 : 40 : 140 g vine⁻¹ recorded highest average yield of 2.69 kg vine⁻¹ in Panniyur - 1 (Table 11). Observations for Karimalligesara could not be taken as the population of this variety was not sufficient.

Table 11. Effect of irrigation and fertilizer on the yield of black pepper variety Panniyur - 1 in arecanut plantation (2002-03) - Sirsi

| I/M levels | Yield (fresh, kg vine ⁻¹) | | | | |
|------------|---------------------------------------|-------|-------|-------|------|
| | M - 0 | M - 1 | M - 2 | M - 3 | Mean |
| I - 1 | 1.96 | 2.00 | 2.69 | 2.40 | 2.26 |
| I - 2 | 1.40 | 1.56 | 2.22 | 2.00 | 1.79 |
| I - 3 | 1.25 | 1.45 | 1.53 | 2.23 | 1.62 |
| Mean | 1.54 | 1.67 | 2.15 | 2.21 | 1.89 |

Irrigation levels

I - 1 = IW/CPE=1.00, 30 mm water (30 l palm⁻¹ vine⁻¹ day⁻¹)

I - 2 = IW/CPE=0.66, 20 mm water (20 l palm⁻¹ vine⁻¹ day⁻¹)

I - 3 = IW/CPE=0.33, 10 mm water (10 l palm⁻¹ vine⁻¹ day⁻¹)

Fertilizer levels

M - 0 =Control

M - 1=50 :20 :70 NPK g vine⁻¹

M - 2=100:40:140 NPK g vine⁻¹

M - 3=150:60:210 NPK g vine⁻¹

PEP/CM/1.2 Drip irrigation in black pepper

(Panniyur)

Panniyur

The experiment was laid out at Pepper Research Station, Panniyur during the year 1996, to study the influence of drip irrigation on growth, yield and quality of black pepper. The experiment was concluded during 2001-02. The design was 3 x 3 factorial RBD with 3 irrigation levels and 3 varieties. The treatments are as follows.

Irrigation:

I₀ - No irrigation

I₁ - Drip irrigation (21 day⁻¹)

I₂ - Drip irrigation (41 day⁻¹)

Varieties:

V₁ - Panniyur - 3

V₂ - Panniyur - 5

V₃ - Panniyur - 1

During 1997-98, observations on survival of vines were recorded. The survival rate was 87% in I₂ (41 day⁻¹) and 81.5% in I₀ and I₁. During the year 1998-99 irrigation levels did not show any appreciable effect on yield characters among the varieties. There was no significant difference for yield and yield attributing characters during the year

1999-2000. During 2000-2001, among the different levels of irrigation, irrigation at 2 l day⁻¹ contributed more towards spike yield, spike number and spike length even though there was no significant difference between the levels of irrigation. But the other factor ie, varieties showed significant difference for yield and yield attributing characters. Among the varieties, Panniyur - 5 recorded the highest spike yield of 2.13 kg vine⁻¹ with 358 spikes and spike length of 13.69 cm. During the year 2001-02, there was no significant difference between levels of irrigation and varieties. Among the different levels of irrigation, irrigation at 2 l day⁻¹ contributed more towards spike number, green berry yield and spike length. The maximum spike yield of 1.83 kg vine⁻¹ was recorded for I₁ (2 l vine⁻¹). The highest number of spikes, number of developed berries spike⁻¹ and spike length were recorded in I₁. Among the varieties, Panniyur - 5 recorded the highest spike yield of 2.589 kg vine⁻¹ with 470.8 spikes and spike length of 11.48 cm. (Table 12).

The mean yield data from 1999 to 2002 also revealed that there was no significant difference between levels of irrigation and varieties. Among the different levels of irrigation, irrigation at 2 l day⁻¹ contributed more towards spike number, green berry yield and spike length. The maximum mean spike yield of 1.74 kg vine⁻¹ was recorded for I₁. Among the varieties, Panniyur - 5 recorded the highest spike yield of 2.08 kg vine⁻¹ (Table 13).

Table 12. Effect of drip irrigation on the yield of black pepper – Panniyur

| Levels of irrigation | Yield(kg vine ⁻¹) | | |
|----------------------|-------------------------------|-----------|-----------|
| | 1999-2000 | 2000-2001 | 2001-2002 |
| I ₀ | 1.47 | 1.61 | 1.52 |
| I ₁ | 1.49 | 1.89 | 1.83 |
| I ₂ | 0.95 | 1.51 | 1.20 |
| CD (5%) | NS | NS | NS |
| Varieties | | | |
| V ₁ | 1.44 | 1.28 | 0.84 |
| V ₂ | 1.50 | 2.13 | 2.59 |
| V ₃ | 0.97 | 1.60 | 1.12 |
| CD (5%) | NS | 0.91 | NS |

Table 13. Yield and yield attributing characters of black pepper (1999-2002) - Panniyur

| Treatment | Spike yield (kg vine ⁻¹) | No. of spikes vine ⁻¹ | Spike length (cm) |
|-------------------------------|---|-------------------------------------|----------------------|
| Levels of irrigation | | | |
| I ₀ | 1.53 | 225.60 | 11.59 |
| I ₁ | 1.74 | 261.39 | 12.31 |
| I ₂ | 1.21 | 182.11 | 12.08 |
| CD (5%) | NS | NS | NS |
| Varieties | | | |
| V ₁ | 1.18 | 154.48 | 10.98 |
| V ₂ | 2.08 | 352.59 | 12.58 |
| V ₃ | 1.23 | 162.01 | 12.08 |
| CD (5%) | NS | NS | NS |
| I ₀ V ₁ | 1.05 | 141.61 | 10.61 |
| I ₀ V ₂ | 2.37 | 378.38 | 11.87 |
| I ₀ V ₃ | 1.17 | 156.81 | 12.29 |
| I ₁ V ₁ | 1.66 | 218.39 | 11.80 |
| I ₁ V ₂ | 2.27 | 400.83 | 12.82 |
| I ₁ V ₃ | 1.28 | 164.94 | 12.32 |
| I ₂ V ₁ | 0.82 | 103.48 | 10.55 |
| I ₂ V ₂ | 1.58 | 278.59 | 13.05 |
| I ₂ V ₃ | 1.23 | 164.29 | 11.62 |
| CD (5%) | NS | NS | NS |

PEP/CM/2 Nutrient Management Trial
PEP/CM/2.1. Efficacy of biofertilizer
using *Azospirillum* in black pepper

(Panniyur, Sirsi, Yercaud, Thdiyankudisai and Ambalavayal)

Panniyur

The trial was laid out in RBD with 6 treatments replicated four times at two locations in Mattanur, Kannur District.

Sirsi

Yield data showed non significant difference during 2000-01 and 2001-02. However it was significant during 2002-03. The pooled data revealed that treatment T2 (inorganic N 75% + *Azospirillum* 50 g + FYM 10 kg) recorded the highest yield of 6.41 kg vine⁻¹, and treatments T1 and T3 were on par (Table 14).

Table 14. Efficacy of biofertilizer, *Azospirillum* in black pepper (2000-2003, pooled data) - Sirsi

| Treatment | Mean fresh yield (kg vine ⁻¹) | | | |
|--|---|---------|---------|--------|
| | 2000-01 | 2001-02 | 2002-03 | Pooled |
| T1 - Inorganic N 100% + <i>Azospirillum</i> 50 g + FYM 10 kg | 6.49 | 6.20 | 6.25 | 6.30 |
| T2 - Inorganic N 75% + <i>Azospirillum</i> 50 g + FYM 10 kg | 6.23 | 6.35 | 6.52 | 6.41 |
| T3 - Inorganic N 50% + <i>Azospirillum</i> 50 g + FYM 10 kg | 6.49 | 6.32 | 5.99 | 6.20 |
| T4 - FYM 10 kg + <i>Azospirillum</i> 50 g | 6.40 | 6.08 | 5.57 | 5.91 |
| T5 - FYM 10 kg alone | 6.83 | 5.67 | 5.27 | 5.76 |
| T6 - Recommended dose of fertilizer | 5.91 | 6.19 | 4.38 | 5.59 |
| CD (5%) | NS | NS | 0.70 | 0.44 |

Yercaud

This trial was laid out in the year 2000-2001. The shade trees (*Erythrina lithosperma*) were planted in the month of April and the pepper plants were planted in the month of August 2000. *Azospirillum* 25 g vine⁻¹ + FYM 5 kg were applied as basal dose and the rooted cuttings of pepper were planted. Fifteen days after planting, the inorganic fertilizers viz., urea, rock phosphate and muriate of potash were applied according to the treatments. In the month of November, top dressing with

Azospirillum 25 g vine⁻¹ + FYM 5 kg were applied and after 15 days, the inorganic fertilizers were applied according to the treatment.

The observation on vine length, number of leaves and leaf area were recorded and the vine length was high (94.6 cm) in the treatment T2, (inorganic N 75% + *Azospirillum* 50 g + FYM 10 kg). The number of leaves (22.5) and leaf area (59.00 cm²) were high in T3 (inorganic N 50% + *Azospirillum* 50 g + FYM 10 kg).

Ambalavayal

The experiment was started during 2003 with 5 treatments in RBD replicated four times.

Thadiyankudisai

Report not received.

PEP/CM/2.2 Efficacy of biofertilizer using P - solubilizer (Phosphobacteria) on black pepper

(Panniyur, Yercaud, Ambalavayal, Thadiyankudisai and Sirsi)

Panniyur

The trial was laid out in RBD with 6 treatments during 2001.

Yercaud

This trial was laid out in the year 2000 in RBD with 6 treatments replicated four times. The shade trees (*Erythrina lithosperma*) were planted in the month of April and the pepper plants were planted in the month of August 2000. Phosphobacteria 25 g vine⁻¹ + FYM 5 kg were applied as basal dose and the rooted cutting of pepper were planted. Fifteen days after planting, the inorganic fertilizers viz., urea, rock phosphate

and muriate of potash were applied according to the treatments. In the month of November, top dressing with Phosphobacteria 25 g vine⁻¹ + FYM 5 kg were applied and after 15 days, the inorganic fertilizers were applied according to the treatments.

Observation on vine length, number of leaves and leaf area were recorded and the vine length was high (98.6 cm) in the treatment T4 (FYM 10 kg + Phosphobacteria 50 g). The number of leaves per vine was higher (29.0) in the treatment T2 (inorganic P 50% + Phosphobacteria 50 g + FYM 10 kg) whereas the leaf area was high (58.6 cm²) in T1 (inorganic P 100% + Phosphobacteria 50 g + FYM 10 kg).

Ambalavayal

The trial will be laid out during 2003 with 5 treatments replicated four times in RBD.

Sirsi

The trial was laid out during 2000-01 with 6 treatments replicated four times in RBD.

Non-significant differences in yield were observed during 2000-01 and 2001-02. The pooled data revealed that treatments T1, T2, T3 and T4 are on par (Table 15).

Table 15. Efficacy of biofertilizer using P - solublizer in black pepper -Pooled data –Sirsi

| Treatment | Fresh yield (kg vine ⁻¹) | | | |
|---|--------------------------------------|---------|---------|--------|
| | 2000-01 | 2001-02 | 2002-03 | Pooled |
| T1 - Inorganic P 100% + P solublizer 50 g + FYM 10 kg | 6.68 | 6.27 | 6.63 | 6.55 |
| T2 - Inorganic P 75% + P solublizer 50 g + FYM 10 kg | 5.74 | 6.20 | 6.53 | 6.08 |
| T3 - Inorganic P 50% + P solublizer 50 g + FYM 10 kg | 6.31 | 6.00 | 6.57 | 6.37 |
| T4 - FYM 10 kg + P solublizer 50 g | 6.00 | 6.31 | 6.13 | 6.15 |
| T5 - FYM 10 kg alone | 5.74 | 6.71 | 4.77 | 5.39 |
| T6 - Recommended dose of fertilizer | 6.28 | 6.06 | 4.82 | 5.49 |
| SEm ± | 0.37 | 0.35 | 0.29 | 0.20 |
| CD (5 %) | NS | NS | 0.86 | 0.61 |

Thadiyankudisai

Report not received.

PEP/CM/2.3 Organic farming in black pepper

(*Panniyur, Sirsi, Ambalavayal, Yercaud and Thadiyankudisai*)

Sirsi

The trial was initiated during 2000-01 in RBD with five treatments. The pooled data showed that application of FYM 10 kg and burnt earth 10 kg gave the highest yield of 6.29 kg vine⁻¹, among the treatments (Table 16).

Table 16. Performance of organic farming in black pepper - Sirsi

| Treatment | Yield (kg vine ⁻¹ , fresh) | | | |
|---|---------------------------------------|---------|---------|--------|
| | 2000-01 | 2001-02 | 2002-03 | Pooled |
| FYM 10 kg vine ⁻¹ + P 40 g + wood ash 2 kg | 5.36 | 5.84 | 5.13 | 5.37 |
| FYM 10 kg vine ⁻¹ + P 40 g + wood ash 2 kg | 5.06 | 5.40 | 5.02 | 5.13 |
| FYM 10 kg + burnt earth 10 kg | 6.74 | 6.52 | 5.94 | 6.29 |
| FYM 10 kg + <i>Azospirillum</i> 50 g vine ⁻¹ + wood ash 2 kg | 5.05 | 5.62 | 4.72 | 5.03 |
| FYM 10 kg + Leaf manure 10 kg (local practice) + wood ash 2 kg | 5.61 | 5.82 | 4.09 | 4.90 |
| SEm ± | 0.27 | 0.16 | 0.18 | 0.15 |
| CD (5 %) | 0.85 | 0.49 | 0.55 | 0.45 |

Yercaud

The trial was initiated during 2001-02 with 6 treatments in RBD.

Panniyur, Ambalavayal, and Thadiyandudisai

Reports not received

PEP/CM/3 Multiplication Trial

PEP/CM/3.1 Rapid multiplication of black pepper on soil mound

(*Dapoli*)

Dapoli

The trial stated at Dapoli during 1999 was concluded during 2002. The trial was conducted in Randomized Block Design with six treatments replicated 5 times. A soil mound of size 2.5 x 0.60 m (45° angle) was prepared, with locally available lateritic soil. In the upper layer of 5 cm, fine FYM was mixed. Black

pepper cuttings were planted at the base of soil mound at different spacings as per the treatment in the month of April, 1999.

Growth of black pepper cuttings was recorded and presented in Table 17. The mean length at the time of harvesting the cuttings (3 months) ranged from 1.17 (T5) to 1.92 m (T1). The number of roots produced varied between 2.81 (T5) to 3.93 (T1). The variation observed for both the characters was statistically significant for three years as well as for pooled data.

The number of cuttings available per harvest as well as per year are presented in Table 18. Maximum number of cuttings were obtained from treatment T1 per harvest (18.41) as well as per year (73.50). The lowest number of cuttings was from bamboo splits

(9.70 and 38.80, per harvest and per year respectively). In all the spacings tested produced higher number of cuttings compared to the number of cutting obtained in bamboo splits.

These cuttings were planted in polybags along with cuttings produced by conventional method. The maximum success was observed in treatment T4 (90.95%) which was at par

with T1 (90.71%), T2 (90.09%), T5 (89.77%) and T3 (89.33%). All these treatments were significantly superior to treatment T6 (62.86%) (Table 19).

Economics of the method also indicated that T1 resulted in the highest net profit (Rs. 2593). Hence for black pepper propagation, planting the cuttings at 15 cm spacing on soil mound is recommended (Table 20).

Table 17. Vegetative growth of black pepper vines on soil mound (1999 - 2000 to 2001-2002) - Dapoli

| Treatment | Length of vine (m) | | | No. of roots per node | | | No. of shoots per vine | | | | | |
|-------------------------------------|--------------------|---------|---------|-----------------------|-----------|---------|------------------------|------|-----------|---------|---------|------|
| | 1999-2000 | 2000-01 | 2001-02 | Mean | 1999-2000 | 2000-01 | 2001-02 | Mean | 1999-2000 | 2000-01 | 2001-02 | Mean |
| T1 - 15 cm. spacing on soil mound | 2.20 | 1.77 | 1.78 | 1.92 | 5.020 | 3.30 | 3.46 | 3.93 | 1.20 | 1.20 | 1.20 | 1.20 |
| T2 - 22.5 cm spacing on soil mound | 1.69 | 1.66 | 1.70 | 1.63 | 4.230 | 3.40 | 3.40 | 3.68 | 1.00 | 1.20 | 1.00 | 1.06 |
| T3 - 30 cm spacing on soil mound | 1.68 | 1.60 | 1.71 | 1.66 | 4.670 | 3.50 | 3.45 | 3.87 | 1.00 | 1.00 | 1.20 | 1.06 |
| T4 - 37.5 cm spacing on soil mound | 1.66 | 1.62 | 1.88 | 1.72 | 4.260 | 3.50 | 3.25 | 3.67 | 1.00 | 1.00 | 1.00 | 1.00 |
| T5 - 15 cm spacing on bamboo splits | 1.06 | 1.30 | 1.15 | 1.17 | 3.140 | 2.50 | 2.80 | 2.81 | 1.00 | 1.00 | 1.20 | 1.07 |
| Mean | 1.65 | 1.59 | 1.64 | 1.62 | 4.270 | 3.24 | 3.27 | 3.59 | 1.04 | 1.08 | 1.12 | 1.08 |
| SEm ± | 0.07 | 0.03 | 0.06 | 0.09 | 0.243 | 0.19 | 0.21 | 0.16 | 0.09 | 0.13 | 0.14 | 0.07 |
| CD (5%) | 0.17 | 0.08 | 0.14 | 0.24 | 0.590 | 0.41 | 0.45 | 0.43 | NS | NS | NS | NS |

Table 18. Production of black pepper cuttings on soil mound (1999-2000 to 2001-2002) - Dapoli

| Treatment | No. of cutting per harvest | | | | No. of cuttings per year | | | |
|-------------------------------------|----------------------------|-----------|-----------|-------|--------------------------|-----------|-----------|-------|
| | 1999-2000 | 2000-2001 | 2001-2002 | Mean | 1999-2000 | 2000-2001 | 2001-2002 | Mean |
| T1 - 15 cm spacing on soil mound | 19.41 | 19.52 | 16.30 | 18.41 | 77.66 | 77.66 | 65.20 | 73.50 |
| T2 - 22.5 cm spacing on soil mound | 16.38 | 16.38 | 13.49 | 15.41 | 65.54 | 65.50 | 53.96 | 61.67 |
| T3 - 30 cm spacing on soil mound | 14.94 | 14.95 | 10.73 | 13.54 | 59.76 | 59.79 | 42.92 | 54.16 |
| T4 - 37.5 cm spacing on soil mound | 16.15 | 16.17 | 13.00 | 15.10 | 64.49 | 64.18 | 52.04 | 60.24 |
| T5 - 15 cm spacing on bamboo splits | 9.75 | 9.80 | 9.55 | 9.70 | 39.00 | 39.20 | 38.20 | 38.80 |
| Mean | 15.32 | 15.36 | 12.61 | 14.43 | 61.29 | 61.26 | 50.46 | 57.67 |
| SEm \pm | 0.24 | 0.55 | 0.47 | 0.16 | 0.97 | 2.19 | 1.88 | 0.06 |
| CD (5%) | 0.71 | 1.65 | 1.40 | 0.44 | 2.93 | 6.56 | 5.62 | 0.16 |

Table 19. Survival of black pepper cuttings obtained from soil mound technique (1999 - 2000 to 2001 - 2002) - Dapoli

| Treatment | Success (%) | | | |
|-------------------------------------|------------------|------------------|------------------|------------------|
| | 1999-2000 | 2000-2001 | 2001-2002 | Mean |
| T1 - 15 cm spacing on soil mound | 91.40 (71.46) | 90.14 (71.81) | 90.60 (72.55) | 90.71 (71.94) |
| T2 - 22.5 cm spacing on soil mound | 90.42 (73.06) | 88.64 (70.32) | 91.20 (72.95) | 90.09 (72.11) |
| T3 - 30 cm. spacing on soil mound | 88.50 (70.18) | 89.66 (71.33) | 89.80 (71.54) | 89.32 (71.02) |
| T4 - 37.5 cm spacing on soil mound | 93.26 (74.95) | 90.20 (71.84) | 89.40 (71.15) | 90.95 (72.65) |
| T5 - 15 cm spacing on bamboo splits | 88.90 (70.55) | 90.40 (72.00) | 90.00 (71.63) | 89.77 (71.40) |
| T6 - Conventional method | 59.40 (50.43) | 61.00 (51.36) | 68.20 (52.06) | 62.86 (51.29) |
| Mean | 85.31 (68.44) | 85.00 (68.11) | 86.53 (68.62) | 85.61 (68.40) |
| SEm \pm | 1.62 | 0.87 | 1.29 | 1.28 |
| CD (5%) | 4.79 | 2.54 | 3.79 | 3.77 |

Table 20. Cost of production for 1000 salable black pepper cuttings - Dapoli

| Particulars | Traditional method (Rs.) | Soil mound (15cm) (Rs.) | Bamboo splits (Rs.) |
|---|-----------------------------|----------------------------|------------------------|
| Material cost | 2100 (54.26) | 1220 (50.69) | 1258 (49.49) |
| Labour cost | 890 (23.08) | 611 (25.38) | 681 (26.79) |
| Other cost | 877 (22.66) | 576 (23.93) | 603 (23.72) |
| Total | 3870 (100.00) | 2407 (100.00) | 2542 (100.00) |
| Net returns from 1000 black pepper plants | 5000 | 5000 | 5000 |
| B.C. ratio | 1.29:1 | 2.07:1 | 1.96:1 |
| Net profit per 1000 cuttings | 1130 | 2593 | 2458 |

PEP/CP/1 Disease Management Trial
PEP/CP/1.2 Biological control of *Phytophthora* foot rot of black pepper – Nursery trial
 (Chintapalle, Pampadumpara and Ambalavayal)

Chintapalle

Planting in solarized soil fortified with *Trichoderma harzianum* 50 g kg⁻¹ of soil + VAM 100 cc kg⁻¹ soil (T3) has recorded significantly less disease incidence (Table 21).

Table 21. Management of *Phytophthora* disease in black pepper nurseries - Chintapalle

| Treatment | No. of plants infected |
|--|------------------------|
| T1 Planting in solarized soil | 3.33 |
| T2 Planting in non-solarized soil | 4.67 |
| T3 T1 + <i>Trichoderma harzianum</i> 50 g kg ⁻¹ soil + VAM 100 cc kg ⁻¹ soil | 3.00 |
| T4 T2 + <i>Trichoderma harzianum</i> 50 g kg ⁻¹ soil + VAM 100 cc kg ⁻¹ soil | 2.00 |
| T5 Ridomil spray 1.0 g l ⁻¹ of water + drenching 25 g vine ⁻¹ | 3.00 |
| T6 T5 + T2 | 3.33 |
| T7 T1+ Copperoxychloride 0.2% drench | 3.00 |
| T8 T2 + Copperoxychloride 0.2% drench | 3.33 |
| T9 T1 + <i>Trichoderma viride</i> 50 g kg ⁻¹ soil | 3.00 |
| T10 T2 + <i>Trichoderma viride</i> 50 g kg ⁻¹ soil | 3.67 |
| SEm ± | 0.25 |
| CD (5%) | 0.73 |
| CV % | 13.18 |

Pampadumpara

The treatments differed significantly for all the parameters studied. Planting in solarized soil fortified with *Trichoderma* and VAM (T3) gave maximum number of sprouted cuttings (65.0), number of roots (5.7)

and the length of roots (9.13) and was on par with T1 (62.5) and T4 (58.3). Number of roots as well as root length were higher in solarised treatments. Incidence of nursery rot was also less in this treatment (Table 22).

Table 22. Management of *Phytophthora* disease in black pepper nursery – Pampadumpara

| Treatment | No. of sprouted cuttings | No. of roots cutting ⁻¹ | Length of roots | Biomass of roots |
|--|--------------------------|------------------------------------|---------------------|--------------------|
| T1 - Solarised soil | 62.5 ^{ab} | 3.78 ^{ab} | 5.83 ^{abc} | 9.68 ^a |
| T2 - Non solarised soil | 34.0 ^d | 2.15 ^{bc} | 4.5 ^{bc} | 3.03 ^c |
| T3 - T1 Trichoderma + VAM | 65.0 ^a | 5.70 ^a | 9.13 ^a | 8.23 ^{ab} |
| T4 - T2 Trichoderma + VAM | 58.3 ^{ab} | 0.75 ^c | 2.60 ^c | 2.75 ^c |
| T5 - T1 Ridomil spray and drench @ 1.25g l ⁻¹ | 46.8 ^c | 3.05 ^{abc} | 6.43 ^{ab} | 7.53 ^{ab} |
| T6 - T2 Ridomil spray and drench @ 1.25g l ⁻¹ | 55.0 ^{cd} | 1.30 ^{bc} | 2.58 ^c | 7.48 ^{ab} |
| T7 - COC @ 0.2% drench + T1 | 41.0 ^d | 3.58 ^{ab} | 7.03 ^{ab} | 8.10 ^{ab} |
| T8 - COC @ 0.2% drench + T2 | 35.8 ^d | 1.55 ^{bc} | 4.80 ^{bc} | 5.15 ^{bc} |
| CD | 8.34 | 2.73 | 3.4 | 3.8 |

Ambalavayal

Among the treatments, solarized soil VAM recorded the maximum sprouting (93.75%) fortified with *Trichoderma harzianum* and with least disease incidence (6.06%) (Table 23).

Table 23. Management of *Phytophthora* disease in black pepper nurseries – Ambalavayal

| Treatment | Sprouting (%) | Disease incidence (%) | Plant height (cm) | Biomass (g plant ⁻¹) |
|--|-------------------|-----------------------|-------------------|----------------------------------|
| T1 - Planting in solarized soil | 85.00 (67.875) | 16.00 (23.573) | 15.213 | 1.242 |
| T2 - Planting in non-solarized soil | 76.25 (61.235) | 23.93 (29.298) | 10.797 | 0.939 |
| T3 - Solarized soil + <i>Trichoderma harzianum</i> + VAM | 93.75 (75.700) | 6.06 (14.250) | 13.577 | 1.744 |
| T4 - Non-solarized soil + <i>Trichoderma harzianum</i> + VAM | 86.25 (68.735) | 14.68 (22.543) | 14.325 | 1.416 |
| T5 - Ridomil spray and drench + T1 | 86.25 (69.400) | 12.81 (20.950) | 12.760 | 1.521 |
| T6 - T5 + T2 | 81.25 (64.610) | 19.63 (26.287) | 9.983 | 1.271 |

| | | | | |
|------------------------------|-------------------|-------------------|--------|-------|
| T7 - Copper oxychloride + T1 | 87.50 (72.630) | 12.13 (20.335) | 10.662 | 1.300 |
| T8 - Copper oxychloride + T2 | 81.50 (64.610) | 18.83 (25.745) | 10.817 | 0.980 |
| F-test | NS | ** | * | ** |
| CD (5%) | - | 2.261 | 3.328 | 0.209 |

Figures in parenthesis are transformed values.

PEP/CP/1.4 Control of *Phytophthora* foot rot disease of black pepper in farmers field - observational trial

(Sirsi, Panniyur, Mudigere and Ambalavayal)
Sirsi

The trial was initiated during 2000-2001 in two locations. During 2002-03 black pepper vines showed least incidence of disease (7.5%) where the vines treated twice in the season (June and August) with metalaxyl gold MZ 68 WP (Ridomil gold)

2.5 g l⁻¹ as spray (2 l vine⁻¹) and drench (3 l vine⁻¹) alone or and in combination with bioagent *Trichoderma harzianum* 50 g of 10⁷ cfu vine⁻¹. Black pepper vines treated with potassium phosphonate (5 ml l⁻¹) as spray and drench in combination with *T. harzianum* 50 g vine⁻¹ twice in the season showed reduced disease incidence (10.00%). The disease incidence was highest in the untreated vines (40.00 %) (Table 24).

Table 24. Management of *Phytophthora* foot rot disease of black pepper - Sirsi

| Treatment | Disease incidence (%) | | | Mean |
|--|-----------------------|------------------|------------------|------------------|
| | 2000-01 | 2001-02 | 2002-03 | |
| T1 - Metalaxyl gold MZ 68 WP (100 ppm, 2.5 g l ⁻¹) as spray (2 l vine ⁻¹) and drench (3 l vine ⁻¹) twice | 17.50 (24.16) | 15.00 (22.48) | 7.50 (13.82) | 13.33 (20.16) |
| T2 - Potassium phosphonate (Akomin 0.5%) as spray and drench twice | 17.50 (24.16) | 17.50 (24.53) | 10.00 (15.86) | 15.00 (21.52) |
| T3 - Soil application of <i>Trichoderma harzianum</i> (10 ⁷ cfu, 50 g vine ⁻¹) with 1 kg of neem cake twice | 27.50 (30.87) | 50.00 (45.00) | 25.00 (29.74) | 34.17 (35.20) |
| T4 - Metalaxyl gold MZ 68 WP (100 ppm, 2.5 g l ⁻¹) as spray (2 l vine ⁻¹) and drench (3 l vine ⁻¹) twice + soil application of <i>Trichoderma harzianum</i> (10 ⁷ cfu, 50 g vine ⁻¹) with 1 kg of neem cake twice | 17.50 (24.53) | 15.00 (22.50) | 7.50 (13.82) | 13.33 (20.29) |

| | | | | |
|--|------------------|------------------|------------------|------------------|
| T5 - Potassium phosphonate (Akomin, 0.5%) as spray and drench twice + soil application of <i>Trichoderma harzianum</i> (10^7 cfu, 50 g vine ⁻¹) with 1 kg of neem cake twice | 15.00 (22.13) | 15.00 (22.50) | 10.00 (15.86) | 13.33 (20.16) |
| T6 - Neem cake 1 kg vine ⁻¹ | 37.50 (37.72) | 55.00 (47.89) | 32.50 (33.97) | 41.67 (39.86) |
| T7 - Control | 52.50 (39.17) | 62.50 (46.00) | 40.00 (46.50) | 51.67 (52.34) |
| SEm \pm | 3.12 | 2.20 | 4.45 | 2.04 |
| CD (5 %) | 9.30 | 6.54 | 13.08 | 5.76 |

Figures in parenthesis are angular trans-formed values.

Panniyur

The Trial was laid out in two locations in Padiyoor and Valiampara, Kannur District of Kerala during 2001. Metalaxyl Gold MZ and *Trichoderma harzianum* was found to be effective in controlling the *Phytophthora* foot rot disease followed by application of Akomin

and *Trichoderma harzianum*. The disease incidence was very low, when Metalaxyl gold MZ was combined with the soil application of *T. harzianum*. Treatments with metalaxyl gold, *T. harzianum* and akomin were on par (Table 25).

Table 25. *Phytophthora* foot rot disease management in black pepper - Panniyur

| Treatment | Valiampara (%) | | | Padiyoor (%) | | |
|---------------------------------------|----------------|------------------|----------------|---------------|------------------|----------------|
| | Leaf infection | Branch infection | Death of vines | Leaf of vines | Branch infection | Death of vines |
| Metalaxyl Gold MZ 68 WP | 2.17 | 2.27 | 0.00 | 2.22 | 2.38 | 0.00 |
| Akomin | 3.36 | 3.38 | 0.00 | 3.38 | 3.70 | 0.00 |
| <i>Trichoderma harzianum</i> | 3.50 | 3.24 | 0.00 | 3.19 | 3.25 | 0.00 |
| Metalxyl God MZ + <i>Trichoderma</i> | 1.33 | 1.31 | 0.00 | 1.35 | 1.35 | 0.00 |
| Akomin + <i>Trichoderma harzianum</i> | 2.13 | 2.21 | 0.00 | 2.18 | 2.51 | 0.00 |
| Neem cake - 1kg | 5.39 | 4.11 | 1.00 | 5.42 | 4.14 | 0.66 |
| Control | 8.42 | 5.56 | 2.00 | 8.37 | 4.85 | 2.00 |
| CD (5%) | 0.47 | 0.96 | 0.15 | 0.92 | 0.71 | 0.75 |

Mudigere

The trial was started during 2000 in two locations. The performance of spraying and drenching with Ridomil MZ 72 WP (1.25 g l⁻¹, 5 l vine⁻¹) and its combinations with *Trichoderma harzianum* 50 g with 1 kg neem

oil cake per vine (T5) during the first week of June and September was found effective in checking the disease to the extent of 98.88 and 98.75%, respectively and they are on par. However, the disease did not appear during the year 2002 in both the locations (Table 26).

Table 26. Management of foot rot disease of black pepper (pooled data) - Mudigere

| Treatment | Mean PDI of 2 locations | | | |
|--|-------------------------|-------|------|-----------------|
| | 2000 | 2001 | 2002 | Average |
| T1 - Akomin 5ml l ⁻¹ , 5 l vine ⁻¹ | 5.99 | 25.00 | 0.00 | 10.33 |
| T2 - Ridomil MZ 72 WP 1.25g l ⁻¹ , 5 l vine ⁻¹ | 3.23 | 0.00 | 0.00 | 1.02 (98.88) |
| T3 - <i>Trichoderma harzianum</i> 50 g + Neem oil cake 1kg vine ⁻¹ | 3.41 | 25.00 | 0.00 | 9.47 |
| T4 - T3 + T1 | 6.04 | 12.50 | 0.00 | 6.18 |
| T5 - T3 + T2 | 3.75 | 0.00 | 0.00 | 1.25 (98.75) |
| T6 - Neem oil cake 1 kg vine ⁻¹ | 7.46 | 29.67 | 0.00 | 12.38 |
| T7 - Control | 8.61 | 33.84 | 0.00 | 14.15 |
| T8 - Bordeaux mixture 1% | - | - | 0.00 | - |
| CD (5%) | 3.21 | 1.75 | 0.00 | |

Note: - Treatment 8 (Bordeaux mixture 1%) is added as local check in 2002.

Ambalavayal

The experiment will be started during 2003.

PEP/CP/1.5 *Phytophthora* foot rot incidence in black pepper under different plant densities in arecanut garden
(Panniyur and Sirsi)

Panniyur

The trial was laid out during 2001 with

four treatments in RBD and pepper cuttings were planted as intercrop in arecanut garden at four levels of population using arecanut palms as standards. Establishment of black pepper was low in 100% population of pepper vines. Maximum vine length (218.8 cm) was observed in 25% population of pepper vines in the arecanut garden (Table 27).

Table 27. *Phytophthora* foot rot incidence in black pepper under different densities in arecanut garden - Panniyur

| Treatment | Disease incidence (%) | Crop establishment (%) | Length of vine (cm) |
|--|-----------------------|------------------------|---------------------|
| T1 - Pepper in 25% population of arecanut | 0.68 | 94.4 | 218.8 |
| T2 - Pepper in 50% population of arecanut | 1.85 | 93.0 | 166.8 |
| T3 - Pepper in 75% population of arecanut | 2.11 | 85.8 | 148.6 |
| T4 - Pepper in 100% population of arecanut | 1.07 | 76.8 | 121.4 |
| CD (5%) | 0.14 | 3.54 | 5.34 |

Sirsi

The trial was started during 2001 in RBD with four treatments. Black pepper establishment was highest in 25% population of vines (93.33%). Growth of the vines was more in 50% (1.88 m) and 25% (1.67 m)

population densities under arecanut cropping system. A few vines started bearing and the yield ranged from 0.328 to 0.358 kg vine⁻¹ (fresh) in different population densities during the year (Table 28).

Table 28. Performance of black pepper under different densities in arecanut garden - Sirsi

| Treatment | Establishment (%) | Plant height (m) | Yield (fresh, kg vine ⁻¹) |
|---|-------------------|------------------|---------------------------------------|
| T1 - Black pepper in 25% population of arecanut | 93.33 | 1.67 | 0.358* |
| T2 -Black pepper in 50% population of arecanut | 90.00 | 1.88 | 0.346 |
| T3 -Black pepper in 75% population of arecanut | 86.67 | 1.53 | 0.328 |
| T4 -Black pepper in 100% population of arecanut | 86.67 | 1.52 | 0.339 |
| SEm ± | 1.60 | 0.10 | - |
| CD (5%) | 5.52 | 0.27 | - |

PEP/CP/1.6 Incidence, epidemiology and management of anthracnose disease of black pepper (Survey for the occurrence of diseases in black pepper)

(*Pampadumpara, Mudigere, Dapoli and Chintapalle*)

Pampadumpara

Five panchayats were surveyed and the infection on spikes and leaves was observed. The incidence of anthracnose on the spikes

was highest in Vandanmedu panchayat (42.5%) followed by Chakupallom panchayat (41.2%). The least incidence of anthracnose on the spikes was recorded in the Karunapuram panchayat (12.3%). However the incidence of foot rot disease was more severe in Kumilly panchayat (19.1% of the vines). Stunted disease of black pepper was recorded in most of the gardens surveyed. It was highest in Karunapuram panchayat (11.2% of the vines) (Table 29).

Table 29. Incidence of various diseases in black pepper in the high ranges of Idukki District, Kerala

| Panchayat | Incidence (%) | | | | | |
|--------------|---------------|--------|----------|--------|--------------------------|--------------------|
| | Anthracnose | | Foot rot | | Stunted disease (plants) | Slow wilt (plants) |
| | Leaves | Spikes | Leaves | Plants | | |
| Chakupallom | 17.8 | 41.2 | 1.5 | | | |
| Vandanmedu | 36.4 | 42.5 | 3.1 | 9.3 | 4.1 | |
| Kumily | 11.6 | 18.9 | 1.6 | 19.1 | 8.1 | |
| Pampadumpara | 20.1 | 26.2 | 1.3 | 15.2 | 5.3 | 9.5 |
| Karunapuram | 29.2 | 12.3 | 1.4 | 15.7 | 11.2 | 8.1 |

The trial on management of anthracnose disease was started during 2003 in RBD with the following treatments.

T1 - Bordeaux mixture 1% spray twice (May-June, August - September)

T2 - Bordeaux mixture 1 % spray thrice (May, July, August)

T3 - Mancozeb 0.2% spray twice (May/June, August/September)

T4 - Propiconazole 0.1 % spray twice (May/June, August/September)

T5 - Control

Dapoli

Four districts of Konkan region

covering 24 black pepper plantations were surveyed for the incidence of various diseases. Five vines were randomly selected to observe the incidence of foliar diseases.

Phytophthora infection on the leaves was noticed throughout the region. The disease intensity ranged from 1.67 to 21.33%. Maximum disease incidence was observed in the plantation at Dapoli (21.26%) and at Shenale (Mandangad 14.67%) in coconut-black pepper mix cropping system (Table 30).

Maximum incidence of *Phytophthora* foot rot disease was observed at Dapoli (23.33%). The intensity of the disease

ranged from 0.33 to 23.33%. There was no incidence of anthracnose in the region. The incidence of algal rust (*Cephaleuros mycoidea*) and little leaf/stunted disease was less. Viral disease was observed only at Dapoli and Awashi.

Table 30. Incidence of different diseases of black pepper in Konkan region

| Name of the place/farmer | Disease incidence (%) | | | | |
|---|-----------------------|-------|------|----|-------|
| | PB | FR | SW | RR | Virus |
| Nursery, Deptt. of Hort., A.C., Dapoli | 21.26 | 23.33 | 3.33 | + | -0.33 |
| ARS, Awashi | 12.67 | 8.33 | 0.33 | + | -0.33 |
| College of Agril., Niwali, Chiplun | 5.33 | 8.33 | 0.33 | + | 0.0 |
| RCRS, Bhatye, Ratnagiri | 8.99 | 4.57 | 0.0 | + | 0.0 |
| RFRS, Vengurla | 7.67 | 4.67 | 0.0 | + | 0.0 |
| Shri. J.D. Khanolkar, Khanoli, Vengurla | 10.67 | 8.33 | 0.0 | + | 0.0 |
| Shri. S.V. Khanolkar, Khanoli, Vengurla | 7.67 | 8.33 | 0.0 | + | 0.0 |
| Shri. Deepak Naik, Prose | 7.67 | 10.67 | 0.0 | + | 0.0 |
| Shri. V.G. Bapat, Diveagar, Raigad | 8.99 | 0.0 | 0.33 | - | 0.0 |
| Shri. V.G. Awalaskar, Diveagar, Raigad | 9.67 | 0.0 | 0.0 | - | 0.0 |
| Shri. A.S. Kelaskar, Diveagar, Raigad | 7.99 | 1.33 | 0.0 | - | 0.0 |
| ARS, Shrivardhan, Raigad | 4.32 | 0.33 | 0.0 | - | 0.0 |
| Shri. A.G. Gogte, Srivardhan | 7.67 | 0.0 | 0.0 | - | 0.0 |
| Shri. D.R. Mukadam, Revdanda, Raigad | 1.99 | 4.67 | 0.0 | + | 0.0 |
| Shri. J.R. Patil, Revdanda, Raigad | 3.33 | 3.0 | 0.0 | + | 0.0 |
| Agril. School, Lanja | 8.67 | 0.0 | 0.0 | + | 0.0 |
| Shri. R. Railkar Chawl, Raigad | 1.99 | 0.33 | 0.0 | + | 0.0 |
| Shri. Ramakant Khot, Nandgaon, Murud | 3.33 | 0.0 | 0.0 | - | 0.0 |
| Shri. K.G. Pednekar, Nandgaon, Murud | 4.99 | 0.33 | 0.0 | - | 0.0 |
| Shri. Vinayak Deshmukh, Shenale, Mandangad | 14.67 | 22.67 | 0.33 | + | 0.0 |
| Shri. V.H. Vaidya, Chaul, Alibag | 1.67 | 0.0 | 0.0 | - | 0.0 |
| Shri. R.S. Shelar, Chaul, Alibag | 1.99 | 0.0 | 0.0 | - | 0.0 |
| Shri. R.R. Mahadik, Borli, Murud | 12.65 | 18.0 | 0.0 | + | 0.0 |
| Shri. S.R. Nagwekar, Borli, Murud Janjira, Raigad | 9.57 | 12.33 | 0.0 | + | 0.0 |

- No incidence, ++ Moderate incidence,

+ Low incidence, +++ High incidence,

Diseases: PB - *Phytophthora* on leaf, FR - Foot rot, SW - Slow wilt, RR - Red rust

Mudigere

The trial was started during 2000. The maximum damage 17.08% on leaf and 6.21% on spike due to anthracnose disease

in black pepper was recorded during the peak monsoon month (July). However, the average incidence recorded was 10.98% on leaf and 3.45% on spike (Table 31).

Table 31. Leaf and spike damage due to anthracnose disease in black pepper (2000 - 2001) - Mudigere

| Location | Disease incidence (%) | | | | | | | | Location Mean | |
|--------------|-----------------------|-------------------|--------------------|--------------------|--------------------|-------------------|---------------------|--------------------|---------------|------|
| | May | | June | | July | | August | | | |
| | L | S | L | S | L | S | L | S | L | S |
| Nandipura | 9.30 | 1.12 | 17.73 | 2.60 | 39.40 | 21.91 | 27.80 | 10.67 | 23.56 | 9.10 |
| M.G.Halli | 3.21 | 0.50 | 11.33 | 1.93 | 36.11 | 10.23 | 23.11 | 7.90 | 18.44 | 5.14 |
| Hesgal | 4.50 | 0.33 | 10.80 | 1.80 | 26.30 | 8.77 | 19.46 | 8.30 | 15.27 | 4.80 |
| Chakkodu | 4.10 | 0.22 | 10.13 | 1.60 | 21.85 | 10.40 | 19.00 | 7.46 | 13.77 | 4.92 |
| Salumara | 1.38 | 0.00 | 1.33 | 0.27 | 8.20 | 2.93 | 7.66 | 2.10 | 5.39 | 1.33 |
| Beejuvalli | 2.64 | 0.00 | 6.80 | 0.83 | 15.00 | 5.33 | 12.75 | 3.36 | 9.30 | 2.31 |
| Kadumane | 6.40 | 0.00 | 8.37 | 3.22 | 10.30 | 2.80 | 8.00 | 2.00 | 8.28 | 2.67 |
| Hoysalalu | 3.00 | 0.00 | 14.11 | 10.13 | 8.60 | 5.38 | 11.50 | 3.82 | 9.30 | 3.44 |
| Gabgal | 3.21 | 0.00 | 7.32 | 0.56 | 9.24 | 1.70 | 7.12 | 1.00 | 6.72 | 1.10 |
| Daradhahalli | 2.60 | 0.00 | 4.39 | 0.39 | 8.70 | 0.27 | 4.00 | 0.00 | 4.92 | 0.33 |
| Ousana | 5.80 | 0.00 | 12.64 | 4.00 | 11.20 | 3.61 | 10.08 | 2.69 | 9.93 | 3.43 |
| B. Hosahalli | 5.50 | 0.00 | 10.00 | 4.41 | 6.17 | 1.12 | 5.66 | 0.00 | 6.83 | 2.77 |
| Monthly Mean | 4.30 ^c | 0.18 ^c | 9.58 ^{bc} | 2.62 ^{bc} | 17.08 ^a | 6.21 ^a | 13.01 ^{ab} | 4.11 ^{ab} | 10.98 | 3.45 |

Studies on the crop loss due to anthracnose disease at the time of spiking was initiated during

2000. The loss was estimated at 3.45% which is 1.10 kg (wet) vine⁻¹ (Table 32).

Table 32. Crop loss due to anthracnose disease in black pepper (2000–2001) -Mudigere

| Location | Av.No of spikes vine ⁻¹ | Av.No of berries spike ⁻¹ | 100 berries weight (g) | | Yield (kg vine ⁻¹ , fresh) | loss of berry (kg vine ⁻¹) | | Total dry yield vine ⁻¹ (kg) | Loss (%) |
|-------------|--|--|---------------------------|------|---|---|------|---|-------------|
| | | | Wet | Dry | | Wet | Dry | | |
| Nandipura | 1785 | 99.70 | 12.95 | 4.32 | 23.05 | 2.09 | 0.70 | 7.68 | 9.10 |
| M.G.halli | 1960 | 93.00 | 14.43 | 4.81 | 26.30 | 1.35 | 0.45 | 8.77 | 5.14 |
| Hesgal | 2320 | 100.80 | 12.64 | 4.21 | 29.56 | 1.42 | 0.47 | 9.85 | 4.80 |
| Chakkod | 2226 | 102.10 | 11.55 | 3.85 | 26.25 | 1.29 | 0.43 | 8.75 | 4.91 |
| Salumara | 3591 | 108.00 | 11.43 | 3.81 | 44.33 | 0.59 | 0.20 | 14.78 | 1.33 |
| Beejuvalli | 2700 | 106.80 | 10.95 | 3.65 | 31.58 | 0.73 | 0.24 | 10.53 | 2.31 |
| Kadumane | 5680 | 69.00 | 10.20 | 3.36 | 39.98 | 1.07 | 0.36 | 13.33 | 2.67 |
| Hoysalau | 3160 | 90.00 | 10.03 | 3.20 | 28.53 | 0.98 | 0.33 | 9.51 | 3.44 |
| Gubgal | 7480 | 84.00 | 8.27 | 2.89 | 51.96 | 0.57 | 0.19 | 17.32 | 1.10 |
| Daradahalli | 8428 | 60.00 | 9.68 | 3.09 | 40.94 | 0.16 | 0.05 | 16.31 | 0.33 |
| Ousana | 3317 | 87.00 | 10.74 | 3.54 | 30.99 | 1.06 | 0.35 | 10.33 | 3.43 |
| B Hosahalli | 4422 | 72.00 | 10.00 | 3.03 | 31.84 | 0.88 | 0.29 | 10.61 | 2.77 |
| Mean | 3923 | 89.39 | 11.08 | 3.65 | 34.45 | 1.10 | 0.36 | 11.48 | 3.45 |

Survey was conducted on the incidence of anthracnose in different areas. The data are presented in Table 33.

Table 33. Incidence of anthracnose disease (2002) – Mudigere

| Name of sector | No. of fields surveyed | No of vines observed | Disease incidence | |
|----------------|---------------------------|----------------------------|-------------------|-------|
| | | | Leaf | Spike |
| MDG-CKM | 07 | 175 | T | - |
| MDG-G.HALLI | 07 | 175 | T | - |
| MDG-BANAKAL | 19 | 475 | T-L | T |
| MDG-BELUR | 14 | 350 | T | T |
| TOTAL | 47 | 1175 | T-L | T |

T - Trace, L - Low

An experiment for the management of anthracnose disease was initiated during 2002-03 with the following treatments.

T1 - Bordeaux mixture 1 % - twice (May/June & August/September)

T2 - Bordeaux mixture 1 %- thrice (May, July and August)

T3 - Mancozeb (Dithane M - 45 (0.2%)) twice (May/June & August/September)

T4 - Propiconazole 0.1 % - twice (May/June & August/September)

T5 - Control.

As there was no incidence of the diseases during the year, treatments could not be imposed.

Chintapalle

The trial was initiated during 2002. Disease incidence was low when spraying was done with Bordeaux mixture 1% thrice (T2). (Table 34).

Table 34. Management of anthracnose of black pepper - Chintapalle

| Treatment | Disease incidence (%) | Reduction in disease incidence (%) |
|--|-----------------------|------------------------------------|
| T1 - Bordeaux Mixture 1% spray –twice (May-June, August-September); | 2.8 | 37.7 |
| T2 - Bordeaux Mixture 1% spray –thrice (May, July & August); | 2.0 | 55.5 |
| T3 - Mancozeb (Dithane Z-78) 0.2% spray – twice (May- June, August-September); | 4.3 | 4.4 |
| T4 - Propiconazole 0.1% spray - twice (May- June, August-September); | 3.8 | 15.5 |
| T5 - Control; | 4.5 | Control |
| SEm \pm | 0.4 | — |
| CD (5%) | 1.3 | — |
| CV% | 12.7 | — |

PEP/CP/2 Pest Management Trial

PEP/CP/2.2 Survey for the incidence of insect pests on black pepper at high altitudes (Pampadumpara)

Pampadumpara

Five panchayats (Pampadumpara, Karunapuram, Vandanmedu, Chakkupallom and Kumily) in Udumbanchola taluk were

surveyed for the occurrence of insect pests on black pepper during October - December. Occurrence of soft scale insects was observed in four gardens. Marginal gall thrips (4.43 to 10.4%) and scale insects (0.32 to 0.91%) were noticed from all panchayats surveyed. Leaf gall was recorded in Kumily panchayat (0.16%) and leaf miner incidence was also on the rise in Chakkupallom (0.75%) and Kumily (0.21%) panchayats (Table 35).

Table 35. Incidence (%) of insect pests on black pepper at high altitudes

| Panchayat | Marginal gall thrips | Scale insect | Mealy bugs (foliar) | Leaf miner | Leaf gall |
|--------------|----------------------|--------------|---------------------|------------|-----------|
| Pampadumpara | 10.40 | 0.91 | 0 | 0 | 0 |
| Karunapuram | 5.17 | 0.37 | 0.16 | 0 | 0 |
| Vandanmedu | 4.43 | 0.64 | 0 | 0 | 0 |
| Chakkupallom | 5.71 | 0.48 | 0.16 | 0.75 | 0 |
| Kumily | 5.60 | 0.32 | 0 | 0.21 | 0.16 |

CARDAMOM

CAR/CI/1 Genetic Resources

CAR/CI/1.1 Germplasm collection, characterization, evaluation and conservation

(*Mudigere* and *Pampadumpara*)

Mudigere

The centre maintains 265 accessions of cardamom germplasm. The data on growth and yield were recorded and reported up to 2001. As the plants became very old, the entire germplasm collections are being replanted. A part of the germplasm was already replanted during August 2002.

Pampadumpara

Germplasm collections were made for super clones and tolerant to biotic and abiotic stress in CHR of Idukki District. Thirty three accessions were collected during the period 2002-2003. A total of 73 accessions are presently conserved in the gene bank. Further,

the germplasm accessions (60) collected in the recent years are being multiplied in the field.

Based on dry yield, ten accessions were selected and the data pertaining to the biotic stresses and quality parameters of these accessions are presented in Table 36a. Maximum wet (2938 g) and dry (555 g) yield of capsules was recorded in S - 1 which is also tolerant to thrips (5%). Borer infestation was lowest in PS - 10 (0.3%) and PPK - 2 (0.5%) whereas MCC - 34 was found to be highly susceptible to thrips (30%) and borer (2%), though it ranked third for dry yield. In general, azhugal infection was very low, except in PS - 10 and BEP - 1 during the year.

The quality parameters such as volatile oil (6.3%) and oleoresin (10.1%) were found to be least in MBP, compared to other accessions. Though BEP - 1 ranked ninth based on dry yield, it recorded the highest oil (7%) and oleoresin (11%) contents.

Table 36a. Yield and quality traits of promising germplasm accessions - Pampadumpara

| Genotype | Yield (g plant ⁻¹) | | 100 capsule weight (g) | Thrips infestation (%) | Stem borer infestation (%) | Volatile oil (%) | Oleoresin (%) |
|----------|-----------------------------------|-----|------------------------------|------------------------------|----------------------------------|------------------------|------------------|
| | Wet | Dry | | | | | |
| S - 1 | 2938 | 555 | 65 | 5.0 | 1.3 | 6.8 | 10.5 |
| BEP - 2 | 2500 | 532 | 80 | 7.0 | 1.5 | 6.6 | 10.6 |
| MCC - 34 | 2500 | 522 | 55 | 30.0 | 2.0 | 6.6 | 10.3 |
| PS - 22 | 2380 | 520 | 65 | 10.0 | 2.0 | 6.5 | 10.1 |
| PPK - 2 | 2300 | 515 | 50 | 8.0 | 0.5 | 6.7 | 10.9 |
| PS - 10 | 2480 | 512 | 60 | 13.0 | 0.3 | 6.6 | 10.5 |
| MBP | 2550 | 509 | 55 | 19.0 | 2.0 | 6.3 | 10.1 |
| PS - 27 | 2830 | 500 | 75 | 12.0 | 0.7 | 6.5 | 10.5 |
| BEP - 1 | 2290 | 498 | 65 | 17.0 | 2.0 | 7.0 | 11.0 |
| PS - 3 | 2290 | 480 | 70 | 9.0 | 1.0 | 6.8 | 10.2 |

CAR/CI/2 Hybridization and selection

CAR/CI/2.1 Evaluation of synthetics and OP progenies

(Mudigere)

Mudigere

Eight promising cardamom clones viz., Mudigere - 1, Mudigere - 2, CL - 692, HS - 1, SKP - 14, Sel. - 98, CCS - 800 and CL - 691, which were found to be better general combiners, were planted during 1995-96 with a closer spacing (6' x 3') and were allowed for open pollination. The seeds were collected and the progenies were raised.

A total of 61 open pollinated seedlings were identified and planted in the main field during the year 2000. Due to high mortality, gap filling was done during 2001 (spacing - 6' x 6', 11 plants for each genotype). As the plants are yet to come to yielding, observations on growth characters are being recorded.

CAR/CI/3.2 CVT 1991/1998 - Series III with Malabar Types

(Mudigere and Shakleshpur)

Mudigere

A CVT was laid out with 15 entries during 1998 with a spacing of 6 x 6' in CRBD with 3 replications having 12 plants per plot. This is the fifth year of the experiment.

Yield data have been recorded for three consecutive years. The yield during third yielding year (2002) was comparatively more in SKP - 72, CCS - 872 and CCS - 893 (90.10, 83.63 and 75.00 kg ha⁻¹ respectively) over the local check M - 1 (68.80 kg ha⁻¹).

There is a steep reduction in the yield of all the genotypes under study over the last three years because of excess shade in the experimental plot. However the average yield over the last three years was high in CL - 692 (139.60 kg ha⁻¹), followed by CL - 679 (138.70 kg ha⁻¹), CL - 683 (135.23 kg ha⁻¹) and SKP - 72 (133.63 kg ha⁻¹) compared to the local check M - 1 (116.20 kg ha⁻¹) (Table 36b).

Table 36b. Performance of promising clones (Malabar types) – Mudigere

| Clone | Dry yield (kg ha ⁻¹) | | | | Remarks |
|-----------|----------------------------------|--------|-------|---------|----------|
| | 2000 | 2001 | 2002 | Average | |
| CL - 679 | 259.80 | 89.00 | 67.30 | 138.70 | 19%>M -1 |
| CL - 683 | 228.10 | 117.20 | 60.40 | 135.23 | |
| CL - 692 | 282.60 | 90.00 | 46.23 | 139.60 | 20%>M -1 |
| CL - 726 | 225.10 | 103.40 | 67.40 | 132.00 | |
| CCS - 800 | 182.10 | 56.40 | 27.63 | 88.71 | |
| CCS - 872 | 154.50 | 109.00 | 83.63 | 115.71 | |
| CCS - 893 | 154.10 | 91.00 | 75.00 | 106.70 | |
| HS - 1 | 138.10 | 103.50 | 61.00 | 100.90 | |
| M - 1 | 180.10 | 99.60 | 68.80 | 116.20 | |
| MCC - 34 | 150.30 | 60.30 | 69.53 | 93.40 | |

| | | | | |
|-----------|--------|--------|-------|--------|
| PV - 1 | 80.80 | 58.00 | 51.60 | 63.50 |
| SKP - 14 | 207.50 | 127.50 | 65.20 | 133.40 |
| SKP - 21 | 130.30 | 63.40 | 43.01 | 78.90 |
| SKP - 72 | 207.80 | 103.00 | 90.10 | 133.63 |
| SKP - 100 | 168.50 | 67.00 | 41.70 | 92.40 |
| CD (5%) | 84.30 | 51.44 | | |
| CV % | 27.48 | 34.13 | | |

Shakleshpur

The experiment was laid out in 1997 with 13 promising clones in RBD with 3 replications and 12 plants as plot size. Morphological and yield data have been recorded and analysed.

Number of tillers plant⁻¹ was significantly high in CL - 726 (22.9) and CL - 679 (22.4). Significantly more panicles

plant⁻¹ were observed in SKP - 169 (25.5). Yield was significantly more in SKP - 170 (265.7 kg ha⁻¹) and SKP - 169 (260.0 kg ha⁻¹). Oil content was significantly more in SKP - 170 (7.1%) and CL - 683 (7.0%) (Table 37). Maximum bold capsules (capsules retained in 8 mm sieve) were found in SKP - 170 (54.4%), followed by SKP - 169 (51.2 %) (Table 38).

Table 37. Performance of promising clones (Malabar types) – Shakleshpur

| Genotype | Height (cm) | No. of tillers | No. of bearing tillers | No. of panicles | Racemes panicle ⁻¹ | Capsules raceme ⁻¹ | Oil (%) | Yield (kg ha ⁻¹) |
|-----------|-------------|----------------|------------------------|-----------------|-------------------------------|-------------------------------|---------|------------------------------|
| CCS - 872 | 191.8 | 19.5 | 8.4 | 14.5 | 15.9 | 2.7 | 6.4 | 105.8 |
| CCS - 893 | 161.0 | 14.5 | 7.1 | 12.6 | 14.5 | 2.1 | 6.4 | 90.3 |
| CCS - 800 | 171.8 | 14.1 | 5.3 | 10.8 | 14.5 | 2.1 | 6.4 | 125.5 |
| PV - 1 | 208.7 | 18.3 | 9.8 | 15.5 | 17.6 | 2.7 | 6.6 | 197.6 |
| CL - 679 | 201.2 | 22.4 | 10.5 | 22.0 | 18.3 | 2.1 | 6.5 | 178.2 |
| CL - 683 | 188.7 | 21.1 | 7.3 | 13.2 | 13.0 | 2.4 | 7.0 | 123.5 |
| CL - 726 | 215.0 | 22.9 | 11.1 | 20.7 | 16.9 | 2.3 | 6.5 | 184.7 |
| MUD - 1 | 202.8 | 19.1 | 7.3 | 10.6 | 15.3 | 2.4 | 6.7 | 156.6 |
| MCC - 34 | 202.0 | 17.6 | 7.4 | 17.9 | 14.0 | 2.1 | 6.5 | 164.3 |
| ICRI - 3 | 227.7 | 20.5 | 11.2 | 24.2 | 18.8 | 2.4 | 6.9 | 208.4 |
| SKP - 72 | 246.3 | 18.0 | 9.8 | 14.7 | 19.1 | 2.2 | 6.1 | 184.3 |
| SKP - 169 | 227.7 | 19.1 | 10.9 | 25.5 | 18.3 | 2.4 | 6.9 | 260.0 |
| SKP - 170 | 221.7 | 18.3 | 10.4 | 18.2 | 17.9 | 2.4 | 7.1 | 265.7 |
| CD (5%) | 48.2 | 2.58 | 1.7 | 3.57 | 2.4 | 0.34 | 0.62 | 46.96 |

Table 38. Capsule size of promising genotypes – Shakleshpur

| Genotype | Recovery of grade (%) | | | | |
|-----------|-----------------------|---------|---------|---------|---------|
| | >8.0 mm | >7.5 mm | >6.5 mm | >6.0 mm | <6.0 mm |
| CCS - 872 | 39.6 | 14.9 | 34.7 | 6.9 | 3.9 |
| CCS - 893 | 39.2 | 29.2 | 13.1 | 13.8 | 4.6 |
| CCS - 800 | 38.0 | 13.0 | 35.2 | 9.2 | 4.6 |
| PV - 1 | 31.2 | 15.4 | 28.2 | 21.8 | 3.4 |
| CL - 679 | 24.7 | 21.7 | 36.7 | 13.3 | 3.6 |
| CL - 683 | 50.4 | 19.1 | 19.9 | 7.4 | 3.1 |
| CL - 726 | 44.2 | 20.9 | 23.3 | 7.8 | 3.9 |
| MUD - 1 | 35.8 | 22.5 | 29.6 | 9.9 | 2.4 |
| MCC - 34 | 19.6 | 18.3 | 40.5 | 17.0 | 4.6 |
| ICRI - 3 | 39.1 | 14.7 | 31.5 | 12.2 | 2.5 |
| SKP - 72 | 25.4 | 23.8 | 27.0 | 21.2 | 2.6 |
| SKP - 169 | 51.2 | 15.7 | 23.2 | 7.5 | 2.4 |
| SKP - 170 | 54.4 | 13.4 | 20.2 | 8.9 | 2.0 |

CAR/CI/3.3 CVT-1991/1998 - Series III with Mysore types

(*Mudigere, Shakleshpur and Myladumpara*)

Mudigere

Five promising clones of Mysore type were studied since 1998 under this trial for their yield performance. The data are presented in Table 39. During the year, MCC - 21 gave highest yield (45.30 kg ha⁻¹).

The average yield over the last three years was high in MCC - 21 (36.10 kg ha⁻¹), followed by MCC - 81, MCC - 61 and MCC - 12 with an average yield of 35.25, 33.91 and 33.90 kg ha⁻¹, respectively.

Based on the results, it is concluded that the Mysore types do not produce economic yield in Karnataka compared to Malabar types.

Table 39. Performance of promising clones (Mysore types) - Mudigere

| Clone | Yield (dry, kg ha ⁻¹) | | | |
|----------|-----------------------------------|-------|-------|---------|
| | 2000 | 2001 | 2002 | Average |
| SKP - 51 | 22.08 | 14.40 | 26.82 | 22.76 |
| MCC - 12 | 45.92 | 22.80 | 28.40 | 33.90 |
| MCC - 21 | 35.28 | 18.60 | 45.30 | 36.10 |
| MCC - 61 | 31.44 | 26.40 | 38.92 | 33.91 |
| MCC - 81 | 36.48 | 25.80 | 39.42 | 35.26 |
| CD (5 %) | - | 13.63 | 30.37 | - |
| CV % | - | 17.28 | 63.35 | - |

Shakleshpur

The trial was initiated during 1997 with 5 promising clones of Mysore types replicated 4 times in RBD. The spacing was 4' x 3' with 12 plants as plot size. The data are presented in Table 40.

Number of tillers plant⁻¹ was significantly more in SKP - 51(28.1) MCC - 21

(25.1) and MCC - 61 (25.1). Number of panicles was significantly more in MCC - 12 (13.8). Yield was significantly more in MCC - 85 (108.7 kg ha⁻¹). Oil content was significantly more in MCC - 61 (6.9%) and MCC - 21 (6.8%) (Table 40). Maximum bold capsules (capsules retained in 8 mm sieve) were in MCC - 21 (50.0%), followed by MCC - 61 (41.7%) (Table 41).

Table 40. Performance of cardamom accessions (Mysore types) – Shakleshpur

| Genotype | Height (cm) | No. of tillers | No. of bearing tillers | No. of panicles | Racemes panicle ⁻¹ | Capsules raceme ⁻¹ | Oil (%) | Yield (kg ha ⁻¹) |
|----------|-------------|----------------|------------------------|-----------------|-------------------------------|-------------------------------|---------|------------------------------|
| MCC - 12 | 208.0 | 26.60 | 7.90 | 13.8 | 16.0 | 2.5 | 5.90 | 68.7 |
| MCC - 21 | 201.5 | 25.10 | 7.20 | 12.7 | 15.4 | 2.6 | 6.80 | 75.6 |
| MCC - 61 | 195.5 | 25.10 | 7.10 | 11.6 | 13.6 | 2.4 | 6.90 | 63.2 |
| MCC - 85 | 229.4 | 20.20 | 8.30 | 13.3 | 16.0 | 2.5 | 6.20 | 108.7 |
| SKP - 51 | 214.5 | 28.10 | 6.70 | 10.3 | 17.5 | 2.5 | 6.20 | 53.1 |
| CD (5%) | 31.3 | 4.17 | 1.41 | 3.0 | 1.60 | NS | 0.47 | 14.59 |

Table 41. Capsule size in the promising genotypes (Mysore types) – Shakleshpur

| Genotype | Recovery of grade (%) | | | | |
|----------|-----------------------|---------|---------|---------|---------|
| | >8.0 mm | >7.5 mm | >6.5 mm | >6.0 mm | <6.0 mm |
| MCC - 12 | 32.7 | 14.5 | 36.4 | 10.9 | 5.5 |
| MCC - 21 | 50.0 | 19.2 | 9.6 | 15.4 | 7.8 |
| MCC - 61 | 41.7 | 16.7 | 39.2 | 8.3 | 4.2 |
| MCC - 85 | 26.5 | 20.6 | 30.9 | 19.1 | 2.9 |
| SKP - 51 | 24.1 | 13.8 | 34.5 | 24.1 | 3.4 |

Myladumpara

Report not received.

CAR/CI/3.4 CVT 2000 - Series IV

(Pampadumpara, Mudigere, Myladumpara and Shakleshpur)

Pampadumpara

The trial was started during 2001 with 12 accessions in RBD. The plot size was 18 plants in 3 replications. Data on morphological characters were recorded (Table 42).

Table 42. Yield attributing characters of cardamom accessions - Pampadumpara

| Entry | Plant height (cm) | No. of tillers plant ⁻¹ | No. of panicles plant ⁻¹ | Leaf length (cm) | Leaf breadth (cm) | Stem girth (cm) |
|------------|-------------------|------------------------------------|-------------------------------------|------------------|-------------------|-----------------|
| CL - 692 | 194.80 | 45.89 | 38.55 | 51.11 | 9.39 | 6.17 |
| SKP - 170 | 198.33 | 48.89 | 39.66 | 47.75 | 7.89 | 5.66 |
| SKP - 165 | 202.22 | 40.78 | 27.77 | 47.66 | 8.38 | 6.39 |
| PS - 44 | 255.00 | 37.11 | 26.66 | 54.00 | 11.06 | 7.56 |
| S - 1 | 234.44 | 29.67 | 42.77 | 60.22 | 11.17 | 7.55 |
| MCC - 200 | 211.11 | 50.22 | 38.55 | 55.22 | 9.50 | 6.50 |
| Green Gold | 234.56 | 27.46 | 18.22 | 60.05 | 12.82 | 7.35 |
| MCC - 347 | 204.44 | 41.67 | 34.00 | 49.00 | 9.00 | 6.44 |
| MCC - 18 | 202.22 | 34.55 | 30.44 | 52.89 | 9.84 | 6.72 |
| MCC - 13 | 194.45 | 32.56 | 18.78 | 51.11 | 9.55 | 6.17 |
| RR - 1 | 123.05 | 23.17 | 10.17 | 41.53 | 7.50 | 4.67 |
| NKE - 19 | 144.33 | 10.67 | 4.00 | 42.22 | 8.93 | 5.28 |
| Mean | 199.91 | 35.22 | 27.46 | 51.06 | 9.59 | 6.37 |
| CD (5%) | 27.97 | NS | NS | 4.63 | NS | NS |

Analysis of variance showed significant differences among all the genotypes for plant height and leaf length. Among twelve genotypes, PS - 44 was the tallest (255.00 cm) followed by Green Gold (234.56 cm) and S - 1 (234.44 cm). Highest number of panicles was recorded in S - 1 (42.77) followed by SKP - 170 (39.66) and CL - 692, MCC - 200 (38.55), whereas maximum number of tillers was observed in MCC - 200 (50.22), SKP - 170 (48.89) and CL - 692 (45.89). However these differences were not statistically significant. PS - 44, S - 1 and Green Gold recorded stem girth more than 7 cm. Maximum length and breadth of leaf were observed in Green Gold (60.05 cm and 12.82 cm, respectively).

Mudigere

The experiment was started during 2001 and the entries were planted with a spacing of 6' x 6' in RBD. As there was high mortality of plants, gap filling was done during August

2002 and hence no observations could be recorded. Thirteen genotypes, namely, CL - 692, M - 2 (RRS, Mudigere), SKP - 165, SKP - 170 (ICRI, Shakleshpur), APG - 281, APG - 284, APG - 293 (IISR, Appangala), MHC - 10, MHC - 13, MHC - 18, MCC - 200 (ICRI, Myladumpara) and PS - 44, S - 1 (Pampadumpara) were included in the trial with 18 plants as plot size.

Myladumpara

Report not received.

Shakleshpur

Twelve genotypes collected from ICRI, Shakleshpur (SKP - 165 and 170), IISR, Appangala (APG - 298, 306 and 310), ICRI, Myladumpara (MCC - 10, 13, 18 and 200), RRS, Pampadumpara (PS - 44 and S - 1) and RRS, Mudigere (CL - 692) were used to lay out this trial in RBD with 3 replications. The trial was started during the year 2002 with 12 plants as plot size.

CAR/CI/4 Varietal Evaluation Trial (VET)**CAR/CI/4.1 Yield evaluation of OP seedling progenies of promising cardamom selection (VET-I)***(Mudigere)**Mudigere*

The experiment was laid out during 1997. The yield data were recorded during 1999-2000. In the mean time another experiment (VET-II) was laid out in the same plot in between the two rows of existing plants. Due to overlapping of plants of these two experiments, observations could not be recorded during 2001. However some superior plants have been identified for replanting in a separate plot to study their yield performance.

CAR/CI/4.2 Yield evaluation of OP seedling progenies of promising cardamom selection (VET-II)*(Mudigere)**Mudigere*

The experiment was laid out in between the rows of VET-I during 1997. Due to

overlapping of these two experimental plants, yield data could not be recorded for the year 2001-02. However based on the first year yield performance, the promising genotypes viz, CL - 730, CI - 692 and D - 237 are included in VET-III & IV and hence, this experiment is closed.

CAR/CI/4.3 Yield evaluation of OP seedling progenies of promising cardamom selections (VET-III)*(Mudigere)**Mudigere*

The progenies of open pollinated seedlings were multiplied and their suckers were planted during 1999. As the plants are yet come to yield, observations are recorded on the morphological characters and the data are presented in Table 43.

Among 13 genotypes tested against local checks M - 1 and M - 2, clones 24-17-D10, 7-10-D11, 7-24-D11, 29-9-D11 were found promising with 26.7, 26.30 and 26.3 tillers per clump, respectively compared to M - 1 (22.7) and M - 2 (24.7).

Table 43. Performance of open pollinated progenies - Mudigere

| Clone | Height (cm) | No. of tillers |
|---------------------|-------------|----------------|
| 7-24-D11 | 189.00 | 26.3 |
| 8-4-D11 | 207.00 | 25.3 |
| 26-16-D11 | 191.66 | 19.7 |
| 23-8-D11 | 201.70 | 19.0 |
| 29-9-D11 | 188.00 | 26.3 |
| 2-4-D4 | 222.00 | 18.7 |
| 12-7-D11 | 207.70 | 21.3 |
| 2-5-D4 | 259.70 | 14.3 |
| 10-6-D10 | 260.00 | 17.3 |
| 24-17-D10 | 220.30 | 26.7 |
| 7-10-D11 | 191.00 | 18.3 |
| 7-12-D11 | 138.70 | 7.3 |
| 10-5-D11 | 193.70 | 13.3 |
| Mudigere - 1(check) | 180.66 | 22.7 |
| Mudigere - 2(check) | 200.33 | 24.7 |

CAR/CI/4.4 Yield evaluation of promising cardamom clones (VET-IV)*(Mudigere)**Mudigere*

The promising open pollinated seedlings were multiplied and suckers were planted during 1999. Observations on number of tillers per clump were recorded and presented in Table 44.

Among eighteen clones tested against the local checks M - 1 and M - 2, OP seedling of CL - 691 has produced highest number of tillers per clump (29.3), followed by OP seedling of CL - 692 (28.0) compared to the local checks M - 1 (22.7) and M - 2 (24.7).

Table 44. Performance of promising OP seedlings - Mudigere

| Clone | Height (cm) | No. of tillers |
|---------------------|-------------|----------------|
| HS - 1 | 244.30 | 23.7 |
| CL - 668 | 158.33 | 23.7 |
| CL - 691 | 194.00 | 29.3 |
| MCC - 34 | 163.00 | 17.7 |
| CCS - 800 | 182.00 | 13.7 |
| Pink pseudostem | 184.00 | 15.0 |
| Sel - 98 | 187.70 | 19.3 |
| CL - 722 | 221.30 | 20.7 |
| SKP - 14 | 216.70 | 15.0 |
| P - 8 | 121.00 | 9.0 |
| P - 17 | 165.70 | 17.0 |
| EB 1277-7 | 190.00 | 10.0 |
| CL - 692 | 181.00 | 28.0 |
| Pink capsule | 67.50 | 10.5 |
| CL - 726 | 156.50 | 24.0 |
| Mudigere - 1(check) | 180.66 | 22.7 |
| Mudigere -2 (check) | 200.33 | 24.7 |
| CL - 730 | 162.30 | 20.3 |

CAR/CI/5 Screening cardamom clones for abiotic stress*(Mudigere)**Mudigere*

The experiment is vitiated due to lack of optimum (uniform) shade in the plot and during the last AICRPS Workshop it was suggested to relayout the experiment under uniform shade conditions.

**CAR/CM/1 Nutrient Management Trial
CAR/CM/1.3 Integrated nutrient management in cardamom***(Pampadumpara and Mudigere)**Pampadumpara*

XVI Workshop suggested to conclude this trial. A new trial with local popular varieties and varieties released/ready for release both under irrigated and rainfed conditions have to be taken up. These trials were not initiated.

Mudigere

The experiment was replanted during 2000. The crop is coming up well. As very few plants came to bearing during this year, the data are not considered for analysis.

CAR/CM/1.4 Efficacy of biofertilizer using *Azospirillum* on cardamom*(Mudigere, Pampadumpara, Myladumpara and Shakleshpur)**Mudigere*

The experiment was initiated during 2000 with 8 treatment combinations replicated thrice in RBD. Ten clumps constituted the plot size. This is the second year of experimentation and all plants did not come to bearing and hence the data presented are the average yield per plant which were not statistically significant (Table 45).

Table 45. Effect of *Azospirillum* on growth and yield of cardamom - Mudigere

| Treatment | Bearing suckers | Total panicles | Capsules panicle ⁻¹ | Panicle length | Flowers panicle ⁻¹ | Fresh weight (g plant ⁻¹) | Dry weight (g plant ⁻¹) |
|--|-----------------|----------------|--------------------------------|----------------|-------------------------------|---------------------------------------|-------------------------------------|
| Inorganic N 100% + <i>Azospirillum</i> 50g + FYM 5kg | 10.67 | 17.77 | 9.30 | 29.17 | 22.93 | 97.03 | 19.61 |
| Inorganic N 75% + <i>Azospirillum</i> 50g + FYM 5kg | 11.11 | 20.90 | 14.13 | 36.41 | 33.93 | 154.71 | 31.39 |
| Inorganic N 50% + <i>Azospirillum</i> 50g + FYM 5kg | 10.49 | 19.90 | 13.00 | 35.21 | 26.08 | 137.74 | 27.80 |
| FYM 5 kg + <i>Azospirillum</i> | 7.77 | 14.48 | 8.50 | 27.58 | 19.27 | 75.03 | 14.83 |
| FYM 5 kg | 7.91 | 19.09 | 9.58 | 27.91 | 20.90 | 109.99 | 21.57 |
| FYM 10 kg + <i>Azospirillum</i> 50g | 9.85 | 18.69 | 10.01 | 30.27 | 24.16 | 89.94 | 18.24 |
| FYM 10 kg | 10.71 | 20.34 | 16.01 | 39.51 | 37.87 | 228.00 | 46.31 |
| Inorganic N 100% | 8.17 | 16.26 | 10.57 | 27.85 | 18.93 | 99.38 | 19.83 |
| Inorganic N 75% | 9.77 | 17.31 | 9.36 | 31.77 | 21.52 | 83.68 | 17.47 |
| CD (5%) | NS | NS | NS | NS | NS | 150.02 | NS |
| CV% | 24.93 | 18.51 | 30.34 | 17.68 | 23.24 | 72.44 | 73.08 |

Pampadumpara

The experiment is in the second year of progress. The experiment was laid out with 8 treatments, replicated four times in RBD. The data are presented in Table 46. The highest yield (490.8 g plant⁻¹) was recorded in T6

followed by T2 (373.5 g plant⁻¹) which were statistically superior to all other treatments. The lowest yield was recorded in T3 (217.0 g plant⁻¹). The yields obtained in all other treatments were on par with each other but inferior to T6 and T2.

Table 46. Effect of biofertilizer, *Azospirillum* on the yield of cardamom – Pampadumpara

| Treatment | Yield (dry, g plant ⁻¹) |
|--|-------------------------------------|
| T1 - Inorganic N 100 % + <i>Azospirillum</i> 50 g + FYM 5 kg | 288.5 ^{bcd} |
| T2 - Inorganic N 75 % + <i>Azospirillum</i> 50 g + FYM 5 kg | 373.5 ^{ab} |
| T3 - Inorganic N 50% + <i>Azospirillum</i> 50 g + FYM 5 kg | 217.0 ^d |
| T4 - <i>Azospirillum</i> 50 g + 5 kg FYM 5 kg | 313.0 ^{bcd} |
| T5 - FYM 5 kg | 60.5 ^{abc} |
| T6 - <i>Azospirillum</i> 50 g + FYM 10 kg | 490.8 ^a |
| T7 - FYM 10 kg | 235.5 ^{bcd} |
| T8 - Control | 252.5 ^{bcd} |
| CD (5%) | 131.2 |

Myladumpara

The trial was laid out in RBD during the year 2000 using *Azospirillum* as nitrogen fixer with seven treatments and four replications with 12 plants plot⁻¹. The sources of P and K were rock phosphate and muriate of potash whereas inorganic nitrogen as urea. The variety used for the study was MCC - 260.

This is the first year of bearing.

Observations on morphological characters (total number of tillers, bearing tillers, young tillers, buds clump⁻¹, panicles clump⁻¹, racemes panicle⁻¹ and yield) of the first round of picking (July 2003) were recorded. Statistical analysis of the data indicated that there was no significant difference in the morphological characters among the treatments during the current year (Table 47). The trial will be continued.

Table 47. Effect of biofertilizer, *Azospirillum* on the yield of cardamom – Myladumpara

| Treatment | Tillers clump ⁻¹ | Buds clump ⁻¹ | Panicles clump ⁻¹ | Racemes panicle ⁻¹ | Yield (kg ha ⁻¹) |
|--|-----------------------------|--------------------------|------------------------------|-------------------------------|------------------------------|
| T 1 - Inorganic N 100% + <i>Azospirillum</i> 50 g + FYM 5 kg | 44.58 | 2.09 | 15.20 | 14.78 | 12.60 |
| T 2 - Inorganic N 75% + <i>Azospirillum</i> 50 g + FYM 5 kg | 39.63 | 1.27 | 10.95 | 12.60 | 6.80 |
| T 3 - Inorganic N 50% + <i>Azospirillum</i> 50 g + FYM 5 kg | 40.03 | 1.24 | 11.08 | 12.65 | 21.40 |
| T 4 - <i>Azospirillum</i> 50 g + FYM 5 kg | 42.98 | 1.66 | 9.70 | 14.08 | 12.86 |
| T 5 - FYM 5 kg | 38.65 | 1.75 | 11.28 | 13.78 | 14.02 |
| T 6 - <i>Azospirillum</i> 50 g + FYM 10 kg | 40.03 | 1.38 | 11.40 | 11.20 | 9.07 |
| T 7 - FYM 10 kg | 42.18 | 1.59 | 12.80 | 13.48 | 22.90 |
| CD (5%) | NS | NS | NS | NS | NS |

CAR/CM/1.5 Efficacy of biofertilizer using P - solubilizers on cardamom
(*Mudigere, Pampadumpara, Myladumpara and Shakleshpur*)

Mudigere

The experiment was initiated during July 2000. This is the second year of progress. The experiment was laid out in RCBD with 9

treatments replicated thrice. The plot size is 10 plants. Large number of plants started yielding hence data were recorded for first year also. However, the yield data were considered only for yielding plants and expressed in terms of yield per plant and the data did not show statistical significance (Table 48). The organic carbon, available nitrogen and the bio-organisms are being monitored.

Table 48. Effect of P - solubilizer on the growth and yield of cardamom - Mudigere

| Treatment | Bearing suckers | Total suckers | Capsules panicle ⁻¹ | Panicle length (cm) | Flowers panicle ⁻¹ | Fresh weight (g plant ⁻¹) | Dry weight (g plant ⁻¹) |
|---|-----------------|---------------|--------------------------------|---------------------|-------------------------------|---------------------------------------|-------------------------------------|
| T1-Inorganic P100% + P solubilizers 50g + FYM 5kg | 14.67 | 19.97 | 15.81 | 36.33 | 42.60 | 445.48 | 91.11 |
| T2 - Inorganic P 75% + P solubilizers 50 g + FYM 5 kg | 11.21 | 23.42 | 15.09 | 37.30 | 32.60 | 354.67 | 71.99 |
| T3 - Inorganic P 50% + P solubilizers 50 g + FYM 5 kg | 9.67 | 22.22 | 16.81 | 36.03 | 41.60 | 336.72 | 75.20 |
| T4 - P solubilizers 50 g + FYM 5 kg | 9.83 | 21.73 | 15.88 | 37.73 | 39.23 | 320.80 | 63.92 |
| T5 - FYM 5 kg | 11.00 | 23.00 | 16.19 | 35.23 | 38.03 | 393.44 | 84.48 |
| T6 - P solubilizers 50 g + FYM 10 kg | 8.61 | 18.57 | 12.37 | 34.83 | 29.00 | 300.22 | 61.29 |
| T7 - FYM 10 kg | 10.94 | 20.51 | 17.09 | 33.17 | 38.00 | 411.39 | 90.62 |
| T8 - Inorganic P 100% | 13.37 | 21.45 | 15.01 | 37.20 | 40.37 | 417.91 | 86.85 |
| T9 - Inorganic P 75% | 11.93 | 22.77 | 17.15 | 42.30 | 41.10 | 446.26 | 79.15 |
| CD (5%) | NS | NS | NS | NS | NS | NS | NS |
| CV % | 24.74 | 11.64 | 18.21 | 12.83 | 26.83 | 20.72 | 29.48 |

N and K were given as per recommended package (75 and 150 kg ha⁻¹ yr⁻¹ in two splits)

Pampadumpara

Report not received.

Myladumpara

The trial was laid out in 2001 under rainfed condition in RBD with 7 treatments, 4 replications having 12 plants per plot. The variety used for the trial was MCC - 21.

The recommended dose of N and K @ 75 kg ha⁻¹ and 150 kg ha⁻¹, respectively were supplied as urea and MOP. P is applied in the form of rock phosphate in two splits in May/June and August/September. The plants have come to bearing during 2003. Observations on morphological characters and yield attributes were recorded (Table 49).

The statistical analysis of the data indicated no significant difference in morphological characters and yield for the first round picking

(normally 6-7 rounds of picking/year) among the treatments. The trial will be continued.

Table 49. Effect of P - solubilizer on the growth and yield of cardamom - Myladumpara

| Treatment | Tillers clump ⁻¹ | Buds clump ⁻¹ | Panicles clump ⁻¹ | Racemes panicle ⁻¹ | Yield (kg ha ⁻¹) |
|---|-----------------------------|--------------------------|------------------------------|-------------------------------|------------------------------|
| T1 - Inorganic P 100% + Phosphobacteria 50 g + FYM 5 kg | 45.60 | 0.86 | 4.81 | 10.15 | 12.62 |
| T2 - Inorganic P 75% + Phosphobacteria 50 g + FYM 5 kg | 51.48 | 1.74 | 7.40 | 8.68 | 19.43 |
| T3 - Inorganic P 50% + Phosphobacteria 50 g + FYM 5 kg | 45.45 | 2.33 | 5.57 | 10.23 | 20.90 |
| T4 - Phosphobacteria 50 g + FYM 5 kg | 36.10 | 1.59 | 3.87 | 9.58 | 12.04 |
| T5- FYM 5 kg | 37.03 | 1.66 | 5.07 | 9.73 | 9.84 |
| T6 - Phosphobacteria 50 g + FYM 10 kg | 44.33 | 1.43 | 5.16 | 9.38 | 28.51 |
| T 7- FYM 10 kg | 40.28 | 1.60 | 5.31 | 7.89 | 13.36 |
| CD (5%) | NS | NS | NS | NS | NS |

Shakleshpur

The experiment was started during 2001 with 12 treatments replicated thrice in RBD, having 16 plants per plot. Significantly higher

yield (153.5 kg ha⁻¹) was recorded in T6, followed by T7 (149.1 kg ha⁻¹) (Table 50). However, *Azospirillum* did not show significant impact on yield.

Table 50. Effect of biofertilizers *Azospirillum* and phosphobacteria on the yield attributes and yield in cardamom - Shakleshpur

| Treatment | Buds clump ⁻¹ | Bearing tillers clump ⁻¹ | Panicles clump ⁻¹ | Yield (kg ha ⁻¹) |
|---|--------------------------|-------------------------------------|------------------------------|------------------------------|
| T1-InorganicN 100%+ <i>Azospirillum</i> + FYM 5 kg | 3.49 | 5.85 | 13.45 | 121.2 |
| T2-Inorganic N 75%+ <i>Azospirillum</i> + 5 kg FYM 5 kg | 4.85 | 6.91 | 14.19 | 108.7 |
| T3-Inorganic N 50%+ <i>Azospirillum</i> + 5 kg FYM 5 kg | 3.19 | 8.35 | 16.15 | 101.5 |
| T4- <i>Azospirillum</i> + FYM 5 kg | 6.11 | 6.95 | 16.45 | 88.3 |
| T5- <i>Azospirillum</i> + FYM 10 kg | 7.01 | 4.75 | 8.32 | 102.5 |

| | | | | |
|--|------|------|-------|-------|
| T6-Inorganic P 100%+Phosphobacteria + FYM 5 kg | 9.41 | 6.00 | 12.98 | 153.5 |
| T7- Inorganic P 75%+Phosphobacteria + FYM 5 kg | 6.50 | 8.11 | 14.45 | 149.1 |
| T8- Inorganic P 50%+Phosphobacteria+ FYM 5 kg | 7.15 | 8.79 | 16.15 | 123.5 |
| T9- Phosphobacteria+ FYM 5 kg | 6.85 | 6.85 | 17.35 | 113.0 |
| T10-Phosphobacteria+ FYM 5 kg | 8.01 | 5.85 | 16.11 | 115.7 |
| T11- FYM 5 kg | 6.14 | 8.65 | 16.50 | 101.6 |
| T12- FYM 10 kg | 3.21 | 9.11 | 16.50 | 107.5 |
| CD (5%) | 1.31 | 0.83 | 1.91 | 18.01 |

CAR/CM/1.6 Effect of neem cake on the productivity, pest and disease incidence in cardamom

(Mudigere, Pampadumpara, Myladumpara and Shakleshpur)

As per the decision of XVI Workshop, this programme has to be taken by Mudigere, Pampadumpara, Myladumpara and Shakleshpur centers. None of the centers has initiated this trial.

CAR/CP/2 Pest Management Trial CAR/CP/2.1 Evaluation of plant based insecticides for the control of thrips and fruit borers in cardamom

(Mudigere)

Mudigere

The experiment was initiated during 2000 to evaluate the efficacy of commercially available neem based pesticides for the

control thrips and capsule borer in cardamom. The trial was laid out in RBD with 7 treatments replicated thrice having 16 plants as plot size. The results are given in Table 51.

Minimum thrips damage was recorded in chemical pesticides treated plots (37%) followed by neem gold and neem oil (41.7% and 42.3%, respectively). Other treatments are on par with control. Similarly, the borer damage was also minimum in the plots treated with chemical pesticides (3.7%). Maximum damage was recorded in the plots treated with neem cake compared to control. The results showed that none of the neem based insecticides proved effective against thrips and capsule borer compared to chemical pesticides and the recommended spray schedule of chemical insecticides was proved effective over neem based insecticides for controlling both thrips and capsule borer.

Table 51. Effect of neem based insecticides against thrips and shoot and fruit borer in cardamom (pooled data) – Mudigere

| Treatment | 2000-2001 | | 2001-2002 | | 2002-2003 | | Mean | |
|---------------------------|------------|-------|------------|-------|------------|-------|------------|-------|
| | Damage (%) | | Damage (%) | | Damage (%) | | Damage (%) | |
| | Thrips | Borer | Thrips | Borer | Thrips | Borer | Thrips | Borer |
| Neem gold (3%) | 17.89 | 2.81 | 23.55 | 5.55 | 41.70 | 12.40 | 27.71 | 6.92 |
| Neem oil cake (0.5kg) | 22.65 | 1.05 | 31.35 | 6.55 | 57.00 | 17.80 | 37.00 | 8.47 |
| NSKE (4%) | 21.99 | 1.11 | 20.99 | 7.55 | 51.00 | 7.80 | 31.32 | 5.49 |
| Neem oil (3%) | 16.79 | 1.77 | 21.55 | 5.20 | 42.30 | 8.20 | 26.88 | 5.06 |
| Eco neem plus | - | - | - | - | 61.90 | 7.40 | - | - |
| Monocrotophos + Phosalone | 10.10 | 0.35 | 6.59 | 2.50 | 37.00 | 3.70 | 17.89 | 2.18 |
| Control | 18.39 | 2.39 | 29.55 | 7.50 | 54.00 | 18.90 | 33.98 | 9.60 |
| CD (5 %) | 3.93 | NS | 5.74 | 1.86 | 13.55 | 2.84 | | |

CAR/CP/2.2 Management of root grub of cardamom*(Pampadumpara and Mudigere)****Pampadumpara***

The experiment initiated during 2001 was laid out in RBD with 7 treatments replicated thrice. Six plants constituted plot size. During the year 2002, the experiment was conducted in 2 seasons to find out the effect of three insecticides at 2 concentrations on root grub population. In the first season (April 2002) the mean initial grub population before subjecting to treatments was 5.46. After treatment, there was a significant reduction in grub population, the maximum being in the treatment carbofuran @ 150 g plant⁻¹ (72.50) which was on par with imidacloprid 0.75 ml l⁻¹ (69.60) and chlorpyrifos 0.07% (59.1%) (Table 52). At higher dosage all the three insecticides were effective in suppressing the grub population.

During the second season (September/October 2002), the results revealed no significant difference among the treatments on the reduction of grub population after insecticidal application (Table 53). However, maximum reduction in grub population was observed in plants treated with carbofuran @ 100 g plant⁻¹ (66.6%) followed by imidacloprid 0.5 ml l⁻¹ (63.2%). The yield data showed significant difference among the treatments. Maximum yield of 442.3 g plant⁻¹ was observed in imidacloprid 0.75 ml l⁻¹. This was followed by the same insecticide at 0.5 ml l⁻¹ (348.7 g plant⁻¹), carbofuran @ 150 g plant⁻¹ (347.5 g plant⁻¹) and carbofuran @ 100 g plant⁻¹ (336.0 g plant⁻¹) which were on par. The insecticides carbofuran and imidacloprid at two concentrations evaluated gave significantly higher yield (>325 g plant⁻¹) with reduction in grub population compared to chlorpyrifos at both the concentrations.

Table 52. Effect of insecticides on root grubs (season 1) - Pampadumpara

| Treatment | Initial grub population | Grub population after treatment* | Reduction after treatment (%)** |
|---|-------------------------|----------------------------------|---------------------------------|
| T1 - Chlorpyrifos 0.05% | 6.03 (2.45) | 2.90(1.70) ^{bc} | 49.80(44.28) |
| T2 - Chlorpyrifos 0.07% | 6.33 (2.52) | 2.60(1.59) ^{bc} | 59.10(50.32) ^{ab} |
| T3 - Carbofuran 100 g plant ⁻¹ | 5.67 (2.38) | 3.10(1.74) ^c | 46.90(43.19) ^b |
| T4 - Carbofuran 150 g plant ⁻¹ | 5.70 (2.38) | 1.70(1.27) ^{ab} | 72.50(58.55) ^a |
| T5 - Imidacloprid 0.5 ml l ⁻¹ | 5.23 (2.29) | 3.60(1.88) ^c | 42.70(40.61) ^{bc} |
| T6 - Imidacloprid 0.75 ml l ⁻¹ | 4.33 (2.05) | 1.40(1.12) ^a | 69.60(57.45) ^a |
| T7 - Control | 4.90 (2.18) | 3.70(1.90) ^c | 23.10(28.61) ^c |
| Mean | 5.46 | 2.71 | 51.96 |
| CD (5%) | NS | 0.45 | 12.46 |

*Values in parenthesis are square root transformed, **Values in parenthesis are arc-sine transformed, Values followed by the same alphabet are not statistically significant

Table 53. Effect of insecticides on cardamom root grub (season 2) – Pampadumpara

| Treatment | Initial grub population | Grub population after treatment* | Reduction after treatment (%)** | Yield (g plant ⁻¹) |
|---|-------------------------|----------------------------------|---------------------------------|--------------------------------|
| T1 - Chlorpyrifos .05% | 2.23(1.48) | 1.22(1.10) | 38.80(38.29) | 181.3 ^{cd} |
| T2 - Chlorpyrifos 0.07% | 2.70(1.62) | 1.44(1.19) | 34.10(35.29) | 237.3 ^c |
| T3 - Carbofuran 100 g plant ⁻¹ | 2.33(1.52) | 0.89(0.89) | 66.60(55.28) | 336.0 ^b |
| T4 - Carbofuran 150 g plant ⁻¹ | 3.53(1.87) | 1.56(1.24) | 56.30(48.69) | 345.7 ^b |
| T5 - Imidacloprid 0.5 ml l ⁻¹ | 3.00(1.71) | 1.11(1.04) | 63.20(53.46) | 348.7 ^b |
| T6 - Imidacloprid 0.75 ml l ⁻¹ | 3.13(1.70) | 1.45(1.15) | 43.20(41.04) | 442.3 ^a |
| T7 - Control | 3.23(1.78) | 1.67(1.28) | 46.80(43.21) | 137.0 ^d |
| CD (5%) | NS | NS | | 76.7 |

*Values in parenthesis are square root transformed, **Values in parenthesis are arc-sine transformed, Values followed by the same alphabets are not significantly different

Mudigere

Report not received

CAR/CP/2.3 Bioecology of natural enemies of major pests of cardamom
(Pampadumpara and Mudigere)

Pampadumpara

Occurrence of larval/pupal parasitoids of cardamom shoot and capsule borer (*Conogethes punctiferalis*) was low (<5%) in field collected caterpillars during 2002.

However, there was an increased incidence of shoot borer in the farm during November/December. A new bacterial disease infecting the caterpillar was observed. Infected caterpillars turn blackish brown and die. Under natural field condition, 15.78% of larvae were found infected. Identification of the organism is being done.

Natural occurrence of *Beauveria bassiana* on the adult beetle of cardamom root grub, *Basilepta fulvicorne* was noticed in a garden at Udumbanchola. Live and healthy adult beetles were attracted to those plants having at least a couple of mummified beetles

infected by the white muscardine fungus. Kairomonic orientation needs further evaluation.

No natural enemy was recorded for cardamom thrips (*Sciothrips cardamomi*).

Mudigere

Report not received

CAR/CP/2.4 Estimation of quantitative and qualitative losses due to thrips damage in cardamom

(*Mudigere*)

Mudigere

Report not received.

GINGER**GIN/CI/1 Genetic Resources****GIN/CI/1.1 Germplasm collection, characterization, evaluation and conservation**

(*Solan, Pottangi, Pundibari, Kumarganj, Dholi and Raigarh*)

Solan

A total of 271 germplasm accessions

are being maintained at this center. The performance of the germplasm was poor during the year. The yield of ten best collections varied from 3.75 to 6.75 kg plots⁻¹. The disease incidence varied from 6.5 to 8.5 %. SG - 877 was found to be good for dry matter, essential oil and oleoresin with comparatively less fibre content. (Table 54).

Table 54. Performance of promising lines /collections – Solan

| Collection | Yield (kg plot ⁻¹) | Disease (%) | Dry matter(%) | E Oil (%) | Oleoresins (%) | Crude fibre (%) |
|-------------|-----------------------------------|----------------|------------------|--------------|-------------------|--------------------|
| SG - 826 | 6.75 | 8.5 | 21.00 | 1.75 | 7.62 | 5.75 |
| SG - 877 | 5.50 | 8.0 | 20.00 | 1.80 | 9.75 | 4.00 |
| SG - 603 | 5.25 | 8.5 | 19.00 | 1.50 | 9.06 | 5.10 |
| Acc - 64 | 5.00 | 8.0 | 18.00 | 1.25 | 8.79 | 6.00 |
| BDJR - 1139 | 4.75 | 7.5 | 17.00 | 1.00 | 7.25 | 5.25 |
| SG - 870 | 4.50 | 8.0 | 16.40 | 1.00 | 5.91 | 5.25 |
| BDS - 9/95 | 4.50 | 8.0 | 17.50 | 1.50 | 9.50 | 4.25 |
| BLP - 1 | 4.25 | 3.5 | 19.50 | 1.00 | 4.75 | 6.41 |
| BDJR - 1242 | 4.00 | 7.5 | 21.00 | 1.00 | 6.44 | 6.00 |
| BDJR - 1011 | 3.75 | 6.5 | | | | |

Pottangi

Out of total 172 ginger accessions collected, 145 accessions were evaluated in two replications of which only 20 accessions yielded more than 7.5 kg 3 m² bed⁻¹ ranging

0.30 kg to 12.75 kg 3 m² bed⁻¹. The highest fresh rhizome yield was recorded in Turia local (12.75 kg 3 m² bed⁻¹) followed by ZO - 2 (10.80 kg 3 m² bed⁻¹) and PGS - 12 (10.50 kg 3 m² bed⁻¹) (Table 55).

Table 55. Performance of ginger germplasm accessions - Pottangi

| Character | Range | Mean | Best 3 types with values in parentheses |
|--|------------|-------|---|
| Plant height (cm) | 34.8-67.4 | 52.00 | ZO - 18 (67.4), KG - 47 (64.8), PGS - 9 (63.8) |
| Number of tillers clump ⁻¹ | 3.8-19.4 | 10.97 | Bansapal (19.4), Narasapatanam (18.6), PGS - 28 (18.4) |
| Number of leaves tiller ⁻¹ | 9.6-20.4 | 15.55 | Bheja (20.4), Junagarh (19.8), Karkal (19.8) |
| Length of fully opened last leaf (cm) | 12.6-21.8 | 15.83 | HP (21.8), Junagarh (21.4), S - 558 (20.2) |
| Width of fully opened last leaf (cm) | 1.4-2.6 | 2.03 | WL(S) (2.6), Acc - 64 (2.5), Saigiguda (2.5) |
| Fresh rhizome yield (kg 3 m ² bed ⁻¹) | 0.30-12.75 | 4.61 | Turia local - 2 (12.75), Zo.2 (10.80), PGS - 12 (10.50) |

Pundibari

Twenty four germplasm accessions were evaluated during 2002-2003. Considering mean values for different characters it was found that GCP - 12 produced highest plant height (69.66 cm) followed by GCP - 17 (69.33 cm) and GCP - 3 and GCP - 21 (68.5 cm). Highest number of tillers was observed in GCP - 22 (15.0)

followed by GCP - 14 (14.6) GCP - 22 recorded maximum leaf length (26.0 cm) followed by GCP - 10 and GCP - 12. Broadest leaf was observed in GCP - 22 (3.0 cm) followed by GCP - 10 (2.95 cm). Highest rhizome yield plant⁻¹ was recorded in GCP - 21 (233.59 g) followed by GCP - 23 (229.93 g) GCP - 22 (227.88 g), GCP - 20 (221.81 g) and GCP - 01 (216.75 g) (Table 56).

Table 56. Performance of ginger germplasm accessions – Pundibari

| Entry | Plant height (cm) | No. of tillers | No of leaves | Leaf length (cm) | Leaf breadth (cm) | Rhizome yield (g plant ⁻¹) |
|----------|----------------------|-------------------|-----------------|---------------------|----------------------|---|
| GCP - 1 | 61.73 | 10.10 | 17.63 | 17.73 | 2.23 | 216.75 |
| GCP - 3 | 68.50 | 11.50 | 15.90 | 22.00 | 2.20 | 214.49 |
| GCP - 4 | 64.00 | 10.00 | 16.00 | 17.50 | 2.00 | 176.47 |
| GCP - 5 | 55.27 | 8.56 | 16.67 | 15.20 | 2.50 | 154.34 |
| GCP - 7 | 61.25 | 10.60 | 16.10 | 19.10 | 2.03 | 176.67 |
| GCP - 8 | 67.75 | 11.60 | 16.75 | 21.40 | 2.08 | 179.67 |
| GCP - 10 | 58.25 | 8.50 | 20.50 | 24.90 | 2.95 | 212.71 |
| GCP - 12 | 69.66 | 11.80 | 16.60 | 24.64 | 2.23 | 172.73 |
| GCP - 13 | 64.00 | 12.00 | 16.50 | 21.50 | 2.27 | 214.36 |
| GCP - 14 | 59.30 | 14.60 | 16.66 | 20.70 | 2.16 | 216.12 |
| GCP - 15 | 58.00 | 11.60 | 12.66 | 17.33 | 2.00 | 181.37 |
| GCP - 16 | 60.25 | 11.60 | 14.90 | 16.12 | 2.25 | 168.00 |
| GCP - 17 | 69.33 | 11.33 | 13.30 | 16.00 | 1.67 | 225.53 |
| GCP - 18 | 54.30 | 10.50 | 14.10 | 16.00 | 1.80 | 187.18 |
| GCP - 19 | 54.25 | 9.00 | 15.00 | 19.00 | 2.43 | 209.80 |
| GCP - 20 | 55.75 | 10.70 | 13.10 | 18.33 | 2.03 | 221.81 |
| GCP - 21 | 68.50 | 13.80 | 15.90 | 22.00 | 2.20 | 233.59 |
| GCP - 22 | 59.00 | 15.00 | 18.03 | 26.00 | 3.00 | 227.38 |
| GCP - 23 | 64.25 | 9.66 | 19.25 | 20.75 | 2.12 | 229.93 |
| GCP - 24 | 54.75 | 9.50 | 15.00 | 21.75 | 2.51 | 177.20 |

Kumarganj

Out of 29 germplasm accessions evaluated, NDG - 6 produced maximum yield of (29.44 q ha⁻¹, fresh rhizomes) followed by

NDG - 28 and NDG - 29 (24.94 and 26.66 q ha⁻¹ respectively) On the basis of two years pooled data NDG - 6 produced maximum rhizome yield of 65.72 q ha⁻¹ (Table 57)

Table 57. Performance of ginger germplasm accessions - Kumarganj

| Accession | Yield (q ha ⁻¹) | | |
|-----------|-----------------------------|-------|-------|
| | 2002 | 2003 | Mean |
| NDG - 1 | 27.67 | 18.61 | 23.14 |
| NDG - 2 | 39.00 | 20.83 | 29.91 |
| NDG - 3 | 18.33 | 16.38 | 17.35 |
| NDG - 4 | 18.00 | 17.49 | 17.74 |
| NDG - 5 | 66.00 | 17.22 | 41.61 |
| NDG - 6 | 102.00 | 29.44 | 65.72 |
| NDG - 7 | 27.67 | 24.99 | 26.33 |
| NDG - 8 | 19.00 | 20.55 | 19.77 |
| NDG - 9 | 64.00 | 20.83 | 42.14 |
| NDG - 10 | 19.67 | 23.05 | 21.36 |
| NDG - 11 | 40.33 | 19.99 | 30.16 |
| NDG - 12 | 16.33 | 21.94 | 19.13 |
| NDG - 13 | 28.33 | 23.60 | 25.95 |
| NDG - 14 | 25.67 | 24.99 | 25.33 |
| NDG - 15 | 40.33 | 20.27 | 30.30 |
| NDG - 16 | 16.00 | 21.94 | 18.97 |
| NDG - 17 | 63.33 | 19.99 | 41.66 |
| NDG - 18 | 27.67 | 23.60 | 25.63 |
| NDG - 19 | 21.00 | 24.99 | 22.99 |
| NDG - 20 | 29.67 | 24.16 | 26.91 |
| NDG - 21 | 18.00 | 22.22 | 20.11 |
| NDG - 22 | 47.00 | 21.94 | 34.47 |
| CD (5 %) | 2.77 | 3.99 | |
| CV % | 4.76 | 10.99 | |

Raigarh

Thirty five germplasm accessions were planted for evaluation but due to rhizome rot disease, evaluation could not be done.

Dholi

Forty two germplasm accessions of ginger were evaluated. Fresh rhizome yield (7.2 m² bed⁻¹) in the genotypes RG - 23, RG - 28, RG - 17, RG - 25, RG - 18 and RG - 3 were 8.50, 7.80, 6.45, 6.00 and 6.00 kg, respectively.

GIN/CI/2 Coordinated varietal trial (CVT)**GIN/CI/2.2 CVT 2000 - Series V**

(*Solan*, *Chintapalli*, *Pottangi*, *Pundibari* and *Raigarh*)

Solan

This trial was initiated during 2001. During 2002 six varieties along with 2 local checks were evaluated in RBD with 3 replications. The plot size was 3 m². All the characters studied showed non-significant differences among the genotypes tested. However, SG - 692 gave maximum increase (17.65%) in yield over the check (released variety) (Table 58).

Table 58. Performance of ginger under CVT - Solan

| Genotype | No of tillers | Plant height (cm) | No of leaves | Leaf length (cm) | Leaf width (cm) | Rhizome length (cm) | Rhizome width (cm) | Yield (g plant ⁻¹) | Yield (kg plot ⁻¹) | Converted yield (t ha ⁻¹) | Increase/decrease over released cultivar (%) |
|-----------------------------------|---------------|-------------------|--------------|------------------|-----------------|---------------------|--------------------|--------------------------------|--------------------------------|---------------------------------------|--|
| V ₁ S ₁ - 2 | 5.10 | 80.50 | 73.90 | 19.80 | 3.20 | 9.50 | 5.80 | 142.00 | 5.40 | 10.85 | 5.88 |
| V ₁ S ₁ - 8 | 5.10 | 76.50 | 73.90 | 19.70 | 3.30 | 10.30 | 6.00 | 150.00 | 5.50 | 11.05 | 7.84 |
| Acc - 35 | 4.90 | 81.90 | 66.60 | 19.20 | 2.90 | 11.60 | 8.80 | 136.70 | 5.80 | 11.66 | 13.73 |
| Acc - 117 | 5.10 | 87.40 | 87.40 | 19.70 | 2.90 | 10.70 | 6.20 | 148.30 | 5.20 | 10.45 | 1.96 |
| SG - 682 | 5.10 | 87.40 | 78.70 | 22.10 | 3.30 | 11.00 | 6.00 | 162.00 | 5.80 | 11.66 | 13.73 |
| SG - 692 | 5.20 | 91.80 | 81.80 | 20.70 | 2.80 | 11.00 | 6.60 | 166.70 | 6.00 | 12.06 | 17.65 |
| Himgiri | 5.60 | 90.60 | 85.10 | 18.90 | 3.20 | 12.50 | 7.10 | 156.70 | 5.10 | 10.25 | - |
| SG - 54 | 5.10 | 79.20 | 71.70 | 19.30 | 3.20 | 9.50 | 5.80 | 136.70 | 5.00 | 10.05 | -1.96 |
| Mean | 5.10 | 83.80 | 78.11 | 19.93 | 3.03 | 10.76 | 6.36 | 149.80 | 5.46 | 10.98 | |
| F test | NS | NS | NS | NS | NS | NS | NS | NS | NS | | |
| SEm ± | 0.53 | 5.90 | 9.33 | 1.23 | 0.31 | 1.58 | 0.72 | 21.09 | 0.52 | | |

Chintapalle

Among eight varieties tested during 2001-2002, significantly higher plant height was recorded by IISR Varada and Jaheerabad local whereas number of tillers per plant was more in V₁S₁ - 2, IISR Varada and Jaheerabad local. The variety IISR Varada recorded highest yield of 29 t ha⁻¹, which is significantly superior to other varieties.

During 2002-03, significantly higher rhizome yields of 22 t ha⁻¹, 21.6 t ha⁻¹ and

17.3 t ha⁻¹ were recorded in IISR Varada, Acc - 117 (IISR Mahima) and Acc - 35, respectively. Number of leaves plant⁻¹ was highest in Acc - 117. There is no significant difference for plant height, number of tillers and leaf width. The yield clump⁻¹ was highest in Acc - 117, followed by IISR Varada. (Table 59).

IISR Varada performed well during 2001-02 and 2002-03 recording a yield of 29 t ha⁻¹ and 22 t ha⁻¹, respectively.

Table 59. Performance of ginger germplasm accessions – Chintapalle

| Variety | Plant height (cm) | No of tillers plant ⁻¹ | No of leaves plant ⁻¹ | Leaf length (cm) | Leaf width (cm) | Yield (g plant ⁻¹) | Yield (t ha ⁻¹) |
|-----------|-------------------|-----------------------------------|----------------------------------|------------------|-----------------|--------------------------------|-----------------------------|
| Acc - 35 | 65.7 | 8.6 | 73.3 | 19.6 | 2.0 | 170.0 | 17.3 |
| Acc - 117 | 72.4 | 9.1 | 117.6 | 22.5 | 2.1 | 210.0 | 21.6 |
| VIS1 - 2 | 71.3 | 8.8 | 80.0 | 19.1 | 2.0 | 193.3 | 15.5 |

| | | | | | | | |
|-------------------|------|------|------|------|-----|-------|------|
| VIC - 8 | 66.6 | 6.8 | 73.3 | 21.9 | 2.3 | 120.0 | 13.1 |
| IISR Varada | 67.6 | 9.0 | 87.6 | 20.4 | 2.0 | 203.3 | 22.0 |
| Jaheerabad local | 61.8 | 7.8 | 58.6 | 17.3 | 2.0 | 100.0 | 8.1 |
| Suprabha | 67.5 | 9.6 | 80.0 | 19.1 | 2.0 | 186.6 | 16.1 |
| Chintapalle Local | 60.0 | 7.5 | 63.0 | 17.5 | 2.0 | 103.3 | 12.1 |
| Sem \pm | 2.7 | 0.6 | 9.3 | 0.9 | 0.1 | 22.1 | 1.8 |
| CV % | 7.2 | 12.6 | 20.5 | 19.6 | 9.9 | 23.8 | 20.2 |
| CD (5%) | NS | NS | 28.1 | 2.7 | NS | 67.2 | 5.6 |

Pundibari

The coordinated varietal trial on ginger initiated in 2001-02 was also conducted during 2002-2003. Seven entries were evaluated in RBD with three replications.

Results on growth parameters and yield of ginger entries showed significant

difference between the entries for all the parameters, except for plant height, tiller number and leaf number. Highest rhizome yield was recorded in Gorubathan (8.87 kg 3 m² bed⁻¹) followed by Acc - 117 (6.5 kg 3 m² bed⁻¹) and it was lowest in V₁S₁ - 8 (5.11 kg 3 m² bed⁻¹) (Table 60).

Table 60. Performance of ginger genotypes – Pundibari

| Genotype | Plant height (cm) | No of tillers | No. of leaves | Leaf length (cm) | Leaf breadth (cm) | Plant girth (cm) | Rhizome yield (kg 3 m ² plot ⁻¹) | Projected yield (t ha ⁻¹) |
|-----------------------------------|-------------------|---------------|---------------|------------------|-------------------|------------------|---|---------------------------------------|
| Acc - 35 | 61.73 | 10.10 | 15.63 | 17.73 | 2.53 | 2.91 | 5.60 | 14.00 |
| Acc - 117 | 67.14 | 8.90 | 17.73 | 20.07 | 2.60 | 2.93 | 6.50 | 16.25 |
| Gorubathan | 65.47 | 10.36 | 18.13 | 20.00 | 2.72 | 3.03 | 8.87 | 21.75 |
| SG - 682 | 60.33 | 8.60 | 16.51 | 17.47 | 2.58 | 2.77 | 5.91 | 14.79 |
| SG - 692 | 55.27 | 8.56 | 16.67 | 16.27 | 2.50 | 2.22 | 6.39 | 15.98 |
| V ₁ S ₁ - 2 | 61.83 | 8.47 | 17.36 | 18.30 | 2.47 | 2.82 | 5.83 | 14.58 |
| V ₁ S ₁ - 8 | 57.84 | 9.40 | 16.87 | 16.6 | 2.11 | 2.46 | 5.11 | 12.76 |
| SEm \pm | NS | NS | NS | 1.08 | 0.128 | 0.17 | 0.79 | 1.98 |
| CD (5%) | - | - | - | 1.55 | 0.183 | 0.25 | 1.72 | 2.82 |

Pottangi

Among the eight entries evaluated significant difference for rhizome yield was recorded. The experiment was conducted for 3 years (2000, 2001 & 2002).

The projected yield (fresh) based on the average yield of 3 years, was highest in V₁E₈ - 2 (26.61 t ha⁻¹) followed by V₃S₁ - 8 (24.44 t ha⁻¹) (Table 61).

Table 61. Performance of ginger germplasm accessions – Pottangi

| Cultivar | Yield (fresh, kg 3 m ² bed ⁻¹) | | | | Projected yield (t ha ⁻¹) | Increase over check variety (%) |
|-----------------------------------|---|-------|------|-------|---------------------------------------|---------------------------------|
| | 2000 | 2001 | 2002 | Mean | | |
| V ₁ E ₈ - 2 | 11.68 | 11.13 | 9.12 | 10.64 | 26.61 | 35.7 |
| V ₃ S ₁ - 8 | 10.49 | 11.43 | 7.41 | 9.78 | 24.44 | 24.6 |
| V ₁ C - 8 | 9.47 | 10.86 | 7.78 | 9.37 | 23.43 | 19.5 |
| Acc - 35 | 7.7 | 7.84 | 6.28 | 7.27 | 18.18 | - |
| Suprabha | 8.2 | 8.68 | 6.65 | 7.84 | 19.61 | Check |
| Acc - 177 | 6.5 | 8.8 | 6.94 | 7.41 | 18.53 | - |
| V ₁ S ₁ - 2 | 7.5 | 9.06 | 8.32 | 8.29 | 20.73 | 5.7 |
| SG - 666 | 6.1 | 8.46 | 7.14 | 7.23 | 18.08 | - |
| CD (5%) | N.S | 1.14 | 1.34 | | | |

GIN/CI/3 Varietal Evaluation Trial**GIN/CI/3.1 Comparative yield trial****(CYT - I & II)***(Solan, Pottangi and Raigarh)**Pottangi*

The experiment is in the third year

of progress. Out of eight entries evaluated, significant difference for yield was recorded. Based on the average yield for 3 years the projected yield (fresh rhizomes) was highest in V₂E₅ - 2 (23.59 t ha⁻¹) followed by S - 646 (21.89 t ha⁻¹) (Table 62).

Table 62. Performance of ginger cultivars – Pottangi

| Cultivar | Yield (fresh, kg 3 m ² bed ⁻¹) | | | | Projected yield (t ha ⁻¹) | Increase over check variety (%) |
|-----------------------------------|---|------|------|------|---------------------------------------|---------------------------------|
| | 2000 | 2001 | 2002 | Mean | | |
| S - 646 | 10.6 | 8.63 | 7.04 | 8.76 | 21.89 | 24.9 |
| V ₂ E ₅ - 2 | 8.90 | 10.9 | 8.51 | 9.44 | 23.59 | 34.6 |
| ZO - 17 | 8.10 | 9.05 | 7.86 | 8.34 | 20.84 | 18.9 |
| V ₃ S ₁ - 8 | 6.20 | 9.88 | 8.56 | 8.21 | 20.53 | 17.2 |
| S - 641 | 5.23 | 7.63 | 7.31 | 6.72 | 16.81 | - |
| Singhjehara | 5.51 | 9.03 | 6.88 | 7.14 | 17.85 | 1.9 |
| Vengara | 4.56 | 8.1 | 7.92 | 6.86 | 17.15 | - |
| Suprabha | 6.30 | 8.13 | 6.59 | 7.01 | 17.52 | Check |
| CD (5%) | 1.64 | 1.99 | 1.02 | | | |

Raigarh

Due to severe incidence of rhizome rot disease no data could be recorded. The trial (CYT-I) was started during 2002 with 5 genotypes and one check (Himgiri) in RBD with 4 replications.

Solan

Non-significant differences were observed for yield during the year. The performance of all the collections was poor compared to check. (Table 63).

Table 63. Performance of ginger genotypes (Trial-I) – Solan

| Genotype | Yield plot (kg 3 m ² bed ⁻¹) | Converted yield (t ha ⁻¹) | Increase/decrease over check (%) |
|-----------------|--|--|-------------------------------------|
| SG - 696 | 5.45 | 10.95 | -5.55 |
| SG - 882 | 4.94 | 9.93 | -14.38 |
| SG - 859 | 4.97 | 9.89 | -13.86 |
| BDJR - 1142 | 5.51 | 11.07 | -4.51 |
| SG - 838 | 5.81 | 11.67 | -0.69 |
| Himgiri (check) | 5.77 | 11.59 | - |
| Mean | 5.41 | 10.87 | - |
| F test | NS | | |
| SEm ± | 0.66 | | |

The data on quality parameters (Table 64) revealed that highest dry matter content (16.8%) was recorded in SG - 838. However, essential oil and oleoresin contents were high in Himgiri. Essential oil content of all the tested genotypes was significantly low compared to the check. Whereas, oleoresin contents recorded in SG - 838, BDJR - 1142, SG - 696 and SG - 859 were on par with check (Himgiri). SG - 838 was found to be superior among all the genotypes tested.

Table 64. Quality Parameters of ginger genotypes (Trial-I) – Solan

| Genotype | Dry matter % | E oil % | Oleoresin % |
|-------------|-----------------|------------|----------------|
| SG - 696 | 15.5 | 1.50 | 5.00 |
| SG - 882 | 14.3 | 1.00 | 3.65 |
| SG - 859 | 14.2 | 1.25 | 4.98 |
| BDJR - 1142 | 16.6 | 1.25 | 4.90 |
| SG - 838 | 16.8 | 1.80 | 5.23 |
| Himgiri | 16.7 | 2.00 | 5.01 |
| CD (5%) | 0.37 | 0.11 | 0.93 |

Another trial (CYT-II) was started in 2001 with 6 genotypes including the check (Himgiri) in RBD replicated 4 times. During the year 2002, non-significant differences for yield among the genotypes were observed. SG - 869 however, recorded marginal increase over the check (Table 65).

Table 65. Performance of ginger genotypes (Trial-II) – Solan

| Genotype | Yield (kg plot ⁻¹) | Converted yield (t ha ⁻¹) | Increase over check (%) |
|----------|-----------------------------------|--|-------------------------------|
| SG - 718 | 5.12 | 10.29 | 11.27 |
| Juggijan | 4.86 | 9.77 | 15.77 |
| SG - 869 | 5.97 | 11.99 | 3.47 |
| 47/95 | 5.47 | 10.99 | 5.20 |
| SG - 868 | 5.56 | 11.17 | 3.64 |
| Himgiri | 5.77 | 11.59 | - |
| Mean | 5.46 | | |
| F test | NS | | |
| SEm ± | 0.46 | | |

SG - 869 was found to be superior to check, Himgiri for all the quality attributes. The yield recorded was also highest in this genotype, which was on par with check (Himgiri) (Table 66).

Table 66. Quality parameters of ginger genotypes (Trial –II) – Solan

| Genotype | Dry matter (%) | Oleoresin (%) | E oil (%) |
|----------|----------------|---------------|-----------|
| SG - 718 | 15.50 | 1.00 | 4.58 |
| Juggian | 15.00 | 1.00 | 3.73 |
| SG - 869 | 19.00 | 1.50 | 5.09 |
| 47/95 | 16.00 | 1.25 | 4.32 |
| SG - 868 | 16.80 | 1.50 | 5.05 |
| Himgiri | 16.70 | 2.00 | 5.01 |
| CD | 0.85 | 0.08 | 0.06 |
| SEm ± | 0.38 | 0.09 | 0.03 |

GIN/CI/3.2 Initial evaluation trial (IET)
(Solan and Pottangi)

Solan

The trial was conducted with 16 genotypes including two checks in RBD with 2 replications during 2002. The data are presented in Table 67.

Table 67. Performance of ginger genotypes – Solan

| Genotype | Yield (kg 3 m ² bed ⁻¹) | Converted yield (t ha ⁻¹) | Increase/decrease over check (%) |
|-----------------------------------|--|---------------------------------------|----------------------------------|
| BDJR - 1024 | 4.07 | 8.18 | -7.50 |
| SG - 716 | 4.20 | 8.44 | -4.55 |
| SG - 889 | 4.98 | 10.01 | 13.18 |
| SG - 827 | 3.50 | 7.03 | -20.45 |
| SG - 853 | 4.02 | 8.08 | -8.64 |
| SG - 568 | 4.50 | 9.04 | 1.14 |
| SG - 701 | 4.85 | 9.75 | 10.23 |
| V ₁ S ₁ - 7 | 3.98 | 7.99 | -9.55 |
| SG - 707 | 5.07 | 10.19 | -15.23 |
| SG - 836 | 4.00 | 8.04 | -9.09 |
| SG - 845 | 4.00 | 8.04 | -9.09 |
| SG - 713 | 3.45 | 6.93 | -21.59 |
| SG - 861 | 4.00 | 8.04 | -9.09 |
| SG - 878 | 3.60 | 7.23 | -18.18 |
| SG - 685 | 3.05 | 6.13 | -30.68 |
| Himgiri (check) | 4.40 | 8.84 | - |
| Mean | 4.09 | 8.21 | - |
| F test | NS | | |
| SEm ± | 0.73 | | |

Non-significant differences for yield among the genotypes were observed. Only four collections recorded increase in yield over the check (Himgiri)

Pottangi

The trial was conducted with 15 genotypes in RBD with 3 replications for 3 years. The data given in Table 68

Table 68. Performance of ginger cultivars – Pottangi

| Cultivar | Yield (fresh, kg 3 m ² bed ⁻¹) | | | | Projected yield (t ha ⁻¹) | Increase over check variety (%) |
|-----------------------------------|---|---------|---------|-------|---------------------------------------|---------------------------------|
| | 2000-01 | 2001-02 | 2002-03 | Mean | | |
| S - 558 | 9.44 | 10.33 | 9.46 | 9.74 | 24.36 | - |
| ZO - 17 | 6.92 | 8.65 | 10.46 | 8.68 | 21.69 | - |
| Vengara | 7.16 | 7.65 | 7.08 | 7.30 | 18.24 | - |
| Rajgarh | 11.43 | 8.86 | 8.01 | 9.43 | 23.58 | - |
| V2E5 - 2 | 8.67 | 9.85 | 10.36 | 9.63 | 24.07 | - |
| Anamica | 10.22 | 8.57 | 9.34 | 9.38 | 23.44 | - |
| SS - 1 | 9.41 | 7.35 | 10.44 | 9.07 | 22.67 | - |
| V ₁ S ₁ - 8 | 7.30 | 9.87 | 9.56 | 8.91 | 22.28 | - |
| V ₁ S ₁ - 8 | 11.64 | 10.96 | 9.17 | 10.59 | 26.48 | 5.3 |
| Jugijan | 7.52 | 7.60 | 5.89 | 7.00 | 17.51 | - |
| ZO - 2 | 9.81 | 6.71 | 10.58 | 9.03 | 22.58 | - |
| S - 646 | 10.76 | 8.09 | 9.67 | 9.51 | 23.77 | - |
| Nadia | 8.63 | 6.98 | 10.29 | 8.63 | 21.58 | - |
| S - 666 | 9.62 | 7.33 | 9.52 | 8.82 | 22.06 | - |
| Suprabha (check) | 10.78 | 9.27 | 10.12 | 10.06 | 25.14 | |
| CD (5%) | 1.94 | 2.54 | 0.99 | | | |

Significant difference among the cultivars for fresh rhizome yield was recorded. Highest fresh rhizome yield was recorded in V₁E₁ - 8 (26.48 t ha⁻¹) followed by Suprabha (25.14 t ha⁻¹).

GIN/CI/3.3 Comparative yield trial (CVT) (*Raigarh*)

Raigarh

A new CVT with five collections was laid out during 2002. Due to the incidence of rhizome rot disease the crop failed.

GIN/CI/4

GIN/CI/4.1 **for quality**

(*Solan*)

Solan

Quality Evaluation Trial

Evaluation of germplasm

The entire ginger germplasm accessions were evaluated for all quality attributes during 2002-03 and were divided into three categories viz. 'Good performers' having dry matter, essential oil and oleoresin content equal to or above the check (Himgiri), 'Average performers' with slightly lower dry matter and other quality

attributes than check and 'Poor performers' having very low dry matter in comparison to check. On this basis, there were 35 Good, 34 Average and 92 Poor performers out of 161 genotypes evaluated. The dry matter content varied

from 13.0 to 22.50%. The oleoresin and essential oil content ranged between 4.00 to 9.67% and 0.25 to 2.00%, respectively. The crude fiber content was estimated only in 'Good performers' which varied between 3.93 to 5.95 % (Table 69)

Table 69. Quality attributes of good performers in ginger

| Genotype | E. oil(%) | Oleoresin(%) | Dry matter(%) | Crude fibre (%) |
|-----------------------------------|-----------|--------------|---------------|-----------------|
| Himgiri | 1.75 | 6.61 | 20.00 | 5.35 |
| SG - 686 | 2.00 | 7.76 | 20.00 | 6.20 |
| V ₁ S ₁ - 2 | 2.00 | 7.56 | 22.40 | 6.00 |
| PG - 370 | 1.75 | 7.56 | 22.40 | 5.01 |
| Shilly Bangi | 1.00 | 7.39 | 20.00 | 4.90 |
| SG - 671 | 1.00 | 7.70 | 20.00 | 5.95 |
| PG - 823 | 2.00 | 6.52 | 22.00 | 5.00 |
| SG - 706 | 1.75 | 8.69 | 20.10 | 4.37 |
| SG - 699 | 1.75 | 8.58 | 20.00 | 5.01 |
| SDR | 1.75 | 7.71 | 21.00 | 4.35 |
| SG - 247 | 1.75 | 6.39 | 20.00 | 4.36 |
| 44/95 | 2.00 | 6.93 | 22.50 | 4.65 |
| SG - 610 | 2.00 | 7.83 | 20.00 | 5.01 |
| V ₁ S ₁ - 8 | 1.75 | 7.15 | 20.00 | 4.75 |
| SG - 713 | 1.75 | 6.99 | 20.00 | 5.01 |
| 47/95 | 1.75 | 7.17 | 20.40 | 5.03 |
| BDJR - 1267 | 1.70 | 7.81 | 20.00 | 4.32 |
| BDJR - 1171 | 1.70 | 7.91 | 10.00 | 4.75 |
| BDJR - 1054 | 1.75 | 9.67 | 20.40 | 3.93 |
| BDJR - 1142 | 1.75 | 7.44 | 21.00 | 4.33 |
| SG - 817 | 1.75 | 6.99 | 22.40 | 4.92 |
| SG - 825 | 1.75 | 7.34 | 20.40 | 5.01 |
| SG - 884 | 1.75 | 7.22 | 20.50 | 4.12 |
| SG - 858 | 1.75 | 7.09 | 20.25 | 4.92 |
| SG - 866 | 1.80 | 7.19 | 20.00 | 4.01 |
| SG - 802 | 1.70 | 7.19 | 20.01 | 4.75 |
| SG - 856 | 1.75 | 6.95 | 20.04 | 4.99 |
| SG - 879 | 1.75 | 7.19 | 21.00 | 4.50 |
| SG - 854 | 1.50 | 7.67 | 20.40 | 4.75 |
| SG - 882 | 1.50 | 6.66 | 20.80 | 4.12 |
| SG - 824 | 1.75 | 7.14 | 20.40 | 5.01 |
| SG - 875 | 1.75 | 6.40 | 20.00 | 5.65 |
| SG - 837 | 1.75 | 7.10 | 20.00 | 5.12 |
| SG - 826 | 1.75 | 7.62 | 21.00 | 5.75 |
| SG - 888 | 1.85 | 7.11 | 20.00 | 4.72 |

GIN/CM/1 Nutrient Management Trial
GIN /CM/1.1 Efficacy of biofertilizer
using *Azospirillum* on ginger

(Solan, Pottangi, Ambalavayal, Pundibari, Dholi and Raigarh)

Pottangi

The experiment is in third year of progress. During 2002-03 the experiment was conducted in RBD with the following treatments replicated thrice.

T1 - N 100% + *Azospirillum* 50 g + FYM 5 kg,
 T2 - N 75% + *Azospirillum* 50 g + FYM 5 kg,
 T3 - N 50% + *Azospirillum* 50 g + FYM 5 kg,
 T4 - FYM 5 kg,
 T5 - *Azospirillum* 50 g + FYM 5 kg,
 T6 + *Azospirillum* 50 g + FYM 10 kg,
 T7 - FYM 10 kg,
 T8 - Recommended dose of fertilizer (125:100:100:NPK kg ha⁻¹).

Solan

The experiment was initially started with eight treatments during 2000. As per the decision of the X Workshop, 5 more treatments were added making the total treatments 13 as follows.

T1 - N 100% + *Azospirillum* (soil application) + FYM 5t ha⁻¹

T2 - 75% N+ *Azospirillum* (soil application) + FYM 5t ha⁻¹

T3 - 50% N+ *Azospirillum* (soil application) + FYM 5t ha⁻¹

T4 - FYM (5 t ha⁻¹) + *Azospirillum* (soil application)

T5 - FYM 5 t ha⁻¹ alone

T6 - FYM 10 t ha⁻¹ + *Azospirillum* (soil application)

T7 - FYM 10 t ha⁻¹ alone

T8 - 100% N+ *Azospirillum* (seed application) + FYM 5 t ha⁻¹

T9 - 75% N + *Azospirillum* (seed application) + FYM 10 t ha⁻¹

T10 - 50% N+ *Azospirillum* (seed application) + FYM 5 t ha⁻¹

T11 - FYM 5 t ha⁻¹ + *Azospirillum* (seed application)

T12 - FYM 10 t ha⁻¹ + *Azospirillum* (seed application)

T13 - NPK 100: 50: 50 kg ha⁻¹ (control)

**Azospirillum* 5 kg ha⁻¹ as soil and seed application.

The results showed non-significant differences for yield. All the treatments except T10 and T11 showed increase in yield over control. The increase was maximum in T7 followed by T6, T4 and T8 (Table 70).

Table 70. Effect of biofertilizer, *Azospirillum* on the yield of ginger - Solan

| Treatment | Yield (kg 3 m ² bed ⁻¹) | Converted yield (t ha ⁻¹) | Increase/decrease over control (%) |
|---------------|---|--|---------------------------------------|
| T1 | 4.97 | 9.99 | 3.11 |
| T2 | 5.22 | 10.49 | 8.30 |
| T3 | 5.45 | 10.95 | 13.07 |
| T4 | 5.65 | 11.35 | 17.22 |
| T5 | 5.05 | 10.15 | 4.77 |
| T6 | 5.78 | 11.62 | 19.92 |
| T7 | 6.02 | 12.10 | 24.90 |
| T8 | 5.65 | 11.35 | 17.22 |
| T9 | 5.43 | 10.91 | 12.66 |
| T10 | 4.62 | 9.28 | -4.15 |
| T11 | 4.73 | 9.50 | -2.07 |
| T12 | 5.20 | 10.45 | 7.88 |
| T13 (control) | 4.82 | 9.68 | - |
| Mean | 5.27 | 10.59 | |
| F test | NS | | |
| SEm ± | 0.61 | | |

The data presented in Table 71 revealed that biofertiliser in different combination increased dry matter, essential oil and oleoresin contents. Dry matter content was highest (17.9 %) in T7 followed by T8 and T2 and was lowest in T11. The essential oil and oleoresin contents were highest in treatment T2.

Table 71. Effect of biofertilizer, *Azospirillum* on the quality attributes of ginger - Solan

| Treatment | Dry matter (%) | E. oil (%) | Oleoresin (%) |
|-----------|-------------------|---------------|------------------|
| T1 | 16.60 | 1.00 | 4.85 |
| T2 | 17.00 | 2.00 | 6.76 |
| T3 | 16.40 | 1.00 | 4.36 |
| T4 | 17.40 | 1.00 | 3.98 |
| T5 | 15.30 | 1.50 | 5.78 |
| T6 | 16.00 | 1.25 | 4.09 |
| T7 | 17.90 | 1.25 | 5.60 |
| T8 | 17.30 | 1.25 | 4.60 |
| T9 | 16.60 | 1.50 | 5.84 |
| T10 | 16.60 | 1.50 | 5.67 |
| T11 | 14.80 | 1.01 | 3.61 |
| T12 | 15.30 | 1.50 | 5.01 |
| T13 | 15.20 | 0.75 | 3.63 |
| CD (5%) | 0.69 | 0.30 | 0.04 |

The original eight treatments completed three years of study and the pooled data for yield are given in Table 72. Non-significant differences for yield in all the years were observed.

Table 72. Effect of biofertilizer, *Azospirillum* on yield of ginger (pooled data) – Solan

| Treatment | Yield (Kg 3 m ² bed ⁻¹) | | | | Converted yield (t ha ⁻¹) | Increase/decrease over control (%) |
|--------------|--|------|------|------|---------------------------------------|------------------------------------|
| | 2000 | 2001 | 2002 | Mean | | |
| T1 | 5.70 | 4.50 | 4.97 | 5.06 | 10.16 | 1.00 |
| T2 | 6.00 | 4.90 | 5.22 | 5.37 | 10.80 | 7.19 |
| T3 | 4.60 | 4.40 | 5.45 | 4.82 | 9.68 | -3.79 |
| T4 | 5.30 | 5.10 | 5.65 | 5.35 | 10.75 | 6.79 |
| T5 | 5.70 | 5.00 | 5.05 | 5.25 | 10.55 | 4.79 |
| T6 | 5.30 | 4.60 | 5.78 | 5.56 | 11.17 | 10.98 |
| T7 | 5.00 | 4.20 | 6.02 | 5.07 | 10.19 | 1.20 |
| T8 (control) | 5.30 | 4.90 | 4.82 | 5.01 | 10.06 | - |
| Mean | 5.36 | 4.70 | 5.37 | | | |
| SEm ± | 0.47 | 0.43 | | | | |

Dholi

The experiment was started during 2002-03 with the following 8 treatments in RBD with 3 replications.

T1 - Inorganic N 100% + *Azospirillum* 50 g + FYM 5 kg

T2 - Inorganic N 5% + *Azospirillum* 50 g + FYM 5 kg

T3 - Inorganic N 50% + *Azospirillum* 50 g + FYM 5 kg

T4 - *Azospirillum* 50 g + FYM 5 kg

T5 - *Azospirillum* 50 g + FYM 10 kg

T6 - FYM 5 kg

T7 - FYM 10 kg

T8 –Recommended dose of fertilizers

The treatment T3 recorded the highest yield of (15.9 t ha⁻¹), followed by T5 and T4 which are at par. T5 gave maximum clump weight (100.4 g) followed by T7 (91.7 g).

Pottangi

The experiment was conducted for 3 consecutive years with 8 treatment combinations. The variety used was Suprabha. The analysis of pooled data showed significant difference among different treatments for fresh rhizome yield. (Table 73). Highest fresh rhizome yield was recorded in T1 (18.91 t ha⁻¹) followed by T8 (18.42 t ha⁻¹).

Table 73. Effect of biofertilizer, *Azospirillum* on the yield of ginger - Pottangi

| Treatment | Fresh rhizome yield (kg 3m ² bed ⁻¹) | | | | Projected yield (t ha ⁻¹) | C:B ratio |
|---|---|---------|---------|------|---------------------------------------|-----------|
| | 2000-01 | 2001-02 | 2002-03 | Mean | | |
| T1 - N 100%+ <i>Azospirillum</i> 50 g + FYM 5 kg | 7.23 | 9.23 | 6.23 | 7.56 | 18.91 | 1.02:0.53 |
| T2 - N 75% + <i>Azospirillum</i> 50 g + FYM 5 kg | 6.81 | 6.80 | 5.00 | 6.20 | 15.51 | 1.01:0.17 |
| T3 - N 50% + <i>Azospirillum</i> 50 g + FYM 5 kg | 6.68 | 5.76 | 4.42 | 5.62 | 14.05 | 1.00:0.40 |
| T4 - <i>Azospirillum</i> 50 g + FYM 5 kg | 5.53 | 4.87 | 2.73 | 4.38 | 10.94 | 1.00:0.09 |
| T5 - <i>Azospirillum</i> 50 g + FYM 5 kg | 5.45 | 4.93 | 3.07 | 4.48 | 11.21 | 0.98:0.14 |
| T6 - <i>Azospirillum</i> 50 g + FYM 10 kg | 5.84 | 6.10 | 3.00 | 4.98 | 12.45 | 1.00:0.25 |
| T7 - <i>Azospirillum</i> 50 g + FYM 10 kg | 5.22 | 4.76 | 3.03 | 4.34 | 10.84 | 0.97:0.11 |
| T8 - Recommended dose (125:100:100::N:P:K kg ha ⁻¹) | 7.14 | 7.96 | 7.00 | 7.37 | 18.42 | 1.00:0.84 |
| CD (5%) | NS | 1.20 | 0.88 | - | - | - |

Raigarh

The experiment was conducted during 2001-02 and 2002-03 with 8 treatments. The pooled data are presented in Table 74.

Table 74. Effect of biofertilizer, *Azospirillum* on yield and economics of ginger – Raigarh

| Treatment | Yield (kg 3m ² bed ⁻¹) | Projected yield (t ha ⁻¹ fresh) | | Mean yield (t ha ⁻¹ fresh) | Cost (Rs. in lacs) | Gross return (Rs. in lacs) | Net. return (Rs. in lacs) |
|-----------|---|--|---------|---------------------------------------|--------------------|----------------------------|---------------------------|
| | 2002-03 | 2001-02 | 2002-03 | | | | |
| T1 | 9.83 | 24.30 | 19.76 | 22.03 | 1.12 | 1.98 | 0.86 |
| T2 | 7.56 | 21.62 | 15.20 | 18.41 | 1.10 | 1.65 | 0.55 |
| T3 | 7.43 | 19.76 | 14.93 | 17.34 | 1.08 | 1.56 | 0.48 |
| T4 | 5.20 | 14.03 | 10.45 | 12.24 | 1.00 | 1.10 | 0.10 |
| T5 | 4.4 | 13.60 | 8.84 | 11.22 | 0.98 | 1.09 | 0.11 |
| T6 | 5.60 | 15.61 | 11.25 | 13.43 | 1.02 | 1.20 | 0.18 |
| T7 | 4.46 | 14.94 | 8.96 | 11.95 | 1.01 | 1.07 | 0.06 |
| T8 | 9.33 | 23.11 | 18.75 | 20.93 | 1.11 | 1.68 | 0.57 |
| CD (5%) | 1.05 | 1.69 | 2.11 | - | - | - | - |

T1-Inorganic N 100% + *Azospirillum* 50 g + FYM 5 kg, T2-Inorganic N 75% + *Azospirillum* 50 g + FYM 5 kg, T3-Inorganic N 50% + *Azospirillum* 50 g + FYM 5 kg, T4- FYM 5 kg + *Azospirillum* 50 g, T5-FYM 5 kg, T6-FYM 10 kg + *Azospirillum* 50 g, T7-FYM 10 kg, T8-Recommended dose of fertilizers.

Data revealed significant differences among the treatments except T1, T8 and T4, T5 and T6, T7. Maximum fresh rhizome yield (22.03 t ha⁻¹) was recorded with application of inorganic N 100% + *Azospirillum* 50 g + FYM 5 kg plot⁻¹ closely followed by T8 (21.30 t ha⁻¹) and T2 (18.41 t ha⁻¹) which are at par. Treatments T4, T5, T6 and T7 also

showed non significant differences. Minimum yield (8.84 t ha⁻¹) was recorded with application of FYM 5 kg alone.

Ambalavayal

The experiment was conducted with seven treatments. The results indicate that T1, T2, T3 and T6 were on par and superior to other treatments (Table 75).

Table 75. Effect of biofertilizer, *Azospirillum* on the yield of ginger – Ambalavayal

| Treatment | Yield (t ha ⁻¹) | Disease incidence (%) |
|--|-----------------------------|-----------------------|
| T1 - N 100 % + <i>Azospirillum</i> 50 g + FYM 5 kg | 31.625 | 10.936 (17.777) |
| T2 - N 75% + <i>Azospirillum</i> 50 g + FYM 5 kg | 27.832 | 13.546 (20.363) |
| T3 - N 50% + <i>Azospirillum</i> 50 g + FYM 5 kg | 29.833 | 15.730 (21.247) |
| T4 - <i>Azospirillum</i> 50 g + FYM 5 kg. | 21.793 | 28.64 (31.543) |
| T5 - FYM 5 kg alone | 15.043 | 7.813 (15.920) |
| T6 - FYM 10 kg + <i>Azospirillum</i> 50 g | 25.043 | 6.773 (14.970) |
| T7 - FYM 10 kg alone | 21.333 | 17.713 (24.550) |
| F - Test | ** | NS |
| CD (5%) | 7.710 | - |

Pundibari

The experiment was started during 2002-03 with 8 treatments, replicated thrice in RBD. The treatments are as follows.

T1 - Inorganic N 100% + *Azospirillum* 50 g + FYM 5 kg

T2 - Inorganic N 75% + *Azospirillum* 50 g + FYM 5 kg

T3 - Inorganic N 50% + *Azospirillum* (50 gm) + 5 kg FYM

T4 - *Azospirillum* 50 g + FYM 5 kg

T5 - *Azospirillum* 50 g + FYM 10 kg

T6 - FYM 5 kg

T7 - FYM 10 kg

T8 - Recommended dose of fertilizers

The treatment T3 recorded the highest yield (15.9 t ha⁻¹) followed by T5 and T4 which are at par. T5 gave maximum clump weight (100.4 g) followed by T7 (91.7 g) (Table 76).

Table 76. Effect of biofertilizer, *Azospirillum* on growth and yield of ginger variety 'Gorubathan' – Pundibari

| Treatment | Plant height (cm) | No of leaves plant ⁻¹ | Leaf length (cm) | Leaf breadth (cm) | No of tiller plant ⁻¹ | Clump weight (g) | Weight of mother rhizome (g) | Weight of finger rhizome (g) | Volume of mother rhizome (cc) | Volume of finger rhizome (cc) | Density of mother rhizome (g/cc) | Density of finger rhizome (g/cc) | Fresh rhizome yield 3m ² bed ⁻¹ (t ha ⁻¹) | Fresh rhizome yield (t ha ⁻¹) | Dryage (%) |
|-----------|-------------------|----------------------------------|------------------|-------------------|----------------------------------|------------------|------------------------------|------------------------------|-------------------------------|-------------------------------|----------------------------------|----------------------------------|---|---|------------|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
| T1 | 81.3 | 183 | 25.2 | 2.9 | 7.9 | 49.1 | 13.2 | 35.9 | 9.5 | 31.7 | 1.39 | 1.13 | 1.3 | 9.5 | 29.1 |
| T2 | 77.1 | 177 | 24.0 | 2.7 | 7.5 | 78.7 | 14.9 | 62.9 | 11.1 | 56.0 | 1.34 | 1.12 | 2.7 | 13.2 | 28.9 |
| T3 | 81.5 | 180 | 25.8 | 2.7 | 5.8 | 80.7 | 17.9 | 63.7 | 14.8 | 56.7 | 1.21 | 1.12 | 3.7 | 15.9 | 27.3 |
| T4 | 78.1 | 180 | 24.9 | 2.7 | 5.7 | 80.1 | 14.7 | 65.2 | 11.5 | 56.5 | 1.28 | 1.15 | 3.1 | 14.2 | 29.3 |
| T5 | 82.7 | 191 | 24.8 | 2.9 | 8.5 | 100.4 | 15.8 | 76.8 | 12.9 | 76.3 | 1.22 | 1.01 | 3.2 | 14.5 | 28.3 |
| T6 | 75.6 | 185 | 24.3 | 2.7 | 5.6 | 78.2 | 13.1 | 65.3 | 10.3 | 53.3 | 1.27 | 1.23 | 2.3 | 12.1 | 29.0 |
| T7 | 83.9 | 184 | 25.5 | 2.9 | 7.3 | 91.7 | 11.3 | 89.85 | 9.4 | 66.3 | 1.27 | 1.23 | 2.7 | 13.2 | 26.3 |
| T8 | 68.8 | 173 | 21.5 | 2.5 | 4.7 | 37.7 | 10.6 | 27.3 | 7.9 | 24.6 | 1.34 | 1.11 | 1.4 | 9.7 | 28.0 |
| CD (5%) | NS | NS | 1.7 | NS | 1.4 | 12.3 | 2.7 | 7.5 | 1.6 | 11.8 | - | - | 0.7 | - | - |

GIN/CM/ 1.2 Organic farming in ginger

(*Solan, Pottangi, Ambalavayal, Dholi and Raigarh*)

Pottangi

The experiment was conducted for 3 years (2000-01 to 2002-03) with the following

treatments, replicated thrice in RBD. The variety used was Suprabha.

The pooled data are presented in Table 77. There was significant difference among different treatments for fresh rhizome yield. Highest fresh rhizome yield was recorded in T8 (20.80 t ha⁻¹) followed by T1 (17.63 t ha⁻¹).

Table 77. Effect organic inputs on the yield of ginger – Pottangi

| Treatment | Fresh rhizome yield (kg 3m ² bed ⁻¹) | | | | Projected yield (t ha ⁻¹) | C:B ratio |
|-----------------------|---|---------|---------|------|---------------------------------------|-----------|
| | 2000-01 | 2001-02 | 2002-03 | Mean | | |
| T1 - A+B+C+D+E+F | 7.48 | 6.61 | 4.50 | 6.20 | 15.49 | 0.80:0.75 |
| T2 - B+C+D+E+F | 5.43 | 5.20 | 3.53 | 4.72 | 11.80 | 0.65:0.53 |
| T3 - A+ C+D+E+F | 5.47 | 5.09 | 3.54 | 4.70 | 11.75 | 0.70:0.48 |
| T4 - A+B+ D+E+F | 5.41 | 4.28 | 3.38 | 4.36 | 10.89 | 0.70:0.39 |
| T5 - A+B+C+ E+F | 5.89 | 4.48 | 3.87 | 4.75 | 11.87 | 0.70:0.49 |
| T6 - A+B+C+D+ F | 4.69 | 4.78 | 3.13 | 4.20 | 10.50 | 0.70:0.35 |
| T7 - A+B+C+D+E | 5.21 | 4.35 | 4.62 | 4.73 | 11.82 | 0.70:0.48 |
| T8 - Recommended dose | 8.13 | 8.50 | 7.56 | 8.06 | 20.16 | 1.00:1.02 |
| CD (5%) | | 1.32 | 0.82 | | | |

T1-A+B+C+D+E+F, T2-B+C+D+E+F, T3-A+C+D+E+F, T4-A+B+D+E+F, T5-A+B+C+ E+F, T6-A+B+C+D+F, T7- A+B+C+D+E, T8-Recommended dose of fertilizer i.e. 125:100:100: NPK kg ha⁻¹.

A - FYM 25 t ha⁻¹, B - Pongamia oilcake 1.25 t ha⁻¹, C - Neem oilcake 1.25 t ha⁻¹, D - Sterameal 1.25 t ha⁻¹, E - Rock phosphate 1.25 t ha⁻¹, F - Wood ash 1.25 t ha⁻¹.

Raigarh

The experiment was conducted during 2001-02 and 2002-03 with the following

treatments in RBD with 3 replications. The variety used was Indira ginger-1. The pooled data are presented in Table 78.

T1-FYM + Rock phosphate + wood ash

T2-Rock phosphate alone 500 g plot⁻¹

T3-Wood ash alone 2 kg plot⁻¹

T4-Azospirillum alone 50 g plot⁻¹

T5-Neem cake + rock phosphate + wood ash

T6-Neem cake alone 250 g plot⁻¹

T7-FYM alone 5 kg plot⁻¹

T8-Conventional farming (recommended dose of fertilizer 150:100:120 kg NPK ha⁻¹)

Table 78. Effect of organic inputs on yield and economics of ginger – Raigarh

| Treatment | Yield (kg 3m ² bed ⁻¹) | Projected yield (t ha ⁻¹) | | Mean | Cost (Rs. in lacs) | Gross return (Rs. in lacs) | Net return (Rs. in lacs) |
|-----------|--|---------------------------------------|---------|-------|-----------------------|----------------------------------|-----------------------------|
| | | 2001-02 | 2002-03 | | | | |
| T1 | 8.90 | 18.96 | 17.88 | 18.42 | 1.07 | 1.65 | 0.58 |
| T2 | 4.76 | 9.91 | 9.56 | 9.73 | 0.75 | 0.87 | 0.12 |
| T3 | 4.33 | 9.78 | 8.70 | 9.24 | 0.75 | 0.83 | 0.08 |
| T4 | 4.66 | 10.51 | 9.36 | 9.93 | 0.78 | 0.89 | 0.11 |
| T5 | 8.70 | 18.76 | 17.48 | 18.12 | 1.07 | 1.63 | 0.56 |
| T6 | 5.26 | 11.32 | 10.57 | 10.94 | 0.85 | 0.98 | 0.13 |
| T7 | 6.50 | 12.06 | 13.06 | 12.56 | 0.90 | 1.13 | 0.23 |
| T8 | 10.10 | 22.31 | 20.30 | 21.30 | 1.10 | 1.91 | 0.81 |
| CD (5%) | 1.11 | 1.97 | 2.23 | - | - | - | - |

The study revealed significant differences among organic and conventional farming. But among organic inputs T2, T3, T4, T6 and T7 showed non significant differences.

Solan

The experiment was conducted for 3 years (2000-01 to 2002-03) with the following treatments in RBD replicated thrice.

T1- FYM+ P+ wood ash

T2- *Azospirillum* + P + wood ash

T3- P alone

T4- Wood ash alone

T5- *Azospirillum* alone

T6- Neem cake + P + wood ash

T7- Neem cake alone

T8- Control (NPK @ 100:50:50 kg ha⁻¹)

FYM-20 t ha⁻¹

P-50 kg ha⁻¹

Wood ash-10 kg ha⁻¹

Azospirillum-5 kg ha⁻¹ as soil application

Neem cake-2 t ha⁻¹

During 2002-03, non-significant differences were observed for yield. However,

T2 gave an increase (19.76%) over the check. Since the experiment completed three years, the pooled data for the years are presented in Table 79.

Table 79. Effect of organic inputs on the yield of ginger (2003) – Solan

| Treatment | Yield plot (kg) | Converted yield (t ha ⁻¹) | Increase over control (%) |
|-----------|--------------------|---|---------------------------------|
| T1 | 5.17 | 10.39 | 3.19 |
| T2 | 6.00 | 12.06 | 19.76 |
| T3 | 5.75 | 11.55 | 14.77 |
| T4 | 5.58 | 11.21 | 11.38 |
| T5 | 5.41 | 10.87 | 11.69 |
| T6 | 5.25 | 10.55 | 4.79 |
| T7 | 5.08 | 10.21 | 1.40 |
| T8 | 5.01 | 10.07 | - |
| Mean | 5.41 | 10.87 | - |
| F test | NS | | |
| SEm ± | 0.35 | | |

The pooled data showed non-significant differences for yield in all the years. The overall mean indicated that only two treatments showed marginal increase over the check (Table 80).

Table 80. Effect of organic inputs on the yield of ginger (pooled data) - Solan

| Treatment | Yield (kg 3 m ² bed ⁻¹ fresh) | | | | Converted yield (t ha ⁻¹) | Increase/ decrease over check (%) |
|-----------|---|------|------|------|--|---|
| | 2000 | 2001 | 2002 | Mean | | |
| T1 | 6.20 | 4.60 | 5.17 | 5.32 | 10.70 | -3.97 |
| T2 | 6.00 | 4.10 | 6.00 | 5.37 | 10.78 | -3.07 |
| T3 | 5.80 | 4.90 | 5.75 | 5.48 | 11.02 | -1.08 |
| T4 | 6.00 | 4.60 | 5.58 | 5.39 | 10.84 | -2.71 |
| T5 | 7.00 | 4.90 | 5.41 | 5.77 | 11.59 | 4.15 |
| T6 | 6.60 | 4.90 | 5.25 | 5.58 | 11.22 | 0.72 |
| T7 | 6.00 | 4.90 | 5.08 | 5.33 | 10.70 | -3.79 |
| T8 | 6.50 | 5.10 | 5.01 | 5.54 | 11.12 | - |
| Mean | 6.25 | 4.70 | 5.41 | 5.45 | 10.96 | |
| SEm ± | 0.51 | 0.49 | 0.35 | | | |

The perusal of data (Table 81) on the effect of organic farming showed that different organic inputs increased all the quality attributes namely dry matter, essential oil and oleoresin contents. The highest dry matter (17.7%), essential oil (2.0 %) and oleoresin content (6.98%) were recorded in treatment T2 (*Azospirillum* + P + wood ash) which is statistically at par with control, followed by T1 and T5.

Table 81. Effect of organic farming on quality of ginger

| Treatment | Dry matter (%) | E.oil (%) | Oleoresin (%) |
|--------------|-------------------|--------------|------------------|
| T1 | 16.90 | 1.25 | 5.60 |
| T2 | 17.70 | 2.00 | 6.98 |
| T3 | 15.40 | 1.50 | 5.10 |
| T4 | 16.00 | 1.25 | 5.44 |
| T5 | 16.80 | 1.50 | 5.78 |
| T6 | 15.60 | 1.00 | 3.85 |
| T7 | 15.80 | 1.28 | 4.12 |
| T8 (Control) | 15.70 | 1.00 | 4.54 |
| CD (5%) | 0.31 | 0.29 | 0.06 |

Dholi and Ambalavayal

Reports not received.

GIN/CM/1.3 Micronutrient on ginger (Dholi)

Dholi

An experiment to study the effect of micronutrients on the yield of ginger was initiated during 2001-02. Data recorded during both years indicated that the micronutrients had significance effect on the yield. It was observed that two sprayings of ferrous sulphate 1% at 45 and 55 days interval increased the plant height (57.97 cm) followed by three sprayings of ferrous sulphate 1% at 45, 55 and 65 days (57.77 cm). While maximum number of branches per plant (24.49) was recorded with ferrous sulphate 1% at 45 and 55 days followed by zinc sulphate 5 kg ha⁻¹ as soil application. Maximum fresh rhizome yield per plot and per hectare (11.43 kg plot⁻¹ and 21.09 t ha⁻¹, respectively) was recorded with two sprayings of ferrous sulphate 1% at 45 and 55 days, followed by soil application of zinc sulphate 10 kg ha⁻¹ (11.19 kg plot⁻¹ and 20.27 t ha⁻¹). The yield was 143.82% higher over control with two sprayings of ferrous sulphate 1% at 45 and 55 days after planting.

GIN/CP/1 Disease Management Trial **GIN/CP/1.1 Integrated management on** **rhizome rot of ginger**

(Dholi, Pundibari and Solan)

Pundibari

The experiment was conducted during this year and the observations are being recorded.

Solan

Report not received.

Dholi

Final report not received.

GIN/CP/1.2 Biocontrol studies on **rhizome rot of ginger**

(Pundibari, Raigarh, Kumarganj, Pottangi and Dholi)

Raigarh

Report not received.

Pundibari

The experiment initiated during 2000-01 was conducted during 2002-03 with the following 9 treatments in RBD replicated thrice.

T1-Seeds sown directly.

T2-Seed treatment with hot water at 51⁰ C for 10 minutes

T3-Seed treatment with mancozeb (3 g l⁻¹) for 30 minutes

T4-Seed treatment with biocontrol inoculum 100 g 5 l⁻¹ (10⁷ cfu) of water for 30 minutes

T5-Seed treatment with hot water at 51⁰C for 10 minutes + mancozeb treatment for 30 minutes.

T6-Seed treatment with hot water at 51⁰ C for 10 minutes + biocontrol inoculum mixed with 1 kg of neem cake at the time of planting.

T7-Soil application of neem cake

T8-Biocontrol inoculum mixed with 1 kg. of neem cake at the time of planting + furadan

T9-Seed treatment with biocontrol inoculum + biocontrol inoculum mixed with 1 kg. of neem cake at the time of planting.

The disease incidence was recorded four times at an interval of 20 days starting from third month, which coincided with the monsoon. The results presented in Table 82

indicated that seed treatment with hot water and *Trichoderma* mixed with neem cake (T6) was the most effective treatment in reducing

the disease incidence at different phases of crop growth. This treatment recorded 36% less disease incidence as compared to control.

Table 82. Management of rhizome rot of ginger - Pundibari

| Treatment | Germination (%) | Disease incidence (%) | | | | Reduction in disease (%) | Yield (kg 3m ² bed ⁻¹) |
|-----------|-----------------|-----------------------|---------|---------|---------|--------------------------|---|
| | | 90 DAS | 110 DAS | 130 DAS | 150 DAS | | |
| T1 | 85.8 | 18.61 | 29.06 | 52.58 | 59.71 | - | 2.50 |
| T2 | 88.2 | 31.08 | 35.67 | 46.08 | 48.35 | 19.02 | 3.46 |
| T3 | 92.5 | 20.05 | 21.77 | 38.75 | 42.20 | 29.32 | 4.76 |
| T4 | 94.8 | 19.79 | 25.87 | 39.30 | 43.62 | 26.94 | 4.71 |
| T5 | 95.2 | 23.73 | 26.56 | 34.22 | 40.41 | 30.65 | 5.29 |
| T6 | 94.5 | 19.62 | 21.94 | 29.53 | 37.80 | 36.69 | 5.44 |
| T7 | 86.8 | 16.46 | 22.15 | 34.35 | 47.00 | 21.29 | 4.11 |
| T8 | 89.8 | 18.85 | 28.71 | 39.62 | 46.48 | 22.15 | 2.73 |
| T9 | 88.2 | 16.97 | 25.97 | 34.15 | 43.07 | 27.87 | 3.86 |
| LSD (5%) | | 5.36 | 4.86 | 7.21 | 6.93 | | 0.17 |

An extensive survey was made in the three major blocks of Darjeeling District namely, Kalimpong I, Kalimpong II and Kalimpong III, the principal ginger growing belt of West Bengal. Thirteen locations, well distributed in the three said blocks were selected. Gorubathan is most extensively cultivated followed by Bhaisi, Majoeley and Nongrey. Disease incidence at different locations was recorded

during the monsoon period (2002). Results indicated that Kalimpong I is one of the hot spots for rhizome rot complex disease of ginger (Table 83). The disease incidence was maximum (1.5 to 2.5%) in soils with pH 4.5-5.5 and low organic carbon indicating that the disease is favoured by low pH and low organic carbon. Thus a scope exists to manage the disease by manipulating the soil environment.

Table 83. Incidence of rhizome rot disease in the farmers' fields

| Block | Location | No. of fields | Disease (%) |
|-------------|-----------|---------------|--------------|
| Kalimpong I | Nassey | 2 | 60.00 |
| | Echey | 3 | 54.30 |
| | Samalbong | 3 | 46.30 |
| | Suruk | 4 | 53.70 |
| | Bhalukhop | 6 | 41.70 |
| | | | 51.20 |

| | | | |
|-----------------------------|-------------------|----|--------------|
| Kalimpong II | Santook | 2 | 18.60 |
| | Payong Dalapchand | 4 | 11.20 |
| | Sakyong, Pedong | 5 | 24.00 |
| | Menchu (Upper) | 10 | 22.90 |
| | Menchu (Lower) | 6 | 62.10 |
| | Lingsey | 5 | 27.20 |
| | Sangsey | 12 | 17.50 |
| | | | 26.20 |
| Kalimpong III Gorubathan | Alley Bich Gaon | 3 | 20.00 |
| | Gorubathan | 2 | 21.90 |
| | Dhukurey | 3 | 27.30 |
| | Amblok Dip Dara | 4 | 58.25 |
| | | | 31.90 |

This experiment was laid with 3 treatments, SAAF 0.2% with monocrotophos 0.25%, SAAF + *Trichoderma harzianum* and control during 2001-02. The results indicated that among the treatments, combination product of mancozeb and carbendazim (Companion) when applied with biocontrol agent gave better recovery after 3 months of storage (Table 84).

Table 84. Effect of different treatments on storage rot of ginger – Pundibari

| Treatment | Disease incidence(%) | Recovery (%) |
|--|----------------------|--------------|
| Companion (SAAF) + Monocrotophos | 21.7 | 77.6 |
| Companion (SAAF) + <i>T. harzianum</i> | 16.8 | 82.3 |
| Control | 28.6 | 68.4 |

Kumarganj

The experiment was started in 2001-02 with 7 treatments and 3 replications in RBD. The results of the experiment conducted in 2002-03 showed minimum rhizome rot disease (52%) was in rhizomes treated with hot water for 51° C for 10 minutes and *T. harzianum* mixed with neem cake (T6) over control (63.33%) yielding 33.03 q ha⁻¹ of fresh rhizomes over control (24.00 q ha⁻¹), showing 40.73% decrease in disease incidence and 27.09% increase in yield over control. This was followed 62.66% of disease incidence in rhizomes treated with T4 (seed treatment with *T. harzianum* for 30 minutes) yielding 23.31 q ha⁻¹ of fresh rhizomes. Two years pooled data analysis also showed T6 as the best treatment in controlling the disease resulting higher yield with better germination (Tables 85, 86 and 87).

Table 85. Effect of fungicides and biocontrol agent on germination - Kumarganj

| Treatment | Seed germination (%) | | | |
|--|----------------------|---------|--------|-------|
| | 2001-02 | 2002-03 | Total | Mean |
| T1- Seeds sown directly | 75.55 | 64.67 | 140.22 | 70.11 |
| T2-S.T. hot water 51 ⁰ C for 10 minutes | 88.88 | 69.33 | 140.22 | 70.11 |
| T3-S.T. Mancozeb (3 g l ⁻¹) for 30 minutes | 84.44 | 76.00 | 160.44 | 80.22 |
| T4-S.T. <i>T. harzianum</i> 100 g 5 l ⁻¹ for 30 minutes | 82.21 | 70.00 | 152.21 | 76.10 |
| T5-S.T. hot water 51 ⁰ C for 10 minutes + S.T. Mancozeb for 30 minutes | 82.22 | 74.67 | 156.89 | 78.44 |
| T6-S.T. hot water 51 ⁰ C for 10 minutes + S.T. <i>T. harzianum</i> mixed with neem cake | 93.33 | 76.67 | 170.00 | 85.00 |
| T7-Soil application of neem cake at the time of sowing | 88.86 | 66.67 | 155.53 | 77.76 |
| CD (5%) | 19.04 | 4.87 | | |
| CV % | 12.04 | 3.85 | | |

S. T. - Seed treatment

Table 86. Effect of fungicides and biocontrol agent on the incidence of rhizome rot disease - Kumarganj

| Treatment | Incidence of rhizome rot disease (%) | | | |
|---|--------------------------------------|---------|--------|-------|
| | 2001-02 | 2002-03 | Total | Mean |
| T1- Seeds sown directly | 75.55 | 64.67 | 140.22 | 70.11 |
| T1 - Seed sown directly | 66.66 | 71.33 | 137.99 | 68.99 |
| T2 - S.T. Hot water 51 ⁰ C (10 minutes) | 48.88 | 61.33 | 110.21 | 55.10 |
| T3 - S.T. Mancozeb (3 g l ⁻¹) (30 minutes) | 51.11 | 59.33 | 110.44 | 55.22 |
| T4 - S.T. - <i>T. harzianum</i> 100 g (30 minutes) | 48.88 | 62.67 | 111.55 | 55.77 |
| T5 - S.T. Hot water 51 ⁰ C (10 minutes) + S.T. Mancozeb S.T. (30 minutes) | 53.33 | 60.00 | 113.33 | 56.66 |
| T6 - S.T. Hot water 51 ⁰ C (10 minutes) + S.T. <i>T. harzianum</i> mixed with neem cake | 63.33 | 35.55 | 87.55 | 43.77 |
| T7 - S.A. neem cake at the time of sowing & planting | 48.88 | 63.33 | 112.21 | 56.10 |
| CD (5%) | 9.09 | 6.28 | | |
| CV % | 10.45 | 5.74 | | |

S T-Seed treatment, S.A - Soil Application

Table 87. Effect of fungicides and biocontrol agent on the yield - Kumarganj

| Treatment | Incidence of rhizome rot disease (%) | | | |
|--|--------------------------------------|---------|-------|--------|
| | 2001-02 | 2002-03 | Total | Mean |
| T1 - Seed sown directly | 45.37 | 23.47 | 68.84 | 34.42 |
| T2 - S.T. Hot water 51 ^o C (10 minutes) | 35.18 | 29.33 | 64.51 | 32.25 |
| T3 - S.T. Mancozeb (3 g l ⁻¹) (30 minutes) | 30.55 | 29.40 | 59.95 | 29.97 |
| T4 - S.T. - <i>T. harzianum</i> 100 g (30 minutes) | 59.25 | 23.31 | 82.56 | 41.28 |
| T5 - S.T. Hot water 51 ^o C (10 minutes) + S.T. Mancozeb S.T. (30 minutes) | 63.88 | 24.55 | 88.43 | 44.21 |
| T6 - S.T. Hot water 51 ^o C (10 minutes) + S.T. <i>T. harzianum</i> mixed with neem cake | 63.33 | 90.74 | 33.03 | 132.77 |
| T7 - S.A. neem cake at the time of sowing & planting | 63.88 | 24.00 | 87.88 | 43.94 |
| CD (5 %) | 16.02 | 3.09 | | |
| CV % | 14.10 | 6.50 | | |

S.T. - Seed treatment, S.A. - Soil Application

Pottangi

The experiment was started during

2002-03 with 4 treatments in an observational trial with the variety Suprabha. The data are presented in Table 88.

Table 88. Effect of different treatments on yield and disease incidence - Pottangi

| Treatment | Yield fresh rhizome (kg 3 m ² bed ⁻¹) | Disease incidence (%) |
|--|--|-----------------------|
| T1- <i>Trichoderma viridae</i> with pongamia oil cake (Seed treatment & soil application) | 5.60 | 13.0 |
| T2- <i>Trichoderma viridae</i> without pongamia oil cake (Seed treatment & soil application) | 4.80 | 19.0 |
| T3- Recommended fungicide | 6.40 | 7.0 |
| T4- Control | 3.70 | 31.0 |

Dholi

Report not received.

(Pundibari, Solan and Dholi)

*Pundibari***GIN/CP/1.4****Integrated management of *Pythium*, *Fusarium* and *Ralstonia***

The trial was started during this year and is in progress.

Solan

The experiment was started during 2001-02 with 6 treatments in RBD replicated 4 times. The treatments are as follows.

T1 - Mancozeb 0.3%

T2 - *Trichoderma harzianum*

T3 - Rhizome solarization for 45 minutes at 45°C

T4 - Hot water treatment at 45°C for 30 minutes

T5 - Copper oxychloride (Kocide) 0.3%

T6 - Control

It is evident from the data (Table 89) that all the treatments were effective in increasing sprouting and yield of ginger and decreasing the incidence of diseases. However, rhizome solarization for 45 minutes (11 am to 11.45 am) at 45°C was found superior to other treatments in increasing the sprouting (90%) and yield (8.831 kg 3 m² bed⁻¹) of ginger and decreasing the incidence of rhizome rot (3.13%). It was followed by seed treatment with mancozeb 0.3% which also increased the yield (5.87%) and decreased (20%) the incidence of the disease over control.

Table 89. Effect of seed treatment on sprouting, disease incidence and yield of ginger - Solan

| Treatment | Sprouting (%) | Disease incidence (%) | Yield (kg 3 m ² bed ⁻¹) | Increase/decrease in yield over control (%) |
|-----------|---------------|-----------------------|--|---|
| T1 | 89.00 (9.433) | 5.87 (2.422) | 6.938 | 30.14 |
| T2 | 86.00 (9.273) | 7.05 (2.654) | 5.325 | -0.11 |
| T3 | 90.00 (9.487) | 3.313 (1.764) | 8.831 | 65.65 |
| T4 | 85.00 (9.219) | 10.37 (3.219) | 6.194 | 16.19 |
| T5 | 85.25 (9.232) | 12.75 (3.571) | 6.438 | 20.77 |
| T6 | 83.75 (9.150) | 20.00 (4.472) | 5.331 | - |
| CD (5%) | 0.22 | 0.13 | 0.420 | |

Dholi

Data indicated that Metalaxyl mancozeb (200-300 ppm) as seed treatment

proved better in controlling the diseases and gave maximum yield of 4.50 t ha⁻¹ with less disease incidence (18.65%).

TURMERIC

TUR/CI/1 Genetic Resources

TUR/CI/1.1 Germplasm collection, characterization, evaluation and conservation

(Coimbatore, Jagtial, Dholi, Pottangi, Raigarh, Pundibari, Solan and Kumarganj)

Coimbatore

A total of 230 turmeric germplasm accessions consisting 224 indigenous and 6 exotic were evaluated in RBD during 2002-2003. These accessions showed wide variation in yield which ranged from 7.35 to 45.37 t ha⁻¹. The accession CL - 101 gave the highest yield of 45.37 t ha⁻¹ followed by CL - 147 (43.70 t ha⁻¹) while the lowest yield (7.35 t ha⁻¹) was observed in CL - 195. Six accessions CL - 154, CL - 26, CL - 169, CL - 48, CL - 47 and CL - 18 recorded an yield of more than 35 t ha⁻¹ which ranged from 35.70 to 40.30 t ha⁻¹. Eleven accessions registered an yield of more than 30 t ha⁻¹ and 25 accessions recorded an yield of more than 25 t ha⁻¹. The yield was less than 10 t ha⁻¹ in 19 accessions

Jagtial

At present, 189 genotypes are being maintained at RARS, Jagtial. Germplasm has been collected from Adilabad, Kovvuru, Chintapalle, Anantharajpeta. High variability was observed for growth and yield characters especially with respect to number of primary fingers, length of primary fingers, number of secondaries, length and diameter of mother rhizome, curing per cent and curcumin

content. Variability was also observed for reaction to rhizome rot and *Collectotrichum* and *Taphrina* leaf diseases.

During this year, Turmeric local and GS in long duration, CLI - 335, JTS - 308 in medium duration and JTS - 606 and Paderu local in short duration types were found promising.

Dholi

The programme was started in 1992. At present the center maintains 76 accessions. Out of these, 8 accessions RH - 16, RH - 50, RH - 9/90, RH - 24, RH - 14, RH - 13/90, RH - 80 and RH - 17 were found promising and selected for IET.

Pottangi

Out of 193 turmeric accessions, 179 were evaluated in two replications. Among these 155 were *Curcuma longa*, 20 were *Curcuma aromatica* and 4 were *Curcuma amada*. The range in fresh rhizome yield in *C. longa* varied from 1.80 kg to 15.0 kg 3 m² bed⁻¹ and forty accessions gave more than 10 kg 3 m² bed⁻¹.

In *Curcuma aromatica* the range in fresh rhizome yield varied from 3.0 kg to 11.1 kg 3 m² bed⁻¹ and five accessions gave more than 7.5 kg 3 m² bed⁻¹. Out of four *C. amada* types the range in yield was 6.1 kg to 11.4 kg 3 m² bed⁻¹.

Raigarh

Raigarh centre maintained 61 accessions. Among them IT - 1, IT - 2, IT - 3, IT - 4, IT - 5, IT - 6, IT - 7, IT - 8 and IT - 9 performed well with respect to yield.

Pundibari

The programme was started during 1998-99. During the year 42 accessions were added to the germplasm thus making the total to 125. Among the 74 accessions evaluated during the year, maximum rhizome yield (622 g plant⁻¹) was obtained in TCP - 2, followed by TCP - 11 (597 g plant⁻¹), TCP - 56 (558 g plant⁻¹) and TCP - 9 (546 g plant⁻¹)

Solan

The center evaluated 171 accessions of turmeric. The yield of ten best lines varied from 4.50 to 9.00 kg plot⁻¹. The maximum dry matter, essential oil, oleoresins and curcumin were recorded in SD - 691, PTS - 24, PTS - 24 and ST - 691, respectively.

Kumarganj

The center maintains 102 accessions and evaluated. Maximum fresh rhizome yield was obtained in NDH - 18 (500.00 q ha⁻¹), followed by 483.44 q ha⁻¹ in NDH - 14 and Rajendra Sonia (470.55 q ha⁻¹). The reaction of germplasm to leaf blotch and leaf spot diseases is given in Tables 90 & 91.

Table 90. Incidence of leaf blotch and leaf spot diseases in turmeric germplasm (2002-03) - Kumarganj

| Genotype | Incidence (PDI) | |
|----------|-----------------|-----------|
| | Leaf blotch | Leaf spot |
| NDH - 1 | 0.00 | 10.49 |
| NDH - 3 | 0.00 | 21.60 |
| NDH - 8 | 0.00 | 15.12 |
| NDH - 27 | 0.00 | 43.20 |
| NDH - 40 | 0.00 | 43.21 |
| NDH - 47 | 0.00 | 29.63 |
| NDH - 53 | 0.00 | 22.83 |
| NDH - 56 | 16.66 | 0.00 |
| NDH - 68 | 0.00 | 22.22 |
| NDH - 69 | 0.00 | 20.99 |
| NDH - 70 | 0.00 | 19.75 |
| NDH - 77 | 0.00 | 23.45 |
| NDH - 80 | 0.00 | 20.98 |
| NDH - 81 | 0.00 | 20.37 |
| NDH - 85 | 0.00 | 20.98 |
| NDH - 86 | 0.00 | 37.03 |
| NDH - 87 | 0.00 | 41.97 |
| NDH - 88 | 0.00 | 24.69 |
| NDH - 93 | 0.00 | 18.51 |
| NDH - 94 | 0.00 | 18.51 |

The pooled data for 3 years showed that higher yield was obtained in NDH - 18

(533.71 q ha⁻¹), followed by NDH - 14 (519.48 q ha⁻¹) (Table 91).

Table 91. Yield of promising turmeric germplasm (2000-01 to 2002-03) - Kumarganj

| Genotype | Yield (q ha ⁻¹) | | | Mean |
|----------|-----------------------------|---------|---------|--------|
| | 2000-01 | 2001-02 | 2002-03 | |
| NDH - 1 | 248.44 | 472.22 | 305.55 | 342.07 |
| NDH - 9 | 305.55 | 565.55 | 338.89 | 403.33 |
| NDH - 10 | 325.55 | 557.22 | 305.55 | 396.11 |
| NDH - 11 | 321.10 | 550.00 | 297.22 | 389.44 |
| NDH - 12 | 318.88 | 552.78 | 263.88 | 378.51 |
| NDH - 13 | 331.66 | 518.89 | 269.22 | 373.26 |
| NDH - 14 | 501.66 | 573.33 | 483.44 | 519.48 |
| NDH - 17 | 417.77 | 179.11 | 191.66 | 262.85 |
| NDH - 18 | 522.25 | 578.89 | 500.00 | 533.71 |
| CV (%) | | 14.49 | | |

TUR/CI/2 Coordinated Varietal Trial
TUR/CI/2.1 CVT 1996 Series IV
(Kumarganj)

Kumarganj

The trial was started in 1996 in RBD

with 9 genotypes. Three years pooled data (1996-97 to 1998-99) revealed that Rajendra Sonia (508.99 q ha⁻¹) out yielded the other entries in fresh rhizome yield, followed by Acc - 861 (465.61 q ha⁻¹) (Table 92).

Table 92. Performance of turmeric accessions (1996-97 to 1998-99) – Kumarganj

| Genotype | Yield (q ha ⁻¹) | | | |
|-----------|------------------------------|---------|---------|--------|
| | 1996-97 | 1997-98 | 1998-99 | Mean |
| PTS - 43 | 439.66 | 432.50 | 437.77 | 436.66 |
| PTS - 12 | 409.66 | 414.88 | 391.10 | 405.20 |
| PTS - 62 | 310.66 | 315.91 | 354.75 | 327.10 |
| JTS - 1 | 428.00 | 435.60 | 418.88 | 427.46 |
| JTS - 2 | 385.66 | 364.35 | 377.77 | 375.92 |
| Acc - 360 | 349.66 | 354.00 | 429.99 | 392.88 |
| Acc - 861 | 472.00 | 483.73 | 441.11 | 465.61 |
| R. Sonia | 483.00 | 500.65 | 543.33 | 508.99 |
| RH - 5 | 455.00 | 459.05 | 426.66 | 446.90 |

TUR/CI/2.2 CVT 2000 - Series V
(Pottangi, Dholi, Pundibari, Raigarh, Jagtial, Kumarganj, Coimbatore and Chintapalle)

Pottangi

The trial was started in 2000 in RBD

with 15 entries. Out 15 entries evaluated significant difference for fresh rhizome yield was recorded. Highest fresh rhizome yield was recorded in PTS - 11 (27.08 t ha⁻¹), followed by PTS - 52 (26.77 t ha⁻¹) and PTS - 55 (25.13 t ha⁻¹) (Table 93).

Table 93. Performance of turmeric accessions under CVT – Pottangi

| Cultivar | Fresh rhizome yield (kg/3 m ²) | | | | Projected yield (t ha ⁻¹) | Increase over check (%) |
|----------|--|---------|---------|-------|---------------------------------------|-------------------------|
| | 2000-01 | 2001-02 | 2002-03 | Mean | | |
| RH - 5 | 8.99 | 11.83 | 9.10 | 9.97 | 24.93 | 7.0 |
| PTS - 52 | 10.24 | 13.39 | 8.49 | 10.71 | 26.77 | 14.9 |
| PTS - 55 | 8.46 | 11.93 | 9.76 | 10.05 | 25.13 | 7.9 |

| | | | | | | |
|-----------|-------|-------|------|-------|-------|-------|
| PTS - 11 | 11.33 | 11.74 | 9.43 | 10.83 | 27.08 | 16.3 |
| PTS - 59 | 9.32 | 11.62 | 8.64 | 9.86 | 24.65 | 5.8 |
| NDH - 18 | 5.81 | 9.62 | 6.86 | 7.43 | 18.58 | - |
| TCP - 1 | 7.89 | 7.24 | 7.00 | 7.38 | 18.44 | - |
| TCP - 2 | 6.25 | 7.08 | 7.47 | 6.93 | 17.33 | - |
| Acc - 585 | 7.29 | 8.83 | 6.79 | 7.64 | 19.09 | - |
| Acc - 584 | 6.08 | 7.66 | 6.76 | 6.83 | 17.08 | - |
| Tu. No.1 | 7.10 | 12.78 | 8.36 | 9.41 | 23.53 | - |
| Surama | 9.21 | 11.69 | 8.44 | 9.78 | 24.45 | 1.0 |
| Roma | 8.13 | 11.15 | 8.67 | 9.32 | 23.29 | Check |
| PTS - 15 | 7.32 | 10.64 | 8.83 | 8.93 | 22.32 | - |
| PCT - 8 | 7.96 | 9.67 | 7.07 | 8.233 | 20.58 | - |
| CD (5%) | 1.96 | 1.99 | 1.34 | | | |

Chintapalle

The experiment started in 2000-01 was concluded in 2002-03. Field experiment was carried out under rainfed conditions at the RARS, Chintapalle. The trial was laid-out in RBD with three replications using fifteen varieties/selections viz., TCP - 1, TCP - 2, TCP - 11 (Pundibari, West Bengal), PTS - 55, TU No.1, PTS - 11, PTS - 15, PTS - 52, PTS - 59 (Pottangi), JTS - 1, JTS - 2 (Jagtial) Accs - 126, 585, (IISR, Calicut), NDH - 18 (Faizabad) and BSR - 1 (local check). The net

plot size was 3 m x 1m and a spacing of 30 cm x 15 cm was adopted. Observations on plant height, number of tillers per plant, number of leaves per plant, leaf length, leaf breadth and yield attributes were recorded.

The data on the performance of the varieties with respect yield are presented in Table 94. Variation in fresh yield rhizomes was noticed among cultivars. Rhizome weight per clump ranged from 162 g to 247 g and the higher rhizome weight/clump was recorded in NDH - 18 (247 g) followed by PTS - 52 (217 g).

Table 94. Performance of turmeric accessions under CVT (2000-01 to 2002-03) – Chintapalle

| Variety | Rhizome weight/clump (g) | | | | Fresh rhizome yield (t ha ⁻¹) | | | | BC Ratio |
|----------|--------------------------|---------|---------|-------|---|---------|---------|------|----------|
| | 2000-01 | 2001-02 | 2002-03 | Mean | 2000-01 | 2001-02 | 2002-03 | Mean | |
| NDH - 18 | 119.6 | 466.6 | 155.3 | 247.1 | 23.0 | 14.7 | 10.0 | 15.9 | 1:1.1 |
| BSR - 1 | 150.0 | 280.0 | 156.6 | 195.5 | 25.0 | 17.1 | 10.0 | 17.3 | 1:1.3 |
| PTS - 59 | 152.0 | 200.0 | 138.0 | 163.3 | 14.5 | 12.7 | 17.4 | 14.8 | 1:1.0 |

| | | | | | | | | | |
|----------|-------|-------|-------|-------|------|------|------|------|------|
| PTS - 55 | 138.0 | 186.6 | 163.3 | 162.6 | 13.2 | 18.5 | 21.0 | 17.5 | 1.13 |
| PTS - 11 | 119.3 | 386.6 | 113.3 | 206.3 | 12.6 | 24.8 | 14.9 | 17.4 | 1.13 |
| PTS - 15 | 125.3 | 200.0 | 182.6 | 169.3 | 11.5 | 14.5 | 14.2 | 13.4 | 1.08 |
| TU - 1 | 114.0 | 280.0 | 210.0 | 201.3 | 12.0 | 18.6 | 15.5 | 15.6 | 1.1 |
| PTS - 52 | 114.0 | 340.0 | 197.6 | 217.2 | 12.5 | 15.8 | 10.3 | 12.8 | 1.07 |
| TCP - 2 | 108.0 | 326.6 | 137.3 | 190.6 | 12.5 | 9.2 | 12.6 | 11.4 | 1.05 |
| TCP - 1 | 119.3 | 240.0 | 151.6 | 170.2 | 9.2 | 4.6 | 12.0 | 8.6 | 1.01 |
| CD (5%) | 33.6 | 103.4 | 73.5 | 70.1 | 3.4 | 6.4 | 4.7 | 4.8 | |

Jagtial

During the year 2002-2003, out of fifteen cultures tested RH - 5 gave more fresh

rhizome yield (34.50 t ha^{-1}) followed by PTS

- 52 (24.10 t ha^{-1}) in comparison to check variety Duggirala (21.70 t ha^{-1}) (Table 95).

Table 95. Performance of turmeric accessions under CVT - Jagtial

| Genotype | Fresh rhizome yield (kg/3m^2) | Fresh rhizome yield (t ha^{-1}) | Cured yield (t ha^{-1}) | Curing (%) |
|---------------|--|--|------------------------------------|------------|
| TCP - 1 | 5.6 | 18.60 | 3.34 | 18.0 |
| TCP - 2 | 6.3 | 20.90 | 3.76 | 18.0 |
| Acc - 584 | 2.6 | 8.60 | 1.54 | 20.0 |
| PTS - 59 | 5.3 | 17.80 | 3.56 | 26.0 |
| PTS - 11 | 2.2 | 7.40 | 1.48 | 20.0 |
| PTS - 55 | 2.2 | 7.40 | 1.95 | 26.0 |
| PTS - 52 | 7.2 | 24.10 | 4.85 | 20.2 |
| Acc - 593 | 2.1 | 7.00 | 1.36 | 18.4 |
| Acc - 585 | 2.3 | 7.50 | 1.50 | 20.1 |
| Acc - 657 | 2.8 | 9.30 | 1.68 | 18.1 |
| RH - 5 | 10.3 | 34.50 | 8.97 | 26.0 |
| PTS - 15 | 3.1 | 10.40 | 1.87 | 18.0 |
| NDH - 18 | 6.6 | 22.00 | 5.30 | 20.0 |
| TCP - 11 | 1.6 | 5.40 | 1.03 | 12.0 |
| Duggirala Red | 6.5 | 21.70 | 6.90 | 32.0 |
| CD (5%) | | 3.60 | | |
| CV % | | 14.48 | | |

Raigarh

The trial was started with fifteen entries including three entries as local checks during 2002. The result showed that TCP - 1 (41.4 t ha⁻¹) of Pundibari was found to be significantly superior to the rest of the entries with respect to yield (Table 96).

Table 96. Performance of turmeric accessions under CVT – Raigarh

| Genotype | Mean yield | Converted yield (t ha ⁻¹) | | Mean |
|-----------|---|--|---------|-------|
| | (kg 3 m ² plot ⁻¹) | 2002-03 | 2001-02 | |
| TCP - 2 | 17.3 | 34.87 | 38.1 | 36.84 |
| TCP - 1 | 20.6 | 41.40 | 32.8 | 37.10 |
| PTS - 55 | 3.1 | 6.20 | 8.2 | 7.20 |
| TU - 11 | 5.5 | 11.00 | 10.5 | 10.75 |
| PTS - 15 | 1.8 | 3.70 | 7.1 | 5.40 |
| PTS - 11 | 3.3 | 6.70 | 10.4 | 8.55 |
| PTS - 52 | 3.3 | 6.60 | 10.4 | 8.50 |
| PTS - 59 | 1.5 | 3.40 | 7.7 | 5.55 |
| RH - 5 | 10.1 | 20.30 | 21.1 | 20.90 |
| Acc - 593 | 2.9 | 5.80 | 5.0 | 5.40 |
| Acc - 584 | 4.2 | 8.50 | 6.5 | 7.50 |
| Acc - 585 | 5.1 | 10.30 | 9.5 | 9.90 |
| IT - 01-1 | 13.3 | 26.70 | 39.2 | 32.95 |
| IT - 01-2 | 8.0 | 16.00 | 36.8 | 26.40 |
| IT - 01-5 | 7.2 | 14.40 | 35.5 | 24.95 |

X=14.39, CD=2.89, CV%=9.37

Pundibari

The trial started during 2000-01 with 15 entries was continued during 2001-02 and 2002-03.

The results showed that TCP - 2 recorded highest yield (11.35 kg 3 m² bed⁻¹) followed by TCP - 11, TCP - 1 and RH - 5 (10.62 kg, 9.60 kg and 8.90 kg, respectively). Lowest yield was recorded in Acc - 585 (4.50 kg) followed by Acc - 584 (4.78 kg).

TCP - 2 also had highest weight of primary fingers, length of primary fingers, number of secondary fingers, weight of secondary fingers and length of secondary fingers which might have contributed towards higher rhizome yield.

Highest rhizome yield was obtained in TCP - 2 (28.38 t ha⁻¹) followed by TCP - 11 (26.56 t ha⁻¹), TCP - 1 (24 t ha⁻¹) and RH - 5 (22.25 t ha⁻¹). Lowest yield was recorded in Acc - 585 (11.25 t ha⁻¹) and Acc - 584 (11.96 t ha⁻¹) (Table 97).

Table 97. Performance of turmeric accessions under CVT - Pundibari

| Genotype | Yield (kg/ plot) | Weight of mother clump (g) | Length of mother (cm) | No of mother clump ¹ | No of primary fingers | Weight of primary fingers (g) | Length of primary fingers (cm) | No of secondary fingers | Weight of secondary fingers(g) | Length of secondary fingers (cm) | Weight of clump(g) (t/ha) | Projected yield (t/ha) | Increase over check (%) |
|-----------|------------------------|----------------------------------|-----------------------------|---------------------------------------|-----------------------------|-------------------------------------|--------------------------------------|-------------------------------|--------------------------------------|--|---------------------------------|------------------------------|-------------------------------|
| PTS - 11 | 6.30 | 76.27 | 7.29 | 1.00 | 5.60 | 57.00 | 5.52 | 4.23 | 16.68 | 3.67 | 208.12 | 15.75 | 10.52 |
| PTS - 15 | 6.03 | 73.80 | 7.96 | 1.40 | 5.63 | 42.27 | 5.31 | 4.25 | 15.20 | 4.08 | 188.98 | 15.08 | 5.78 |
| PTS - 52 | 6.15 | 70.13 | 7.31 | 1.00 | 5.86 | 52.53 | 4.93 | 4.06 | 6.98 | 2.41 | 191.90 | 15.37 | 7.89 |
| PTS - 55 | 6.98 | 85.47 | 8.15 | 1.20 | 7.27 | 93.27 | 6.38 | 5.10 | 18.63 | 2.85 | 241.90 | 17.47 | 22.45 |
| PTS - 59 | 5.60 | 72.38 | 7.50 | 1.00 | 7.17 | 76.89 | 6.32 | 5.00 | 12.77 | 3.29 | 172.39 | 14.00 | - |
| Acc - 584 | 4.78 | 65.95 | 7.11 | 1.14 | 6.00 | 45.80 | 5.08 | 5.85 | 14.30 | 4.39 | 135.34 | 11.96 | - |
| Acc - 585 | 4.50 | 63.20 | 6.90 | 1.00 | 6.13 | 80.28 | 5.42 | 7.20 | 25.80 | 2.68 | 167.85 | 11.25 | - |
| TCP - 1 | 9.60 | 36.76 | 6.51 | 1.07 | 6.47 | 96.95 | 6.29 | 10.60 | 99.47 | 5.46 | 235.67 | 24.00 | 68.42 |
| TCP - 2 | 11.35 | 41.90 | 6.91 | 1.54 | 6.67 | 108.59 | 7.40 | 13.71 | 105.73 | 5.90 | 283.36 | 28.38 | 99.12 |
| TCP - 11 | 10.62 | 36.43 | 6.94 | 1.27 | 6.55 | 80.93 | 6.12 | 8.48 | 64.09 | 4.59 | 218.77 | 26.56 | 86.31 |
| TU - 1 | 6.27 | 68.16 | 7.10 | 1.00 | 6.70 | 77.47 | 4.55 | 4.53 | 18.97 | 3.00 | 168.35 | 15.63 | 10.00 |
| RH - 5 | 8.90 | 38.37 | 7.41 | 1.20 | 6.20 | 88.50 | 5.68 | 6.87 | 48.18 | 5.44 | 209.83 | 22.25 | 56.14 |
| Pt. abha | 6.13 | 69.00 | 7.22 | 1.00 | 6.67 | 84.65 | 4.75 | 7.21 | 23.40 | 3.48 | 200.86 | 15.33 | 7.54 |
| Pt. tibha | 6.52 | 77.48 | 7.49 | 1.07 | 6.73 | 70.53 | 4.84 | 5.67 | 25.47 | 3.32 | 202.53 | 16.29 | 14.39 |
| Acc - 126 | 5.70 | 67.88 | 6.50 | 1.27 | 6.93 | 77.43 | 4.85 | 4.43 | 18.48 | 2.82 | 189.56 | 14.25 | - |
| CD (5%) | 1.44 | 10.37 | NS | 0.21 | NS | 14.64 | 0.66 | 1.43 | 8.60 | 0.61 | 29.35 | 3.60 | |

Dholi

The project was started during 2000-01 and continued for 3 years (2002-03). The pooled data indicated that there was significant difference among the genotypes in respect of plant height. The maximum plant height was recorded in Acc - 657 (119.67 cm) followed by Acc - 585 (118.98 cm). However, there was non-significant difference among the genotypes in respect of the number of tillers per plant. Genotypes also had significant differences in maturity. Acc - 657 and Acc - 585 took longer period (262.00 and 237.89 days, respectively). RH

- 5 produced 12.91% higher fresh rhizomes over the check with a cost benefit ratio of 1:4.98.

Kumarganj

The trial was initiated in 2000 with 16 genotypes in RBD. Maximum fresh rhizome yield was obtained in NDH - 18 (483.32 q ha⁻¹) followed by NDH - 14 (470.00 q ha⁻¹) and RH - 5 (400.00 q ha⁻¹). The pooled data (2000-2003) showed that NDH - 18 was superior, producing maximum fresh rhizome yield of 419.81 q ha⁻¹ over the check R. Sonia (410.76 q ha⁻¹) and other entries (Table 98).

Table 98. Performance of turmeric accessions under CVT – Kumarganj

| Genotype | Yield (q ha ⁻¹) | | | |
|------------------|-----------------------------|---------|---------|--------|
| | 2000-01 | 2001-02 | 2002-03 | Mean |
| TCP - 1 | 418.77 | 130.56 | 143.33 | 244.22 |
| TCP - 2 | 435.55 | 242.78 | 246.66 | 308.33 |
| Acc - 585 | 459.90 | 134.22 | 311.11 | 301.74 |
| Acc - 584 | 21.75 | 22.22 | 19.44 | 21.13 |
| Acc - 593 | 433.33 | 200.00 | 294.22 | 309.18 |
| Acc - 657 | 401.10 | 207.78 | 327.78 | 312.22 |
| PTS - 55 | 401.22 | 169.44 | 244.44 | 271.70 |
| TU - 1 | 383.33 | 157.68 | 285.55 | 275.52 |
| PTS - 15 | 416.66 | 221.78 | 272.22 | 307.22 |
| PTS - 59 | 419.99 | 207.78 | 224.44 | 284.04 |
| PTS - 11 | 411.10 | 190.00 | 255.55 | 285.55 |
| PTS - 52 | 412.21 | 208.33 | 248.89 | 289.81 |
| RH - 5 | 408.88 | 245.56 | 400.00 | 351.48 |
| NDH - 18 | 510.55 | 265.56 | 483.33 | 419.81 |
| R. Sonia (check) | 498.95 | 253.33 | 480.00 | 410.76 |
| CD (5%) | 27.76 | 9.32 | 60.45 | |
| CV% | | 20.14 | 12.42 | |

Coimbatore

Report not received

**TUR/CI/3 Varietal Evaluation Trial
TUR/CI/3.1 Comparative yield trial (CYT)
(1999-2000)***(Pottangi, Dholi, Pundibari, Jagtial and Raigarh)**Jagtial*

Out of seven long duration varieties tested during 2002-2003, JTS - 12 gave higher fresh rhizome yield (31.2 t ha⁻¹) followed by JTS - 15 (29.7 t ha⁻¹) in comparison to check Duggirala Red (29.0 t ha⁻¹) (Table 99).

Table 99. Performance of turmeric accessions under CVT – Jagtial

| Genotype | Fresh rhizome yield (kg 3 m ² bed ⁻¹) | Fresh rhizome yield (t ha ⁻¹) | Cured yield (t ha ⁻¹) | Curing (%) |
|---------------|---|--|--------------------------------------|---------------|
| JTS - 10 | 7.3 | 24.30 | 5.83 | 24.0 |
| JTS - 11 | 8.2 | 27.50 | 4.40 | 16.0 |
| JTS - 12 | 9.3 | 31.20 | 6.24 | 20.0 |
| JTS - 13 | 6.3 | 21.00 | 5.04 | 24.0 |
| JTS - 14 | 8.4 | 28.20 | 5.64 | 20.0 |
| JTS - 15 | 8.9 | 29.70 | 5.94 | 20.0 |
| Duggirala Red | 8.7 | 29.00 | 6.38 | 22.0 |
| SE | | 3.07 | | |
| CD (5%) | | 6.69 | | |
| CV% | | 13.80 | | |

During the year 2002-2003 out of 14 mid duration varieties tested, JTS - 319 gave more fresh rhizome yield (26.7 t ha⁻¹) followed by JTS - 316 (26.6 t ha⁻¹) compared to check variety CLI - 317 (19.9 t ha⁻¹). Out of seven short duration varieties tested during 2002-2003, JTS - 607 gave higher fresh rhizome yield (26.5 t ha⁻¹) followed by JTS - 612 (25.3 t ha⁻¹) and JTS - 609 (24.6 t ha⁻¹) and the check variety, PCT - 13 recording maximum fresh rhizome yield 27.3 t ha⁻¹.

Dholi

The trial was started in 2001-02 with 8 genotypes. During 2002-03, highest yield

was recorded in RH - 5 (46.64 t ha⁻¹) with early maturity (198 days).

Pundibari

The experiment could not be conducted during 2002-2003 due to non receipt of the seed materials.

Pottangi

Out of 8 entries evaluated, significant difference for rhizome yield was recorded. The pooled data (2000-01 to 2002-03) indicated that highest rhizomes yield was recorded in PTS - 39 (24.93 t ha⁻¹) followed by PTS - 50 (23.83 t ha⁻¹) (Table 100).

Table 100. Performance of turmeric accessions under CYT - Pottangi

| Cultivar | Fresh rhizome yield (kg 3 m ² bed ⁻¹) | | | | Projected yield (t ha ⁻¹) | Increase over check (%) |
|--------------|--|---------|---------|------|---------------------------------------|-------------------------|
| | 2000-01 | 2001-02 | 2002-03 | Mean | | |
| PTS - 51 | 7.26 | 11.07 | 7.86 | 8.73 | 21.83 | - |
| PTS - 50 | 8.43 | 11.09 | 9.08 | 9.53 | 23.83 | 8.9 |
| Tu.No.6 | 6.24 | 11.81 | 8.16 | 8.74 | 21.84 | - |
| PTS - 34 | 8.91 | 11.38 | 8.09 | 9.46 | 23.65 | 8.1 |
| PTS - 39 | 8.67 | 11.27 | 9.97 | 9.97 | 24.93 | 13.9 |
| PTS - 4 | 6.88 | 10.47 | 9.65 | 9.00 | 22.50 | 2.9 |
| PTS - 16 | 6.57 | 9.72 | 8.72 | 8.34 | 20.84 | - |
| Roma (check) | 7.92 | 10.10 | 8.22 | 8.75 | 21.87 | |
| C.D. (0.05) | NS | NS | 1.01 | | | |

Raigarh

The experiment was laid out with five entries along with five local checks during

2002. The local check, IT - 01-1 (31.85 t ha⁻¹) was found significantly superior to the rest of the entries with respect to yield (Table 101).

Table 101. Performance of turmeric accessions under CYT - Raigarh

| Genotype | Mean | Converted | Converted | Converted | Converted | Mean |
|-----------|---|--|--|--|--|-------|
| | yield (kg 3 m ² plot ⁻¹) | yield (t ha ⁻¹) 2002-03 | yield (t ha ⁻¹) 2001-02 | yield (t ha ⁻¹) 2000-01 | yield (t ha ⁻¹) 1999-00 | |
| Prabha | 6.70 | 13.4 | 12.30 | 12.3 | 23.6 | 15.40 |
| Pratibha | 5.80 | 11.6 | 20.10 | 11.3 | 22.1 | 16.27 |
| Acc - 584 | 4.30 | 8.6 | 6.50 | 10.6 | 22.0 | 11.92 |
| Acc - 126 | 3.30 | 6.7 | 6.10 | 11.2 | 20.6 | 11.07 |
| Acc - 585 | 5.10 | 10.0 | 12.10 | 12.7 | 20.4 | 13.80 |
| IT - 01-1 | 12.20 | 24.5 | 39.20 | - | - | 31.85 |
| IT - 01-2 | 8.00 | 16.0 | 36.80 | - | - | 26.40 |
| IT - 01-3 | 8.70 | 17.4 | 34.40 | - | - | 25.90 |
| IT - 01-4 | 7.60 | 15.2 | 32.30 | - | - | 23.75 |
| IT - 01-5 | 6.80 | 13.6 | 35.40 | - | - | 24.50 |
| CD (5%) | 2.98 | | | | | |
| CV% | 12.74 | | | | | |

TUR/CI/3.2 Initial Evaluation Trial (IET)

(Pottangi and Solan)

Pottangi

The pooled data revealed that out of total 15 entries evaluated for the last three

years (2000-01 to 2002-03), highest fresh rhizomes yield was recorded by PTS - 39 (26.62 t ha⁻¹) followed by Tu.No.3 (25.14 t ha⁻¹) and PTS - 34 (24.73 t ha⁻¹) (Table 102).

Table 102. Performance of turmeric accessions under IET (2000-01 to 2002-03) – Pottangi

| Cultivar | Fresh rhizome yield (kg 3 m ²) | | | | Projected yield (t ha ⁻¹) | Increase over check (%) |
|--------------|--|---------|---------|-------|---------------------------------------|-------------------------|
| | 2000-01 | 2001-02 | 2002-03 | Mean | | |
| PTS - 39 | 9.43 | 12.8 | 9.71 | 10.65 | 26.62 | 28.8 |
| Tu.No.6 | 6.46 | 9.95 | 7.39 | 7.93 | 19.83 | - |
| PTS - 51 | 7.21 | 11.29 | 6.61 | 8.37 | 20.93 | 1.3 |
| PTS - 29 | 6.59 | 9.60 | 7.73 | 7.97 | 19.93 | - |
| PTS - 50 | 8.21 | 8.27 | 7.62 | 8.03 | 20.08 | - |
| Tu.No.3 | 10.61 | 8.51 | 11.05 | 10.06 | 25.14 | 21.6 |
| Alleppey | 6.11 | 9.95 | 7.08 | 7.71 | 19.28 | - |
| PTS - 13 | 7.21 | 11.58 | 8.50 | 9.10 | 22.74 | 10.0 |
| PTS - 47 | 6.13 | 12.89 | 10.12 | 9.71 | 24.28 | 17.5 |
| PTS - 27 | 5.84 | 7.59 | 5.57 | 6.33 | 15.83 | - |
| PTS - 4 | 7.32 | 10.93 | 7.77 | 8.67 | 21.68 | 4.9 |
| PTS - 16 | 6.75 | 8.24 | 7.37 | 7.45 | 18.63 | - |
| PTS - 34 | 9.93 | 11.50 | 8.25 | 9.89 | 24.73 | 19.6 |
| Ranga | 9.12 | 8.51 | 7.97 | 8.53 | 21.33 | 3.2 |
| Roma (check) | 8.21 | 10.01 | 6.58 | 8.27 | 20.67 | |
| CD (5%) | 2.42 | 2.30 | 1.39 | | | |

Solan

The trial was started in 2002 in RBD with 16 genotypes. The collections showed significant differences for yield. However, only five collections registered higher yield over the check (Armoor). It was maximum in Cls - 29 followed by DKG - 26, BDJR - 1244 and PTS - 24. The yield was minimum in ST - 760 (Table 103).

Table 103. Performance of turmeric accessions under IET – Solan

| Genotype | Yield | | Increase /decrease over check (%) |
|----------------|-----------------------|--------------------|-----------------------------------|
| | kg plot ⁻¹ | t ha ⁻¹ | |
| ST - 365 | 6.39 | 12.84 | 24.08 |
| BDJR - 1244 | 6.13 | 12.32 | 19.03 |
| Cls - 29 | 6.83 | 13.72 | 32.62 |
| ST - 760 | 4.50 | 7.03 | -32.04 |
| ST - 54 M | 5.04 | 10.13 | -2.14 |
| ST - 645 | 4.92 | 9.88 | -4.47 |
| PTS - 24 | 6.06 | 12.18 | 17.64 |
| T.No 262 | 4.36 | 8.76 | -15.34 |
| BDJR - 1272 | 4.81 | 9.67 | -6.60 |
| PCT - 2 | 4.92 | 9.89 | -4.47 |
| T.No 138 | 4.02 | 8.08 | -21.94 |
| ST - 693 | 4.53 | 9.10 | -12.04 |
| ST - 616 | 4.54 | 9.12 | -11.84 |
| ST - 323 | 4.81 | 9.67 | -6.60 |
| DKH - 26 | 6.01 | 12.01 | 22.64 |
| Armoor (check) | 5.15 | 10.35 | - |
| Mean | 5.19 | 10.43 | |
| CD (5%) | 1.70 | | |

TUR/CI/4 Quality Evaluation Trial
TUR/CI/4.1 Quality Evaluation of
germplasm

(Solan and Coimbatore)

Solan

During 2002-03, out of 171 accessions of turmeric, 144 were evaluated for quality

parameters viz, dry matter, essential oil, oleoresin and curcumin content. Among these, 52 were good, 62 were average and 30 accessions were poor in curcumin. In these accessions, dry matter content varied from 14.00 to 21.25%. The oleoresin and essential oil ranged between 5.82 to 17.00 and 2.00 to 8.00 %, respectively (Table 104).

Table 104. Quality traits of promising turmeric germplasm – Solan

| Genotype | Dry matter (%) | E. oil (%) | Oleoresin (%) | Curcumin (%) |
|-------------|-------------------|---------------|------------------|-----------------|
| Acc - 360 | 18.00 | 5.25 | 13.43 | 3.05 |
| R. Sonia | 19.20 | 5.00 | 12.63 | 3.00 |
| JTS - 2 | 16.50 | 6.50 | 14.02 | 3.79 |
| BSR - 3 | 16.00 | 5.00 | 10.40 | 3.00 |
| BDJR - 1242 | 17.00 | 4.50 | 10.29 | 3.45 |
| PCT - 1 | 21.40 | 6.50 | 15.17 | 3.37 |
| BDJR - 1025 | 16.50 | 5.00 | 10.52 | 3.05 |
| BDJR - 1244 | 15.60 | 5.50 | 16.50 | 3.37 |
| PTS - 38 | 18.50 | 4.50 | 11.00 | 3.39 |
| PTS - 53 | 17.50 | 4.50 | 12.50 | 3.77 |
| BDJR - 1133 | 16.50 | 3.50 | 8.41 | 4.29 |
| PCT - 1 | 15.80 | 3.25 | 9.50 | 3.00 |
| C.L Puram | 22.10 | 6.50 | 14.86 | 3.33 |
| T.No.323 | 18.10 | 5.00 | 17.53 | 4.04 |
| Ammamigada | 20.00 | 5.23 | 12.92 | 4.00 |
| Sugandham | 18.40 | 4.50 | 10.35 | 3.00 |
| BDJR - 1055 | 16.50 | 4.00 | 10.29 | 3.50 |
| TC - 2 | 16.80 | 5.50 | 11.50 | 3.00 |
| ST - 691 | 20.60 | 4.00 | 9.59 | 3.50 |
| ST - 85 | 18.20 | 5.50 | 10.35 | 3.00 |
| Armoor | 15.87 | 4.00 | 9.30 | 2.98 |
| BSR - 2 | 15.00 | 3.99 | 9.00 | 3.00 |
| Thabyama | 15.00 | 5.00 | 9.58 | 3.98 |
| BDJR - 1235 | 15.50 | 5.00 | 9.47 | 3.37 |
| CIS - 24 | 17.20 | 4.00 | 10.80 | 3.06 |

| | | | | |
|-----------------|-------|------|-------|------|
| BDJR - 1182 | 18.00 | 5.50 | 10.80 | 2.99 |
| PTS - 7 | 16.00 | 4.50 | 10.10 | 3.79 |
| Alleppey finger | 16.00 | 5.00 | 11.42 | 4.58 |
| BDJR - 1260 | 16.50 | 7.50 | 14.78 | 4.93 |
| CLS - 21 | 20.00 | 5.00 | 9.90 | 3.74 |
| BDJR - 1292 | 19.90 | 7.00 | 11.96 | 3.81 |
| No. 2A | 18.80 | 5.00 | 10.46 | 3.23 |
| BDJR - 1035 | 19.20 | 6.75 | 12.00 | 4.29 |
| BDJR - 1125 | 18.20 | 5.25 | 10.37 | 3.30 |
| BDJR - 1151 | 19.00 | 5.00 | 9.46 | 3.17 |
| CLS - 22 | 21.25 | 7.00 | 10.45 | 3.27 |
| BDJR - 1224 | 19.80 | 5.00 | 9.30 | 3.45 |
| BDJR - 1250 | 20.40 | 6.50 | 13.36 | 4.00 |
| BDJR - 1216 | 15.00 | 5.00 | 11.59 | 3.43 |
| BDJR - 1072 | 14.80 | 4.00 | 9.00 | 3.05 |
| ST - 29 M | 16.00 | 5.25 | 12.20 | 3.56 |
| ST - 43 | 16.83 | 5.19 | 10.37 | 3.98 |
| BDJR - 1172 | 16.10 | 5.00 | 10.57 | 3.00 |
| BDJR - 1082 | 16.70 | 6.12 | 10.95 | 3.50 |
| BDJR - 1116 | 15.20 | 5.00 | 11.35 | 3.00 |
| PTS - 16 | 16.90 | 5.50 | 10.95 | 3.50 |
| ST - 402 | 19.00 | 6.00 | 12.35 | 3.70 |
| BDJR - 1247 | 17.90 | 5.92 | 7.89 | 3.81 |
| ST - 44M | 18.50 | 7.00 | 11.57 | 3.06 |
| BDJR - 1280 | 19.50 | 5.50 | 9.81 | 3.00 |
| PCT - 13 | 16.50 | 5.00 | 10.00 | 3.77 |
| PCT - 14 | 17.90 | 4.95 | 9.83 | 3.09 |
| ST - 832 | 18.30 | 6.50 | 11.12 | 3.69 |
| BDJR - 1160 | 17.00 | 7.50 | 13.92 | 3.73 |

Coimbatore

The trial is in the fourth year of progress. The curcumin content of all the 230 accessions was analyzed and the results are presented in Table 105. Curcumin content of these accessions varied between 1.02 to 6.04%. The highest curcumin content of

6.04% was observed in CL - 67 followed by CL - 18 (6.00%) and CL - 147 (5.5%). The lowest curcumin content (1.02%) was recorded in CL - 87. Among the 230 accessions, 14 accessions recorded more than 5.0% curcumin and 111 accessions registered more than 4.0 % (Table 105).

Table 105. Curcumin content of turmeric accessions – Coimbatore

| Accession | Curcumin (%) |
|-----------|--------------|
| CL - 18 | 6.00 |
| CL - 26 | 5.05 |
| CL - 32 | 5.05 |
| CL - 34 | 3.41 |
| CL - 35 | 4.30 |
| CL - 39 | 3.98 |
| CL - 40 | 3.93 |
| CL - 58 | 4.23 |
| CL - 66 | 4.63 |
| CL - 72 | 4.50 |
| CL - 74 | 5.03 |
| CL - 75 | 3.73 |
| CL - 79 | 1.73 |
| CL - 80 | 5.05 |
| CL - 98 | 3.90 |
| CL - 106 | 3.99 |
| CL - 112 | 3.45 |
| CL - 114 | 4.07 |
| CL - 115 | 5.43 |
| CL - 119 | 5.03 |
| CL - 120 | 4.93 |

TUR/CI/4.2 Impact of environment on quality of turmeric*(Pottangi and Coimbatore)**Coimbatore*

A trial was laid out with five cultivars and one accession (Acc - 360) to assess the impact of environment on quality of turmeric. The results indicated that the Suguna recorded the highest yield of 39.69 t ha⁻¹ compared to 25.73 t ha⁻¹ in BSR - 2. The curing percentage ranged from 20.00 to 24.01%. The highest curing percentage was observed in JTS - 2 (24.01). The curcumin content was high in Acc - 360 (5.21%) (Table 106).

Table 106. Impact of environment on quality of turmeric - Coimbatore

| Accession | Yield | | Curing (%) | Curcumin (%) |
|----------------------|--------------------------|-----------------------|------------|--------------|
| | (kg plot ⁻¹) | (t ha ⁻¹) | | |
| 131 (Suguna) | 19.85 | 39.69 | 20.83 | 4.68 |
| 151 (Acc. 360) | 14.75 | 29.50 | 22.75 | 5.21 |
| 141 (Rajendra Sonia) | 8.98 | 17.95 | 22.89 | 4.01 |
| 140 (JTS - 2) | 12.23 | 24.46 | 24.01 | 4.67 |
| 2 (BSR - 2) | 12.87 | 25.73 | 21.70 | 4.58 |
| 133 (Roma) | 10.72 | 21.43 | 23.80 | 4.50 |
| CD (5%) | | 2.65 | | |

Pottangi

The trial was started in 1998-99. The trial was conducted in 2002-03 in RBD with 6 genotypes. Highest fresh yield was recorded in JTS - 2 (23.76 t ha⁻¹) with 14%

dry recovery followed by Rajendra Sonia (22.22 t ha⁻¹) with 14% dry recovery. Highest dry recovery was recorded in cultivar Roma (26%) followed by Acc - 360 (21%).(Table 107)

Table 107. Performance of turmeric cultivars (pooled data) - Pottangi

| Cultivar | Fresh rhizome yield (kg 3 m ² bed ⁻¹) | | | | | Mean | Projected yield (t ha ⁻¹) | Dry yield (t ha ⁻¹) |
|-----------|--|--------|--------|-------|-------|------|---------------------------------------|---------------------------------|
| | 98 -99 | 99 -00 | 00 -01 | 01-02 | 02-03 | | | |
| Roma | 8.76 | 5.50 | 9.50 | 11.29 | 8.15 | 8.64 | 21.60 | 5.62 |
| R.Sonia | 12.66 | 5.37 | 7.80 | 11.39 | 7.22 | 8.89 | 22.22 | 3.11 |
| Alleppey | 10.77 | 5.67 | 8.21 | 11.05 | 7.63 | 8.67 | 21.67 | 4.33 |
| JTS - 2 | 13.28 | 6.95 | 6.71 | 10.29 | 10.28 | 9.50 | 23.76 | 3.33 |
| Acc - 360 | 8.12 | 3.80 | 7.42 | 10.13 | 7.77 | 7.45 | 18.62 | 3.91 |
| BSR - 2 | 9.30 | 4.79 | 6.84 | 10.71 | 7.52 | 7.83 | 19.58 | 3.72 |
| CD (5 %) | NS | 2.38 | NS | NS | 0.89 | | | |

TUR/CM/1 Nutrient Management Trial**TUR/CM/1.1 Efficacy of biofertilizer using *Azospirillum* on turmeric**

(Coimbatore, Pottangi, Raigarh, Kumarganj, Solan, Pundibari and Ambalavayal)

Kumarganj

The trial was started in 2000-2001 with 7 treatments in RBD. Experimental results indicate that the treatment consisting of inorganic nitrogen 100% with *Azospirillum* 50 g and FYM 5 kg produced maximum yield of 375 q ha⁻¹ (Table 108).

Table 108. Effect of biofertilizer, *Azospirillum* on turmeric - Kumarganj

| Treatment | Plant height (cm) | No. of tillers clump ⁻¹ | Weight of fresh rhizome clump ⁻¹ (g) | Yield (q ha ⁻¹) |
|---|-------------------|------------------------------------|---|-----------------------------|
| T ₁ - Inorganic N 100% + <i>Azospirillum</i> 50 g + FYM 5 kg | 81.17 | 2.13 | 283.33 | 375.00 |
| T ₂ - Inorganic N 75% + <i>Azospirillum</i> 50 g + FYM 5 kg | 81.60 | 2.27 | 315.00 | 336.11 |
| T ₃ - Inorganic N 50% + <i>Azospirillum</i> 50 g + FYM 5 kg | 81.10 | 1.93 | 220.00 | 19.42 |
| T ₄ - FYM 5 kg + <i>Azospirillum</i> 50 g | 82.23 | 2.20 | 295.00 | 297.22 |
| T ₅ - FYM 5 kg alone | 86.23 | 2.13 | 328.33 | 322.00 |
| T ₆ - FYM 10 kg + <i>Azospirillum</i> 50 g | 85.30 | 2.13 | 256.67 | 341.66 |
| T ₇ - FYM 10 kg alone | 87.13 | 227.00 | 360.00 | 344.44 |
| CD (5%) | NS | 0.06 | 64.96 | 28.65 |
| CV% | 7.11 | 16.82 | 12.42 | 4.83 |

Pooled mean yield data of three years (t ha⁻¹) was in T1 (inorganic nitrogen 100 % + showed maximum fresh rhizome yield (422.59 *Azospirillum* 50 g + FYM 5 kg) (Table 109) .

Table 109. Effect of biofertilizer, *Azospirillum* on turmeric (pooled data) – Kumarganj

| Treatment | Yield (q ha ⁻¹) | | | |
|---|------------------------------|---------|---------|--------|
| | 2000-01 | 2001-02 | 2002-03 | Mean |
| T ₁ - Inorganic N 100% + <i>Azospirillum</i> 50 g + FYM 5 kg | 498.33 | 394.44 | 375.00 | 422.59 |
| T ₂ - Inorganic N 75% + <i>Azospirillum</i> 50 g + FYM 5 kg | 481.65 | 345.56 | 336.11 | 387.77 |
| T ₃ - Inorganic N 50% + <i>Azospirillum</i> 50 g + FYM 5 kg | 435.16 | 338.84 | 319.42 | 364.47 |
| T ₄ - FYM 5 kg + <i>Azospirillum</i> 50 g | 408.33 | 309.44 | 297.22 | 338.33 |
| T ₅ - FYM 5 kg alone | 376.66 | 353.89 | 322.00 | 350.85 |
| T ₆ - FYM 10 kg + <i>Azospirillum</i> 50 g | 416.66 | 357.22 | 341.66 | 371.84 |
| T ₇ - FYM 10 kg alone | 405.50 | 375.00 | 344.44 | 374.98 |
| CD (5%) | 24.60 | 42.36 | 28.65 | |
| CV % | | 6.35 | 4.83 | |

Solan

The trial was initiated during 2002 in RBD with 13 treatments. During 2002-03, non

significant differences for yield were observed. Only two treatments, T10 and T11 registered increase in yield over the control (Table 110).

Table 110. Effect of biofertilizer, *Azospirillum* on turmeric - Solan

| Treatment | Yield (kg plot ⁻¹) | Converted yield (t ha ⁻¹) | Increase/decrease over control (%) |
|--|--------------------------------|---------------------------------------|------------------------------------|
| T1 - N 100% + <i>Azospirillum</i> (soil application) + FYM (5 t ha ⁻¹) | 5.10 | 10.25 | -25.55 |
| T2 - N 75% + <i>Azospirillum</i> (soil application) + FYM (5 t ha ⁻¹) | 5.10 | 10.25 | -25.55 |
| T3 - N 50% + <i>Azospirillum</i> (soil application) + FYM (5 t ha ⁻¹) | 4.15 | 8.34 | -39.42 |
| T4 - FYM (5 t ha ⁻¹) + <i>Azospirillum</i> (soil application) | 4.80 | 9.65 | -29.93 |

| | | | |
|--|------|-------|--------|
| T5 - FYM (5 t ha ⁻¹) alone | 4.65 | 9.34 | -32.12 |
| T6 - FYM (10 t ha ⁻¹) + <i>Azospirillum</i> (soil application) | 5.50 | 11.05 | -19.71 |
| T7 - FYM (10 t ha ⁻¹) alone | 6.20 | 12.46 | -9.49 |
| T8 - N 100% + <i>Azospirillum</i> (seed application) + FYM (5 t ha ⁻¹) | 5.55 | 11.15 | -18.98 |
| T9 - N 75% + <i>Azospirillum</i> (seed application) + FYM (10 t ha ⁻¹) | 7.60 | 15.27 | 10.95 |
| T10 - N 50% + <i>Azospirillum</i> (seed application) + FYM (5 t ha ⁻¹) | 7.20 | 14.47 | 5.11 |
| T11 - FYM (5 t ha ⁻¹) + <i>Azospirillum</i> (seed application) | 7.30 | 14.67 | 6.57 |
| T12 - FYM (10 t ha ⁻¹) + <i>Azospirillum</i> (seed application) | 3.15 | 6.33 | -54.01 |
| T13 - NPK @ 100: 50: 50 kg ha ⁻¹ - control <i>Azospirillum</i> 5 kg ha ⁻¹ as seed and soil application. | 6.85 | 13.77 | - |
| Mean | 5.63 | 11.31 | |
| F test | NS | | |
| SEm ± | 0.34 | | |

Coimbatore

The trial was conducted with ten treatments and three replications in RBD to find out the effect of *Azospirillum* on growth and yield of turmeric. The results revealed that application of inorganic N 50% + *Azospirillum* 5 kg ha⁻¹ + FYM 5 t (T3) gave the highest yield

(29.94 t ha⁻¹) as against 20.01 t ha⁻¹ in the control (recommended dose of fertilizer, T10) which accounted for an increased yield of 49.63%. This was closely followed by T2 with an yield of 27.10 t ha⁻¹. The lowest yield (12.30 t ha⁻¹) was recorded in the treatment T8 (Table 111).

Table 111. Effect of biofertilizer, *Azospirillum* on turmeric - Coimbatore

| Treatment | Plant height (cm) | No. of tillers plant ⁻¹ | Weight of mother rhizome (g) | Yield | |
|---|-------------------|------------------------------------|------------------------------|-----------------------|--------------------|
| | | | | kg plot ⁻¹ | t ha ⁻¹ |
| T1 - Inorganic N 100% + <i>Azospirillum</i> 5 kg ha ⁻¹ SA + FYM 5 t ha ⁻¹ | 31.5 | 2.7 | 71.4 | 12.60 | 25.19 |
| T2 - Inorganic N 75% + <i>Azospirillum</i> 5 kg ha ⁻¹ SA + FYM 5 t ha ⁻¹ | 31.6 | 3.0 | 86.6 | 13.55 | 27.10 |
| T3 - Inorganic N 50% + <i>Azospirillum</i> 5 kg ha ⁻¹ SA + FYM 5 t ha ⁻¹ | 32.3 | 3.0 | 118.2 | 14.97 | 29.94 |

| | | | | | |
|---|------|-----|------|-------|-------|
| T4 - FYM 5 t ha ⁻¹ + <i>Azospirillum</i> | | | | | |
| 5 kg ha ⁻¹ SA | 30.0 | 2.3 | 71.4 | 8.35 | 16.70 |
| T5 - FYM 5 t ha ⁻¹ alone | 30.4 | 2.7 | 62.5 | 7.95 | 15.90 |
| T6 - FYM 10 t ha ⁻¹ + <i>Azospirillum</i> | | | | | |
| 5 kg ha ⁻¹ SA | 30.1 | 1.7 | 71.6 | 9.25 | 18.50 |
| T7 - FYM 10 t ha ⁻¹ alone | 29.4 | 1.7 | 62.7 | 8.05 | 16.10 |
| T8 - <i>Azospirillum</i> 5 kg ha ⁻¹ SA alone | 27.4 | 1.3 | 58.3 | 6.15 | 12.30 |
| T9 - Urea 100% alone | 28.3 | 1.7 | 58.7 | 7.15 | 14.30 |
| T10 - Control | 30.7 | 2.7 | 63.4 | 10.05 | 20.01 |
| CD (5%) | 3.0 | 0.3 | 7.2 | | 1.90 |

Raigarh

The experiment was initiated during 2001. During 2002-03, the trial was conducted with 8 treatments in RBD. The result showed maximum fresh rhizome yield of 34.85 t ha⁻¹

was recorded with application of inorganic N 100% + *Azospirillum* 50 g + FYM. 5 kg plot⁻¹, closely followed by T8 (33.17 t ha⁻¹) Minimum yield of 20.19 t ha⁻¹ was recorded with application of FYM 5 kg (Table 112).

Table 112. Effect of biofertilizer, *Azospirillum* on turmeric - Raigarh

| Treatment | Rhizome yield (kg plot ⁻¹) | Yield (t ha ⁻¹) | | | Cost (Rs. lacs) | Gross return (Rs. lacs) | Net return (Rs. lacs) |
|---|--|-----------------------------|---------|-------|-----------------|-------------------------|-----------------------|
| | | 2001-02 | 2002-03 | Mean | | | |
| T1 - Inorganic N 100% + <i>Azospirillum</i> 50 g + FYM 5 kg | 14.96 | 39.65 | 30.06 | 34.85 | 0.92 | 2.09 | 1.17 |
| T2 - Inorganic N 75% + <i>Azospirillum</i> 50 g + FYM 5 kg | 12.66 | 32.42 | 25.44 | 28.93 | 0.91 | 1.73 | 0.82 |
| T3 - Inorganic N 50% + <i>Azospirillum</i> 50 g + FYM 5 kg | 12.03 | 30.50 | 24.18 | 27.34 | 0.89 | 1.64 | 0.75 |
| T4 - FYM 5 kg + <i>Azospirillum</i> 50 g | 10.40 | 24.32 | 20.90 | 22.61 | 0.88 | 1.32 | 0.44 |
| T5 - FYM 5 kg alone | 9.50 | 21.30 | 19.09 | 20.19 | 0.86 | 1.21 | 0.35 |
| T6 - FYM 10 kg + <i>Azospirillum</i> 50 g | 11.16 | 27.53 | 22.43 | 24.98 | 0.87 | 1.49 | 0.62 |
| T7 - FYM 10 kg alone | 9.86 | 22.83 | 19.81 | 21.32 | 0.87 | 1.27 | 0.40 |
| T8 - Recommended dose of fertilizer | 14.33 | 37.84 | 28.80 | 33.17 | 0.19 | 1.99 | 1.08 |
| CD (5%) | 1.18 | 2.65 | 2.37 | | | | |

Pottangi

The trial is in the third year of progress with 8 treatments. There was significant difference among the treatments for fresh rhizome yield. Highest fresh rhizome yield was recorded in T1 (18.78 t ha⁻¹) followed by T8 (18.53 t ha⁻¹) and T2 (15.28 t ha⁻¹) (Table 113).

Table 113. Effect of biofertilizer, *Azospirillum* on turmeric (pooled data) - Pottangi

| Treatment | Fresh rhizome yield (kg/ 3 m ²) | | | | Projected yield (t ha ⁻¹) | C:B ratio |
|---|---|---------|---------|------|---------------------------------------|-----------|
| | 2000-01 | 2001-02 | 2002-03 | Mean | | |
| T1 - Inorganic N 100% + <i>Azospirillum</i> 50 g + FYM 5 kg | 8.41 | 8.29 | 5.83 | 7.51 | 18.78 | 0.82:0.49 |
| T2 - Inorganic N 75% + <i>Azospirillum</i> 50 g + FYM 5 kg | 7.10 | 6.76 | 4.47 | 6.11 | 15.28 | 0.81:0.26 |
| T3 - Inorganic N 50% + <i>Azospirillum</i> 50 g + FYM 5 kg | 6.64 | 5.93 | 4.07 | 5.55 | 13.87 | 0.80:0.17 |
| T4 - FYM 5 kg + <i>Azospirillum</i> 50 g | 5.44 | 4.95 | 3.77 | 4.72 | 11.80 | 0.78:0.05 |
| T5 - FYM 5 kg alone | 6.21 | 4.80 | 2.50 | 4.50 | 11.26 | 0.78:0.01 |
| T6 - FYM 10 kg + <i>Azospirillum</i> 50 g | 6.42 | 5.27 | 2.27 | 4.65 | 11.63 | 0.78:0.03 |
| T7 - FYM 10 kg alone | 6.21 | 5.30 | 2.80 | 4.77 | 11.93 | 0.78:0.05 |
| T8 - Recommended dose of fertilizer | 7.34 | 9.56 | 5.33 | 7.41 | 18.53 | 0.80:0.50 |
| CD (5%) | NS | 0.967 | 1.02 | | | |

NB: Selling price of turmeric is Rs. 7.000

Ambalavayal

The experiment was started in 2003 with seven treatments in RBD and is in progress.

Pundibari

The trial was conducted with 8 treatments in RBD. T1 (inorganic nitrogen

100% + *Azospirillum* + FYM 5 kg) recorded highest fresh rhizome yield of 10.5 kg plot⁻¹ (28 t ha⁻¹) followed by T5 (FYM 10 kg + *Azospirillum*) with yield of 10 kg plot⁻¹ (26.7 t ha⁻¹) and T2 (inorganic nitrogen 50% + *Azospirillum* + FYM 5 kg). However there was no significant difference between these treatments (Table 114).

Table 114. Effect of biofertilizer, *Azospirillum* on turmeric – Pundibari

| Treatment | Plant height (cm) | Clump weight (g) | Weight of mother rhizome (g) | Weight of finger rhizome (g) | Fresh rhizome yield kg 3 m ² bed ⁻¹ | Fresh rhizome yield t ha ⁻¹ | Drying (%) |
|---|-------------------|------------------|------------------------------|------------------------------|--|---|------------|
| T1 - Inorganic N 100% + <i>Azospirillum</i> 50 g + FYM 5 kg | 106.6 | 185.1 | 33.3 | 112.1 | 10.5 | 28.0 | 28.3 |
| T2 - Inorganic N 75% + <i>Azospirillum</i> 50 g + FYM 5 kg | 109.9 | 166.1 | 42.6 | 123.8 | 9.7 | 25.9 | 26.7 |
| T3 - Inorganic N 50% + <i>Azospirillum</i> 50 g + FYM 5 kg | 106.5 | 153.9 | 39.7 | 113.8 | 9.1 | 24.3 | 26.2 |
| T4 - FYM 5 kg + <i>Azospirillum</i> 50 g | 109.0 | 126.5 | 32.3 | 85.4 | 8.0 | 21.3 | 27.0 |
| T5 - FYM 5 kg alone | 104.7 | 142.9 | 40.5 | 105.7 | 10.0 | 26.7 | 25.9 |
| T6 - FYM 10 kg + <i>Azospirillum</i> 50 g | 111.6 | 111.5 | 36.7 | 79.5 | 6.9 | 18.4 | 27.1 |
| T7 - FYM 10 kg alone | 106.4 | 151.9 | 41.9 | 142.9 | 9.8 | 26.1 | 25.5 |
| T8 - Recommended dose of fertilizer | 104.2 | 162.9 | 35.7 | 127.5 | 8.1 | 21.6 | 26.6 |
| CD (5%) | NS | 26.8 | NS | 18.2 | NS | - | NS |

TUR/CM/1.2 Organic farming in turmeric

(Pottangi, Raigarh, Pundibari and Bhavanisagar)

Pottangi

There was significant difference in fresh rhizome yield among different treatments. Highest fresh rhizome yield was recorded in T8 (19.61 t ha⁻¹) followed by T1 (16.45 t ha⁻¹) and T6 (15.83 t ha⁻¹) (Table 115).

The trial is in the third year of progress.

Table 115. Effect of organic inputs on the yield of turmeric – Pottangi

| Treatment | Fresh rhizome yield (kg/3 m ²) | | | | Projected yield (t ha ⁻¹) | C:B ratio |
|-----------------|--|---------|---------|------|---------------------------------------|-----------|
| | 2000-01 | 2001-02 | 2002-03 | Mean | | |
| T1: A+B+C+D+E+F | 8.00 | 7.56 | 4.18 | 6.58 | 16.45 | 0.70:0.45 |
| T2: B+C+D+E+F | 6.32 | 6.04 | 3.19 | 5.18 | 12.96 | 0.55:0.36 |
| T3: A+ C+D+E+F | 6.54 | 6.36 | 3.07 | 5.32 | 13.31 | 0.60:0.33 |
| T4: A+B+ D+E+F | 8.56 | 5.67 | 3.05 | 5.76 | 14.40 | 0.60:0.41 |
| T5: A+B+C+ E+F | 8.47 | 5.28 | 2.77 | 5.51 | 13.77 | 0.60:0.36 |
| T6: A+B+C+D+ F | 9.75 | 6.20 | 3.04 | 6.33 | 15.83 | 0.60:0.51 |

| | | | | | | |
|----------------------|------|------|------|------|-------|-----------|
| T7: A+B+C+D+E | 9.71 | 5.27 | 2.70 | 5.89 | 14.73 | 0.60:0.43 |
| T8: Recommended dose | 8.54 | 8.90 | 6.09 | 7.84 | 19.61 | 0.80:0.57 |
| CD (5%) | N | S | 1.65 | 0.62 | | |

NB Selling price of turmeric is Rs 7,000/t. A-FYM 25 t ha⁻¹, B-Pongamia oilcake 1.25 t ha⁻¹, C-Neem oilcake 1.25 t ha⁻¹, D-Sterameal 1.25 t ha⁻¹, E-Rock phosphate 1.25 t ha⁻¹, F-Wood ash 1.25 t ha⁻¹).

Raigarh

The experiment was conducted during 2001-2002 and 2002-2003. All the organic inputs showed significant differences except T2 and T3. The maximum yield (29.04 t ha⁻¹) was recorded in conventional

farming, farmers practice (T8) closely followed T1 (22.94 t ha⁻¹) and T5 (19.76 t ha⁻¹) and minimum yield of 10.92 t ha⁻¹ was recorded in T3 which was at par with T2 (Table 116).

Table 116. Effect of organic inputs on the yield of turmeric - Raigarh

| Treatment | Rhizome yield (kg plot ⁻¹) (2002-03) | Rhizome yield (t ha ⁻¹) | | | Cost (Rs. in lacs) | Gross return (Rs. in lacs) | Net return |
|--|--|-------------------------------------|---------|-------|--------------------|----------------------------|------------|
| | | 2001-02 | 2002-03 | Mean | | | |
| T1 - FYM + Rock phosphate + wood ash | 10.40 | 24.99 | 20.90 | 22.94 | 0.89 | 1.37 | +0.48 |
| T2 - Rock phosphate alone 500g/plot | 5.43 | 12.46 | 10.91 | 11.68 | 0.85 | 0.70 | -0.15 |
| T3 - Wood Ash alone 2 kg/plot | 5.20 | 11.39 | 10.45 | 10.92 | 0.86 | 0.65 | -0.21 |
| T4 - Azospirillum alone 50g/plot | 5.90 | 14.67 | 11.85 | 13.26 | 0.85 | 0.80 | +0.05 |
| T5 - Neem Cake + Rock phosphate + wood ash | 8.90 | 21.64 | 17.88 | 19.76 | 0.88 | 1.18 | +0.30 |
| T6 - Neem cake alone | 5.56 | 15.61 | 11.17 | 13.39 | 0.86 | 0.80 | -0.06 |
| T7 - FYM alone | 8.80 | 19.55 | 17.68 | 18.61 | 0.88 | 1.11 | +0.23 |
| T8 - Conventional Practice | 13.40 | 31.15 | 26.93 | 29.04 | 0.91 | 1.74 | +0.83 |
| CD (5%) | 1.03 | 01.41 | 2.07 | - | - | - | - |

Bhavanisagar

Report not received

Pundibari

The experiment was started during 2002-03 with 8 treatments in RBD, replicated thrice. Significant differences were observed for plant height, number of leaves per plant, clump

weight and weight and volume of mother and finger rhizomes and non-significant differences for other characters including fresh rhizome yield. Application of all the organic inputs except rock phosphate (T5) resulted maximum clump weight (98.0 g) which was on par with T8 and T1 (Table 117).

Table 117. Effect of organic inputs on the yield of turmeric - Pundibari

| Treatment | Plant height (cm) | Clump weight (g) | Weight of mother rhizome (g) | Weight of finger rhizome (g) | Fresh rhizome yield | | Drying (%) |
|-----------|-------------------|------------------|------------------------------|------------------------------|---------------------------------------|--------------------|------------|
| | | | | | kg 3 m ² bed ⁻¹ | t ha ⁻¹ | |
| T1 | 94.1 | 92.6 | 16.7 | 74.9 | 5.4 | 14.4 | 26.1 |
| T2 | 89.9 | 73.5 | 18.7 | 54.9 | 5.1 | 13.6 | 27.1 |
| T3 | 96.5 | 81.9 | 15.0 | 67.0 | 5.0 | 13.3 | 27.5 |
| T4 | 100.0 | 89.7 | 20.5 | 69.3 | 5.5 | 14.7 | 30.2 |
| T5 | 93.5 | 98.0 | 20.7 | 77.7 | 6.2 | 16.5 | 28.6 |
| T6 | 90.2 | 82.5 | 17.9 | 64.8 | 5.2 | 13.9 | 26.0 |
| T7 | 80.1 | 76.4 | 15.9 | 59.7 | 5.4 | 13.3 | 26.7 |
| T8 | 79.7 | 94.7 | 15.9 | 78.5 | 5.7 | 15.2 | 25.8 |
| CD (5%) | 13.1 | 12.1 | 2.7 | 6.5 | NS | - | - |

T1 - All organics (A+B+C+D+E+F)

T2 - 0 FYM + B+C+D+E+F

T3 - 0 Pongamia cake + A+C+D+E+F

T4 - 0 Neem cake + A+B+D+E+F

T5 - 0 Rock phosphate + A+B+C+D+F

T6 - 0 Sterameal + A+B+C+E+F

T7 - 0 Wood ash + A+B+C+D+F

T8 - Recommended dose of fertilizer

Note : A - FYM 10 kg 3 m² ; B - Pongamia cake 250 g 3m²,

C - Neem cake 250 g 3 m² ; D - Sterameal 250 g 3m²

E - Rock phosphate 500 g 3 m² ; F - Wood ash 250 g 3m²

TUR/CP/1 Disease Management trial **TUR/CP/1.1 Survey and identification of disease causing organisms in turmeric and screening of turmeric germplasm against diseases**

(Dholi, Jagtial, Raigarh, Pundibari and Coimbatore)

Jagtial

Over a period of five years (1997-98 to 2001-2002) PCT - 10, JTS - 604, PCT - 14, JTS - 602, JTS - 605, JTS - 606, JTS -

606, JTS - 601 and GS in short duration group. JTS - 302, JTS - 303, JTS - 304, JTS - 306, JTS - 308, CLI - 317, CLI - 330, CLI - 370, PTS - 9, PTS - 19, JTS - 310, JTS - 312, JTS - 313, CLI - 367.II, CLI - 320, CLI - 325, T - 5, JTS - 305, JTS - 311, CLI - 38, PTS - 24, PTS - 38, PTS - 10, JTS - 309, JTS - 307, JTS - 301, in medium duration group and BSR - 1, JTS - 6, ST - 365, ST - 510, JTS - 7, and 361 in long duration group were identified as rhizome rot resistant varieties.

During the year 2002-2003, thirteen varieties GS, JTS - 303, CLI - 370, JTS-604, JTS - 308, PTS - 9, PTS - 10, CLI - 325, CLI - 330, PCT - 10, CLI - 320, PCT - 7, PCT - 14 were identified as rhizome rot disease resistant varieties with disease incidence below 20% and PTS - 38 was susceptible.

Sick plot screening studies conducted during the year indicated that nine varieties were infected by colletotrichum leaf spot disease. JTS - 606 from short duration varieties was resistant to colletotrichum leaf spot disease. PCT - 14 and TC - 2, in short duration group were identified as resistant to leaf blotch disease

Coimbatore

The incidence of rhizome rot, leaf blotch and leaf spot diseases were assessed in 12 conventional turmeric growing areas of Coimbatore, Erode and Salem. Among these the incidence of rhizome rot and leaf blotch were found to be high (48.3 and 28.3%, respectively) at Uonjalur in Erode District and the incidence these two diseases was low at Aasarikottam in Salem District. Leaf spot disease incidence was high at Mathampatti (30.3%) and low at Mylampalayam in Salem District. In the 13 locations the predominant organism associated with rhizome rot was identified as *Pythium aphanidermatum*.

Two hundred and thirty accessions were screened for their reaction to leaf spot and leaf blotch diseases. Among these CL - 32, CL - 34, CL - 54 and CL - 55 were found resistant to both leaf spot and leaf blotch diseases. Ninety eight accessions were moderately resistant, 106 accessions were susceptible and

21 accessions were highly susceptible to leaf blotch disease. Among the germplasm, 95 accessions were moderately resistant, 108 were susceptible and 23 were highly susceptible to leaf spot disease

Raigarh

Report not received.

Dholi

A survey was conducted in turmeric growing areas of North Bihar namely Sitamarhi, East Champaran and West Champaran. It was observed that leaf blotch disease incidence was more severe compared to leaf spot disease. In some areas of East Champaran, rhizome rot disease was also found.

Thirty nine accessions of turmeric were screened against leaf spot and leaf blotch diseases. Kohinoor, G.L. Puram, RH - 24, RH - 5 and Rajendra Sonia were graded as resistant to leaf spot disease while G.L. Puram, Rajendra Sonia, RH - 5 and RH - 24 were graded as resistant to leaf blotch disease.

Pundibari

A preliminary survey was conducted in the district of Coochbehar to identify the diseases occurring in the area. Three major diseases, leaf blotch (*Taphrina* spp.), leaf spot (*Colletotrichum* spp.) and rhizome rot were found to be prevalent in this area. Most of the area is covered with local varieties which are highly susceptible to leaf blotch disease. Average disease severity was about 60% when PDI was calculated on 0-9 scale. A preliminary screening of germplasm against leaf blotch disease was done and the promising lines are given in Table 118.

Table 118. Reaction of turmeric germplasm to leaf blotch disease – Pundibari

| Entry | PDI |
|--------------|-------|
| TCP - 5 | 11.11 |
| TCP - 85 | 16.67 |
| TCP - 112 | 11.11 |
| TCP- 137 | 18.95 |
| TCP- 162 | 18.52 |
| TCP - 148(2) | 11.11 |
| TCP - 7 | 17.46 |
| TCP - 17 | 18.52 |
| TCP - 68 | 11.11 |
| TCP - 75 | 13.13 |

TUR/CP/1.2 Chemical control measures against leaf blotch disease of turmeric (Pundibari)*Pundibari*

This trial was laid out this year and is in progress.

TUR/CP/1.3 Effect of seed treatment on leaf blotch and leaf spot diseases of turmeric

(Dholi, Pundibari, Raigarh and Kumarganj)

Pundibari

The trial was conducted consecutively for 3 years with 7 treatments. Three sprays of fungicides were given starting from first appearance of the disease at 20 days interval. Data on PDI, fresh rhizome yield were recorded. Minimum disease incidence of 31.00% and 24.55% in RH - 5 and Rajendra Sonia, respectively was recorded in carbendazim as foliar spray (Table 119).

Table 119. Effect of fungicides and biocontrol agents on leaf blotch and leaf spot diseases of turmeric – Pundibari

| Treatment | RH-5 | | | | Rajendra Sonia | | | |
|--|-----------------|------------------|----------------------------|--------------------------------|-----------------|-----------------|----------------------------|--------------------------------|
| | PDI at 90 days | PDI at 150 days | Reduction over control (%) | Yield (kg plot ⁻¹) | PDI at 90 days | PDI at 150 days | Reduction over control (%) | Yield (kg plot ⁻¹) |
| T1 - Mancozeb 0.2% | 5.61 (13.70) | 55.80 (48.33) | 25.63 | 6.23 | 5.94 (14.11) | 52.7 (46.53) | 21.25 | 5.23 |
| T2 - Cabendazim 0.2% | 4.23 (11.87) | 49.68 (44.82) | 31.03 | 6.40 | 6.89 (15.22) | 49.3 (44.58) | 24.55 | 4.90 |
| T3 - Mancozeb 0.2% and Carbendazim 0.2% | 4.32 12.00 | 65.03 (53.75) | 17.29 | 5.50 | 3.78 (11.21) | 56.2 (48.71) | 17.57 | 4.77 |
| T4 - <i>Trichoderma viride</i> | 7.36 15.75 | 62.32 (52.13) | 12.86 | 6.57 | 5.62 (13.71) | 69.1 (56.14) | 4.99 | 4.77 |

| | | | | | | | | |
|---|----------------|------------------|-------|------|------------------|-----------------|-------|------|
| T5 - Seed Treatment with Mancozeb (0.25%) and <i>Trichoderma viride</i> as soil application (20 kg ha ⁻¹) | 7.59 15.99 | 69.74 (56.63) | 12.86 | 5.27 | 10.31 (18.73) | 63.8 (53.31) | 9.78 | 3.33 |
| T6 - Seed treatment with Carbendazim (0.2%) and <i>Trichoderma viride</i> as soil application (20 kg ha ⁻¹) | 5.49 13.55 | 71.54 (57.76) | 11.12 | 6.40 | 8.56 (17.01) | 61.4 (51.75) | 12.42 | 4.80 |
| T7 - Untreated check | 20.15 29.67 | 82.12 (64.99) | | 4.23 | 14.37 (22.28) | 73.4 (59.09) | | 3.20 |
| CD (5%) | 3.74 | 4.28 | | 1.36 | 5.74 | 9.95 | | 1.65 |

Figures in parenthesis are angular transformed values

Raigarh

All the treatments were significantly effective in reducing the severity of leaf blotch disease and enhancing the yield of fresh

rhizomes over control. Disease severity was lowest in T3 closely followed by T2 and T1. Yield of fresh rhizomes was the highest in T3 followed by T1 (Table 120).

Table 120. Effect of fungicides and biocontrol agents on leaf blotch disease of turmeric - Raigarh

| Treatment | Disease severity % | Yield (kg plot ⁻¹) | Yield (q ha ⁻¹) |
|---|--------------------|--------------------------------|-----------------------------|
| T1 - Mancozeb 0.2% | 22.37 | 10.75 | 358.33 |
| T2 - Carbendazim 0.2% | 18.50 | 10.50 | 350.00 |
| T3 - Mancozeb 0.2% and Carbendazim 0.2% | 16.33 | 12.90 | 430.00 |
| T4 - <i>Trichoderma viride</i> | 28.80 | 09.75 | 325.00 |
| T5 - Seed Treatment with Mancozeb (0.25%) and <i>Trichoderma viride</i> as soil application (20 kg ha ⁻¹) | 33.63 | 09.60 | 320.00 |
| T6 - Seed treatment with Carbendazim (0.2%) and <i>Trichoderma viride</i> as soil application (20 kg ha ⁻¹) | 23.40 | 07.30 | 243.33 |
| T7 - Untreated check | 41.92 | 04.80 | 160.00 |
| CD (5%) | 8.082 | 2.20 | - |

Severity of colletotrichum leaf spot was lowest in T3 followed by T2 and T1, but yield

of fresh rhizome was significantly higher in T3 closely followed by T2 (Table 121).

Table 121. Effect of fungicides and biocontrol agents on leaf spot disease and yield of turmeric - Raigarh

| Treatment | Disease severity % | Yield (kg plot ⁻¹) | Yield (q ha ⁻¹) |
|---|--------------------|--------------------------------|-----------------------------|
| T1 - Mancozeb 0.2% | 14.0 | 3.70 | 123.33 |
| T2 - Carbendazim 0.2% | 12.8 | 5.13 | 171.00 |
| T3 - Mancozeb 0.2% and Carbendazim 0.2% | 09.3 | 5.63 | 187.67 |
| T4 - <i>Trichoderma viride</i> | 23.1 | 3.70 | 123.33 |
| T5 - Seed Treatment with Mancozeb (0.25%) and <i>Trichoderma viride</i> as soil application (20 kg ha ⁻¹) | 26.7 | 3.67 | 122.33 |
| T6 - Seed treatment with Carbendazim (0.2%) and <i>Trichoderma viride</i> as soil application (20 kg ha ⁻¹) | 24.4 | 3.47 | 115.67 |
| T7 - Untreated Check | 43.2 | 2.67 | 089.00 |
| CD (5%) | 3.18 | 1.15 | - |

Dholi

Mancozeb + carbendazim 0.2% was proved better in controlling the disease resulting in maximum yield (18.98 t ha⁻¹) with less incidence of leaf spot (25.85%) and leaf

blotch (29.72%) whereas in control yield was only 11.07 t ha⁻¹ and disease incidence of leaf spot and leaf blotch were 44.0 and 45.95%, respectively (Table 122).

Table 122. Effect of fungicides and biocontrol agents on leaf spot and leaf blotch diseases of turmeric - Dholi

| Treatment | Leaf spot Disease incidence (%) | Leaf blotch Disease incidence (%) | Yield (t ha ⁻¹) |
|---|---------------------------------|-----------------------------------|-----------------------------|
| T1 - Mancozeb 0.2% | 29.35 | 31.38 | 15.05 |
| T2 - Carbendazim 0.2% | 31.17 | 33.85 | 14.35 |
| T3 - Mancozeb 0.2% and Carbendazim 0.2% | 25.35 | 29.72 | 18.98 |
| T4 - <i>Trichoderma viride</i> | 39.30 | 31.20 | 16.67 |
| T5 - Seed Treatment with Mancozeb (0.25%) and <i>Trichoderma viride</i> as soil application (20 kg ha ⁻¹) | 33.30 | 34.90 | 13.66 |
| T6 - Seed treatment with Carbendazim (0.2%) and <i>Trichoderma viride</i> as soil application (20 kg ha ⁻¹) | 27.45 | 30.68 | 17.59 |
| T7 - Untreated check | 44.00 | 45.95 | 11.07 |
| CD (5%) | 4.96 | 5.18 | 1.85 |
| CV % | 8.33 | 8.59 | 6.78 |

Kumarganj

The trial was started during 2000-2001. During 2002-03 maximum reduction of leaf blotch and leaf spot diseases in R. Sonia and RH - 5 were observed in T3 (Table 123). However, maximum yield was obtained in T2 in R. Sonia and T1 in RH - 5. Three years

pooled data indicated that there was no significant difference on the incidence of leaf blotch and leaf spot diseases in R. Sonia and RH - 5. T3 gave the best control of both the disease in both the varieties. Higher yield was obtained in T6 followed by T3 in both the varieties (Tables 124 & 125).

Table 123. Effect of fungicides and bioagent on leaf blotch and leaf spot diseases of turmeric (2002-03) - Kumarganj

| Treatment | Yield of rhizome (q ha ⁻¹) | | Increase in yield of rhizome (%) | | PDI | | | |
|---|---|--------|-------------------------------------|-------|-------------------------------|------------------|-------------------|------------------|
| | R. Sonia | RH-5 | R. Sonia | RH-5 | Leaf blotch | | Leaf spot | |
| | | | | | R. Sonia | RH-5 | R. Sonia | RH-5 |
| T1 - Mancozeb 0.2% (S.T. + spray) | 258.88 | 282.21 | 10.96 | 30.25 | 25.34 (42.97) ¹ | 36.50 (35.54) | 31.02 (46.64) | 44.48 (15.96) |
| T2 - Carbendazim 0.2% (S.T. + spray) | 283.32 | 261.10 | 21.42 | 20.51 | 27.99 (37.01) | 28.07 (50.43) | 31.79 (45.32) | 34.92 (34.02) |
| T3 - Mancozeb + Carbendazim (S.T. + spray) | 276.66 | 266.66 | 18.57 | 23.07 | 23.64 (46.68) | 27.16 (50.03) | 27.72 (52.32) | 29.59 (44.09) |
| T4 - <i>T. harzianum</i> (S.T.) | 266.66 | 263.88 | 14.28 | 21.79 | 27.17 (38.86) | 35.35 (37.57) | 44.12 (24.11) | 40.99 (23.55) |
| T5 - Mancozeb (S.T.) + <i>T. harzianum</i> (soil application) | 241.66 | 247.21 | 3.57 | 14.10 | 24.48 (44.91) | 28.9 (48.87) | 533.37 (42.60) | 39.59 (25.20) |
| T6 - Carbendazim (S.T.) + <i>T. harzianum</i> soil application) | 261.10 | 258.32 | 11.90 | 19.22 | 30.66 (31.00) | 32.25 (43.05) | 44.81 (22.92) | 47.82 (9.65) |
| T7 - Control | 233.32 | 216.66 | — | — | 43.44 | 56.63 | 58.14 | 52.93 |
| CD (5%) | | | | | 5.59 | 8.83 | 5.29 | 7.50 |
| CV % | | | | | 10.85 | 14.19 | 7.65 | 10.18 |

¹ Figures in parenthesis indicates % change over control.

• S.T. = Seed treatment

Table 124. Effect of fungicides and bioagent on incidence of leaf blotch and spot diseases and yield of turmeric cv. Rajendra Sonia (pooled data) - Kumarganj

| Treatment | Leaf blotch (%) | | | Leaf spot (%) | | | Yield (q ha ⁻¹) | | | | | |
|---|-----------------|---------|---------|---------------|---------|---------|-----------------------------|-------|---------|---------|---------|--------|
| | 2000-01 | 2001-02 | 2002-03 | Mean | 2000-01 | 2001-02 | 2002-03 | Mean | 2000-01 | 2001-02 | 2002-03 | Mean |
| T1 - Mancozeb 0.2% (S T + spray) | 49.00 | 68.10 | 25.34 | 47.48 | 53.06 | 57.62 | 31.92 | 47.23 | 426.66 | 330.27 | 258.88 | 338.60 |
| T2 - Carbendazim 0.2% (S T + spray) | 47.30 | 65.62 | 27.99 | 46.97 | 47.30 | 55.31 | 31.79 | 44.80 | 441.66 | 329.16 | 283.32 | 351.38 |
| T3 - Mancozeb + Carbendazim (S T + spray) | 44.20 | 60.50 | 23.64 | 42.78 | 44.20 | 51.20 | 27.72 | 41.04 | 458.28 | 333.05 | 276.66 | 355.99 |
| T4 - <i>T. harzianum</i> (S T) | 52.80 | 71.13 | 27.17 | 50.36 | 52.80 | 65.81 | 44.12 | 54.24 | 421.62 | 311.66 | 266.66 | 333.31 |
| T5 - Mancozeb (S T) + <i>T. harzianum</i> (soil application) | 39.00 | 70.62 | 24.48 | 44.70 | 39.00 | 60.51 | 33.37 | 44.29 | 473.28 | 325.00 | 241.66 | 346.64 |
| T6 - Carbendazim (S T) + <i>T. harzianum</i> soil application) | 34.20 | 61.52 | 30.66 | 42.12 | 34.20 | 54.41 | 44.81 | 44.47 | 494.28 | 347.05 | 261.10 | 367.47 |
| T7 - Control | 58.80 | 76.81 | 44.44 | 60.01 | 58.80 | 71.05 | 58.14 | 62.66 | 326.63 | 199.95 | 233.32 | 253.30 |
| S T - Seed treatment | | | | | | | | | | | | |

Table 125. Effect of fungicides and bioagent on incidence of leaf blotch and spot diseases and yield of turmeric cv. RH-5 (pooled data) - Kumarganj

| Treatment | Leaf blotch (%) | | | Leaf spot (%) | | | Yield (q ha ⁻¹) | | | | | |
|---|-----------------|---------|---------|---------------|---------|---------|-----------------------------|--------|---------|---------|---------|--------|
| | 2000-01 | 2001-02 | 2002-03 | Mean | 2000-01 | 2001-02 | 2002-03 | Mean | 2000-01 | 2001-02 | 2002-03 | Mean |
| T1 - Mancozeb 0.2% (S.T + spray) | 48.10 | 62.59 | 36.50 | 49.06 | 56.46 | 56.36 | 44.48 | 157.30 | 389.96 | 290.55 | 282.21 | 320.90 |
| T2 - Carbendazim 0.2% (S.T + spray) | 46.40 | 56.27 | 28.07 | 43.58 | 55.36 | 54.15 | 34.92 | 144.43 | 394.29 | 328.22 | 261.10 | 327.87 |
| T3 - Mancozeb +Carbendazim (S.T + spray) | 42.40 | 51.33 | 27.16 | 40.29 | 53.66 | 44.90 | 29.59 | 128.15 | 399.96 | 382.53 | 266.66 | 349.71 |
| T4 - <i>T. harzianum</i> (S.T) | 50.20 | 68.93 | 35.35 | 51.49 | 63.00 | 61.40 | 40.99 | 165.39 | 366.63 | 228.60 | 263.88 | 286.37 |
| T5 - Mancozeb (S.T) + <i>T. harzianum</i> (soil application) | 33.20 | 67.57 | 28.95 | 43.24 | 50.60 | 62.89 | 39.59 | 153.08 | 433.29 | 244.44 | 247.21 | 308.31 |
| T6 - Carbendazim (S.T.) + <i>T. harzianum</i> soil application) | 36.40 | 54.43 | 32.25 | 41.02 | 49.43 | 49.67 | 47.82 | 146.88 | 459.95 | 342.77 | 258.32 | 353.68 |
| T7 - Control | 56.30 | 73.28 | 56.63 | 61.98 | 70.02 | 66.76 | 52.93 | 189.71 | 296.63 | 219.77 | 216.66 | 244.35 |
| CD (5 %) | 10.18 | | | 6.15 | | 11.02 | | | 75.14 | | | |
| CV % | 7.81 | | | 9.28 | | | | | 19.22 | | | |

TUR/CP/1.4**Investigation on the causal organism of rhizome rot of turmeric and screening of biocontrol agents for its management***(Jagtial, Coimbatore and Pundibari)**Jagtial*

During 1994 and 1995 the causal organism of turmeric rhizome rot disease was tentatively identified as *Pythium*. *Pythium* sp isolated from the rhizome rot affected turmeric on inoculation caused the disease.

During 1996, *Fusarium* sp. was isolated from roots and rhizomes of diseased plants of turmeric (Duggirala turmeric in farmer's field). During 1998, *Rhizoctonia* sp. was isolated from diseased rhizomes and roots. During 2000-2001, *Fusarium* sp was isolated from diseased rhizomes and roots of diseased plants of Armoor, Duggirala red, Duggirala white, JTS - 1, JTS - 2 turmeric varieties on autoclaved grains of maize, wheat, jowar, potato tubers and on inoculation it caused rhizome rot disease. The organism was identified as *Fusarium solani*.

Field experiments conducted for 3 years (1997 to 1999) on rhizome rot disease in turmeric showed reduction of the disease by 37.86% by application of FYM with *Trichoderma viride* + *Pseudomonas fluorescens* to soil (12.5 kg ha⁻¹ as basal and 25.0 kg ha⁻¹ as top dressing) followed by application of FYM with *Trichoderma viride* + *Pseudomonas fluorescens* to seed @ 4 g kg⁻¹ of seed.

Coimbatore

The trial is in third year of progress. The treatment T7 (application of NPK 125:60:90 kg ha⁻¹ + FYM 10 t ha⁻¹ + *Trichoderma viride* + *Pseudomonas fluorescens* @ 4 g kg⁻¹ seed treatment + *T. viride* + *P. fluorescens* applied to soil (12.5 kg and 25.0 kg ha⁻¹ as basal and top dressing, respectively) recorded the lowest rhizome rot incidence of 11.70% (68.38% disease reduction) with highest yield of 28.60 t ha⁻¹. Application of NPK 125:60:90 kg ha⁻¹ + FYM 10 t ha⁻¹ + *Bacillus subtilis* (Biostat) @ 1 ml l⁻¹ of water (T8) reduced the disease incidence to the extent of 25.67%. The control treatment (T1) recorded 37% rhizome rot incidence with an yield of 10.33 t ha⁻¹ (Table 126).

Table 126. Effect of biocontrol agents for the management rhizome rot disease of turmeric - Coimbatore

| Treatment | Rhizome rot incidence (%) | Disease reduction (%) | Yield (kg plot ⁻¹) | Yield (t ha ⁻¹) |
|--|---------------------------|-----------------------|--------------------------------|-----------------------------|
| T1 - Recommended NPK (Control) | 37.00 (37.45) | - | 5.17 | 10.33 |
| T2 - Recommended NPK + FYM | 34.04 (35.69) | 8.00 | 6.23 | 12.45 |
| T3 - Recommended NPK + <i>T. viride</i> + <i>Pseudomonas fluorescens</i> @ 4g kg ⁻¹ seed as seed treatment | 25.16 (30.03) | 32.00 | 8.82 | 17.63 |
| T4 - Recommended NPK + <i>T. viride</i> + <i>Pseudomonas fluorescens</i> to be applied to soil @ 12.5 kg ha ⁻¹ and 25.0 kg ha ⁻¹ as basal and top dressing respectively. | 24.26 (29.43) | 34.43 | 12.38 | 24.75 |

| | | | | |
|--|---------------|-------|-------|-------|
| T5 - T2 + T3 | 23.40 (28.87) | 36.75 | 7.57 | 15.13 |
| T6 - T2 + T4 | 22.57 (28.35) | 39.00 | 9.62 | 19.24 |
| T7 - T2 + T3 + T4 | 11.70 (19.99) | 68.38 | 14.30 | 28.60 |
| T8 - T2 + <i>Bacillus subtilis</i> (Biostat) @ 1 ml l ⁻¹ of water. | 27.50 (31.43) | 25.67 | 6.60 | 13.20 |
| CD (5%) | 2.00 | | | 1.77 |

Pundibari

The data (Table 127) indicated that rhizome rot incidence was minimum in carbendazim as seed treatment, which was at par with seed treatment with companion (a combination product of mancozeb and carbendazim).

Table 127. Effect of biocontrol agents for the management of rhizome rot disease of turmeric - Pundibari

| Treatment | PDI | | Per cent reduction over control | Yield (kg plot ⁻¹) |
|--|---------|----------|------------------------------------|-----------------------------------|
| | 90 days | 150 days | | |
| T1 - Recommended NPK (control) | 19.88 | 37.02 | - | 2.77 |
| T2 - Recommended NPK + Farm yard Manure | 20.67 | 21.20 | 42.73 | 7.57 |
| T3 - Recommended NPK + <i>T. viride</i> + <i>Pseudomonas fluorescens</i> as seed treatment | 10.68 | 36.94 | 0.22 | 3.27 |
| T4 - Recommended NPK + <i>T. viride</i> + <i>Pseudomonas fluorescens</i> to be applied to soil @ 12.5 kg ha ⁻¹ and 25.0 kg ha ⁻¹ as basal and top dressing respectively | 10.69 | 27.88 | 24.69 | 3.67 |
| T5 - T2 + T3 | 14.04 | 21.34 | 42.35 | 6.70 |
| T6 - T2 + T4 | 10.69 | 22.34 | 39.65 | 5.23 |
| T7 - T2 + T3 + T4 | 16.95 | 19.80 | 46.52 | 5.93 |
| T8 - T2 + Seed treatment with mancozeb | 11.88 | 21.12 | 42.95 | 7.53 |
| T9 - T2 + Seed treatment with carbendazim | 14.56 | 16.31 | 55.94 | 7.17 |
| T10 - T2 + Seed treatment with Companion (a combination product of mancozeb and carbendazim) | 17.58 | 18.14 | 51.00 | 7.50 |
| CD (5%) | 7.85 | 9.33 | | 1.30 |

B. subtilis was not effective in the last year trial hence, the treatment was not included this year.

TREE SPICES**TSP/CI/1 Genetic Resources****TSP/CI/1. 1 Germplasm collection, characterization, evaluation and conservation of clove, nutmeg and cinnamon**

(*Yercaud/Pechiparai, Ambalavaval and Dapoli*)

Dapoli

The trial in cinnamon was started during 1996-97. Morphological and yield characters were recorded. In nutmeg, 5 elite lines were collected from IISR and added to the existing germplasm. The average of height varied

between 3.79 m (A - 203) to 4.50 m (A - 44). The average girth ranged from 15.16 cm (A - 53) to 18.05 cm (A - 5). The spread of the trees varied from 2.34 m (A - 312) to 3.43 m (A - 44).

The mean bark yield (fresh) showed significant differences. The highest bark yield (559.33 g plant⁻¹) was recorded in A - 312 which was at par with A - 44 (499.33 g plant⁻¹). Dry bark yield and fresh and dry leaf yield showed non significant differences among different accessions. The bark and leaf sample has been sent for analysis to NRC for mushroom (ICAR), Solan H P. and IISR, Calicut (Table 128).

Table 128. Performance of cinnamon accessions - Dapoli

| Accession | Plant height (m) | Stem girth (cm) | Plant spread (m) | Mean bark yield (g plant ⁻¹) | | Mean leaf yield (g plant ⁻¹) | |
|-----------|------------------|-----------------|------------------|--|--------|--|--------|
| | | | | Fresh | Dry | Fresh | Dry |
| A - 5 | 4.43 | 18.05 | 2.83 | 315.66 | 175.00 | 123.33 | 100.00 |
| A - 44 | 4.50 | 17.74 | 3.43 | 499.33 | 288.33 | 130.00 | 93.33 |
| A - 53 | 4.03 | 15.16 | 2.46 | 206.33 | 95.00 | 127.33 | 92.67 |
| A - 63 | 4.43 | 15.68 | 2.46 | 381.00 | 211.67 | 140.00 | 101.00 |
| A - 65 | 4.31 | 16.20 | 2.82 | 218.33 | 128.33 | 123.00 | 88.67 |
| A - 189 | 4.16 | 15.46 | 2.72 | 401.67 | 138.33 | 121.66 | 85.00 |
| A - 203 | 3.79 | 15.91 | 2.38 | 446.33 | 272.67 | 126.67 | 101.67 |
| A - 310 | 4.17 | 15.41 | 2.64 | 248.67 | 125.00 | 161.33 | 96.67 |
| A - 312 | 4.03 | 16.47 | 2.34 | 559.33 | 257.33 | 122.00 | 87.67 |
| Mean | 4.21 | 16.23 | 2.63 | 364.07 | 187.96 | 130.59 | 94.07 |
| CD (5%) | NS | NS | NS | 191.13 | NS | NS | NS |

The programme in clove was initiated during 1996-97. IISR types showed vigorous growth recording maximum height (3.30 m), girth (13.89 cm), number of branches (35-85) and spread (2.31 m) compared to Kallar types. Three plants started flowering and yielding.

Ambalavaval

The experiment will be started in 2003

Yercaud/Pechiparai

In clove, out of 19 accessions evaluated during the year, SA - 7 gave highest yield (36.83 g tree⁻¹), followed by SA - 5 (33.70 g tree⁻¹).

In nutmeg among 11 accessions evaluated during the year, MF - 2 recorded highest yield (1.45 kg tree⁻¹).

In cinnamon among the 12 accessions evaluated during the year, CV - 7 recorded highest leaf yield (8666 kg ha⁻¹) and bark yield (980 kg ha⁻¹) with bark recovery of 34.65%

TSP/CI/2 Coordinated Varietal Trial (CVT)

TSP/CI/2.1 CVT 1992 in clove

(*Yercaud/Pechiparai* and *Dapoli*)

Yercaud/Pechiparai

Among 9 high yielding accessions evaluated during the year, SA - 7 recorded highest yield (36 83 g tree⁻¹) followed by SA - 5 (33.70 g tree⁻¹).

Dapoli

Final report not submitted.

TSP/CI/2.2 CVT 1992 in cinnamon

(*Yercaud/Pechiparai* and *Ambalavaval*)

Yercaud/Pechiparai -

Final report not submitted

Ambalavaval

The programme was started during 2002 with 7 genotypes in RBD. SL - 203 recorded the highest wet (9.035 kg) and dry (3.835 kg) weight of quills/12 plants. Samples were sent to I.I.S.R. Calicut for quality analysis (Table 129)

Table 129. Performance of cinnamon accessions - Ambalavaval

| Treatments | Wet weight (kg/12 plants) | Dry weight (kg/12 plants) |
|------------|------------------------------|------------------------------|
| SL - 44 | 5 010 | 2 270 |
| SL 203 | 9 035 | 3 835 |
| SL 63 | 7 115 | 3 320 |
| SL 189 | 6 525 | 2 910 |
| SL - 53 | 8 225 | 3 711 |
| Acc - 1 | 4 115 | 1 915 |
| Acc - 2 | 3 830 | 1 720 |

TSP/CI/2.3 CVT 2001 in nutmeg

(*Dapoli*, *Sirsi*, *Yercaud/Pechiparai* and *Ambalavaval*)

Dapoli, *Sirsi*, *Yercaud/Pechiparai* and *Ambalavaval*

The planting materials have been collected from IISR, Calicut and experiment has been laid out with 8 genotypes in RBD with 3 replications during 2003.

TSP/CI/2.4 Comparative varietal trial, CVT 2001 Series in Cassia

(*Ambalavaval*, *Dapoli* and *Sirsi*)

Ambalavaval, *Dapoli* and *Sirsi*

The planting materials have been collected from IISR, Calicut and experiment has been laid out with 4 genotypes during 2003

TSP/CM /1 Propagation/Multiplication Trial

TSP/CM/1.1 Vegetative propagation in nutmeg, clove and cinnamon

(*Yercaud/Pechiparai* and *Dapoli*)

Dapoli

Soft wood grafting in Nutmeg: The experiment was conducted during 2000-2001 to 2002-2003. The sprouting percentage varied from 6.66 to 68.33%. During rainy months the success was relatively low. The period from October to March was most congenial period with January to be the best period (68.33%). The mortality was highest during July (93.34%) followed September (87.78%). Thus the present study indicated that February, March and November are the best months for softwood grafting in nutmeg (Table 130)

Table 130. Softwood grafting in nutmeg - Dapoli

| Month | Sprouting (%) | | | Survival (%) | | | Mortality (%) | | | | | |
|-----------|-----------------|-----------------|-----------------|------------------|-----------------|------------------|------------------|------------------|------------------|-----------------|-----------------|------------------|
| | 2000-01 | 2001-02 | 2002-03 | mean | 2000-01 | 2001-02 | 2002-03 | mean | 2000-01 | 2001-02 | 2002-03 | mean |
| April | 16.66 (23.8) | 20.00 (26.5) | 33.33 (35.2) | 23.33 (58.19) | 16.66 (23.8) | 20.00 (26.5) | 30.00 (33.2) | 22.22 (27.8) | 83.34 (66.14) | 80.00 (63.4) | 66.67 (54.7) | 76.67 (61.2) |
| May | 10.00 (16.3) | 10.00 (16.3) | 26.66 (30.9) | 15.5 (64.47) | 6.67 (13.6) | 10.00 (16.3) | 23.33 (28.7) | 13.33 (20.49) | 90.00 (73.6) | 90.00 (76.6) | 73.34 (59.0) | 84.50 (67.4) |
| June | 33.33 (35.2) | 36.66 (37.1) | 40.00 (39.2) | 36.66 (51.67) | 26.66 (30.9) | 33.33 (35.2) | 30.00 (33.2) | 29.99 (35.19) | 66.67 (54.7) | 63.67 (52.8) | 60.00 (50.7) | 63.34 (59.0) |
| July | 00.00 (4.05) | 03.33 (8.8) | 16.66 (23.3) | 06.66 (70.62) | 00.00 (4.05) | 03.33 (8.8) | 10.00 (16.3) | 04.44 (9.75) | 100.00 (58.6) | 96.67 (81.1) | 83.34 (66.6) | 93.34 (74.78) |
| August | 20.00 (26.5) | 23.33 (28.7) | 23.33 (28.7) | 22.22 (61.23) | 16.66 (23.8) | 20.00 (26.0) | 23.33 (28.7) | 19.99 (28.04) | 80.00 (63.4) | 76.67 (61.2) | 76.67 (61.2) | 77.78 (61.4) |
| September | 10.00 (18.4) | 16.66 (23.8) | 10.00 (18.4) | 12.22 (69.88) | 10.00 (18.4) | 16.66 (23.0) | 10.00 (18.4) | 12.22 (20.24) | 90.00 (71.5) | 83.34 (66.1) | 90.00 (71.5) | 87.78 (67.5) |
| October | 50.00 (45.0) | 60.00 (50.7) | 53.33 (46.9) | 54.53 (42.00) | 46.66 (43.0) | 53.33 (45.0) | 46.66 (43.00) | 48.88 (46.28) | 50.00 (45.0) | 40.00 (39.2) | 46.67 (43.0) | 45.67 (42.2) |
| November | 50.00 (45.0) | 60.00 (51.1) | 56.66 (48.8) | 55.55 (40.00) | 46.66 (43.0) | 50.00 (39.20) | 53.33 (46.9) | 50.16 (47.69) | 50.00 (45.0) | 40.00 (38.8) | 43.34 (41.1) | 44.45 (42.0) |
| December | 46.66 (43.0) | 50.00 (46.0) | 50.00 (45.0) | 4.89 (45.12) | 36.66 (37.2) | 40.00 (45.00) | 40.00 (39.2) | 38.89 (42.44) | 53.34 (46.9) | 50.00 (45.0) | 50.00 (45.0) | 51.11 (45.2) |
| January | 85.00 (48.9) | 53.33 (46.9) | 66.66 (54.7) | 6.33 (38.03) | 46.66 (43.0) | 43.33 (41.00) | 50.00 (45.0) | 46.66 (46.95) | 15.00 (41.0) | 46.67 (43.0) | 33.34 (35.2) | 31.69 (33.2) |
| February | 50.00 (45.0) | 53.33 (45.0) | 66.66 (54.9) | 5.55 (38.15) | 50.00 (45.0) | 53.33 (46.90) | 63.33 (52.7) | 55.55 (47.59) | 50.00 (45.0) | 46.67 (43.0) | 33.34 (35.2) | 33.45 (34.0) |
| March | 46.66 (43.0) | 53.33 (46.0) | 63.33 (52.7) | 54.54 (39.66) | 46.66 (43.0) | 53.33 (46.9) | 60.00 (50.8) | 53.33 (46.95) | 53.34 (46.9) | 46.67 (43.0) | 36.67 (37.0) | 45.56 (42.2) |
| Mean | 32.88 | 35.60 | 39.54 | 35.80 | 30.77 | 33.58 | 36.38 | 33.57 | 54.84 | 54.23 | 50.4 | 53.04 |
| SEm ± | 2.76 | 3.92 | 2.65 | 3.18 | 3.73 | 3.53 | 2.96 | 3.40 | 8.42 | 3.82 | 2.69 | 4.97 |
| CD (5%) | 8.11 | 11.50 | 7.89 | 9.16 | 8.01 | 10.35 | 8.68 | 9.01 | 24.69 | 11.22 | 7.89 | 14.6 |

Table 131. Softwood grafting in clove - Dapoli

| Month | Sprouting (%) | | | Survival (%) | | | Mortality (%) | | | | | |
|-----------|------------------|-----------------|-----------------|------------------|-----------------|-----------------|------------------|------------------|------------------|-------------------|------------------|-------------------|
| | 2000-01 | 2001-02 | 2002-03 | mean | 2000-01 | 2001-02 | 2002-03 | mean | 2000-01 | 2001-02 | 2002-03 | mean |
| April | 0 00 (4.05) | 0 00 (4.05) | 0 00 (4 05) | 0 00 (4.05) | 0 00 (4 05) | 0 00 (4 05) | 0 00 (4.05) | 0 00 (4.05) | 100 00 (85 9) | 100 00 (85 90) | 100 00 (85 9) | 100.00 (85 94) |
| May | 6 66 (13.6) | 0 00 (4 05) | 3 33 (8.85) | 3 33 (5 65) | 3 33 (8.8) | 0 00 (8.8) | 1 11 (8.84) | 1 11 (8.84) | 93.34 (76.55) | 100 00 (85 90) | 96.67 (81 1) | 96 67 (81.15) |
| June | 10.00 (18.43) | 3 33 (8 8) | 13 33 (21.1) | 8 88 (7.25) | 3 33 (8.8) | 0 00 (8.8) | 2 22 (16 14) | 2 22 (16 14) | 90.00 (71.5) | 96.67 (81 1) | 86.67 (68 8) | 91.12 (73 86) |
| July | 13.33 (21.1) | 6 66 (13.7) | 20 00 (26 5) | 13 33 (8 85) | 3 33 (8.8) | 3 33 (8.8) | 3 33 (20.45) | 3 33 (20.45) | 86 67 (68.8) | 93 34 (76.3) | 80 00 (63 4) | 86 67 (69 55) |
| August | 46 66 (43.0) | 16 66 (23 3) | 33 33 (35 2) | 32.22 (10 75) | 20 00 (26.5) | 3 33 (26 5) | 13.33 (33.88) | 13.33 (33.88) | 53.54 (46 9) | 83 34 (66 6) | 66.67 (84 7) | 67 78 (56 11) |
| September | 66 66 (54 9) | 20 00 (26 5) | 30 00 (35.0) | 38 88 (26 74) | 33.33 (35 2) | 10 00 (35 2) | 21.21 (38.25) | 21.21 (38.25) | 33.34 (35 0) | 80 00 (63.4) | 70 00 (56.7) | 61 12 (51 74) |
| October | 43.33 (41 0) | 16 66 (23 8) | 23 33 (28.2) | 3 99 (21 76) | 30 00 (33.2) | 6 66 (33.2) | 15.15 (31 07) | 15.15 (31 07) | 56.64 (48 0) | 83.34 (66.1) | 76.67 (61 7) | 69 01 (58.93) |
| November | 33.33 (35.2) | 16 66 (23.8) | 10 00 (16.2) | 19.99 (12.96) | 13 33 (21 1) | 3 33 (21.1) | 6.66 (25 14) | 6.66 (25 14) | 66.67 (54.7) | 83 34 (66.1) | 90.00 (73.6) | 80 01 (64 86) |
| December | 26 66 (30.5) | 16 6 (23 8) | 66.66 (13.2) | 16 44 (8.84) | 10 00 (18.4) | 0 00 (18.4) | 3 33 (22 83) | 3 33 (22 83) | 73.34 (59.0) | 83 34 (66 1) | 93.34 (76 3) | 85.56 (67 70) |
| January | 20.00 (26 5) | 10 00 (18 4) | 3 33 (8.85) | 11.1 (7.25) | 13 33 (8 8) | 3 33 (8 8) | 2 22 (17.95) | 2 22 (17.95) | 80.00 (63 4) | 90 00 (71 5) | 96.67 (81.1) | 88 89 (72 05) |
| February | 6 66 (13.6) | 23.33 (28 2) | 3 33 (8.85) | 11.11 (10.44) | 3 33 (8 8) | 6 66 (8 8) | 4.44 (16.92) | 4.44 (16.92) | 93.34 (76 3) | 76 67 (61 7) | 96.67 (81.1) | 88 89 (73.07) |
| March | 6 66 (13.6) | 16.66 (23.3) | 6 66 (13 6) | 9 99 (9 75) | 0 00 (4 05) | 10 00 (4 05) | 4 44 (16.88) | 4 44 (16.88) | 43.34 (76.3) | 83 34 (66 6) | 93.34 (76.3) | 90.01 (73.12) |
| Mean | 26 37 | 18.51 | 18 22 | 21.03 | 15.57 | 15 57 | 13 97 | 13 97 | 63.62 | 71 48 | 71 77 | 68.62 |
| Sem ± | 3 31 | 3 52 | 3 85 | 8 98 | 3 30 | 3 30 | 3 25 | 3 25 | 3 31 | 3 52 | 3 85 | 3 36 |
| CD (5%) | 9 72 | 10 34 | 11 31 | 18 58 | 9 70 | 9 70 | 9 55 | 9 55 | 9.72 | 10 34 | 11 31 | 8 32 |

Soft wood grafting in clove: The experiment was conducted from 2000-2001 to 2002-2003.

The sprouting of grafts recorded during September was highest (38.88%) followed by August (32.22%). In the month of April total failure of grafts for three consecutive years was recorded. During August to October, the sprouting was more as compared to other months in a year. The mortality was highest during April (100%) followed by May (96.67%). The success of clove grafting on jamun rootstock is low (Table 131).

Yercaud/Pechiparai

Final report not submitted.

TSP/CM/2 Irrigation Trial

TSP/CM/2.1 Drip irrigation in clove and nutmeg

(Yercaud)

Yercaud

Final report not submitted.

TSP/CP/1 Disease Management Trial

TSP/CP/1.1 Survey for disease incidence in tree spices

(Dapoli, Yercaud/Pechiparai and Ambalavayal)

Dapoli

A survey was conducted to assess the incidence of various diseases in nutmeg and cinnamon. In nutmeg, shot hole (*Colletotrichum gloeosporioides*) disease incidence was low to moderate. Sudden death/wither tip disease was observed in all orchards visited, the intensity of which ranged from low to moderate. Low incidence of die back, fruit rot was observed in few orchards. Pink disease was low to moderate in the incidence.

In cinnamon in all seven locations visited showed low to moderate incidence of pink disease, low incidence of leaf blight and leaf spot diseases.

In clove, leaf rot (*Cylindrocladium quinqueseptatum*) was observed to be a major disease having moderate to high incidence of disease in the four locations surveyed. Sudden death of branches was also observed with low intensity.

Ambalavayal

The survey will be done during 2003-04.

Yercaud/Pechiparai

Report not received.

CORIANDER

COR/CI/1 Genetic Resources

COR/CI/1.1 Germplasm collection, description, characterization, evaluation, conservation and screening against diseases

(Jobner, Jagudan, Guntur, Kumarganj, Coimbatore, Hisar and Dholi)

Coimbatore

The centre maintains 224 accessions of coriander. Among the 224 accessions evaluated in RBD during kharif season 2002, CS - 76 recorded the highest yield of 878 kg ha⁻¹ followed by CS - 131 (863 kg ha⁻¹) and CS - 104 (857 kg ha⁻¹). Seven accessions, CS - 116, CS - 18, CS - 119, CS - 219, CS - 181, CS - 120 and CS - 192 registered an yield of 849, 840, 837, 830, 827, 820 and 810 kg ha⁻¹ respectively. A yield of more than 700 kg ha⁻¹ was recorded in 26 accessions and it was more than 600 kg ha⁻¹ in 80 accessions. The accession CS - 207 recorded the lowest yield of 275 kg ha⁻¹ (Table 132).

Two hundred and twenty four accessions were screened for their reaction to powdery mildew disease using 0-5 scale. Among these, none was found resistant to the disease. Fourteen accessions showed moderately resistant reaction to the disease with grade ranging from 1.3 to 1.8. Thirty eight accessions were moderately susceptible, 115 were susceptible and 37 were highly susceptible to the disease.

Forty accessions of coriander were selected from 224 accessions maintained at this center and further evaluated for their growth and green leaf yield. Among these, thirteen accessions CS - 4, CS - 5, CS - 15, CS - 24, CS - 82, CS - 219, CS - 226,

CS - 228, CS - 229, CS - 236, CS - 239, CS - 6-2-1 and CS - 11-3-2 were identified for their high yield of greens.

Table 132. Performance of promising germplasm accessions of coriander - Coimbatore

| Acc. No. | Yield (g plot ⁻¹) | Yield (kg ha ⁻¹) |
|----------|-------------------------------|------------------------------|
| CS - 36 | 338 | 675 |
| CS - 40 | 292 | 583 |
| CS - 131 | 432 | 863 |
| CS - 76 | 439 | 878 |
| CS - 80 | 325 | 650 |
| CS - 171 | 315 | 630 |
| CS - 116 | 425 | 849 |
| CS - 120 | 410 | 820 |
| CS - 211 | 351 | 701 |

Jagudan

A total of 22 accessions are being maintained at this centre. Out of 91 entries of germplasm evaluated at this station for yield and yield attributes, Dhana - 89, EC - 357849, 350690, 363974 and Moroccan (EC) were identified as promising which gave yield more than 500 g plot⁻¹.

Hisar

This centre maintains 89 genotypes. All these accessions were evaluated in two row plots of 2.5 meter length (2.5 sq. m.) using Hisar Anand, Narnaul Selection and Pant Haritima as checks during 2001-2002. The seed yield ranged from 260 g (DH - 229) to 440 g (DH - 224). Forty-four lines gave higher seed yield than Hisar Anand, 70 higher than Narnaul Selection and 73 than Pant Haritima. The most promising lines for seed yield were DH - 220, DH - 221, DH - 224, DH - 228, DH - 236, DH - 240, DH - 244 and DH - 266 (Table 133).

Table 133. Performance of coriander genotypes (2000-01 and 2001-02) - Hisar

| Accession | Seed yield (g plot ⁻¹) | | |
|-----------|------------------------------------|---------|------|
| | 2000-01 | 2001-02 | Mean |
| DH - 220 | 550 | 390 | 470 |
| DH - 221 | 450 | 390 | 420 |
| DH - 224 | 467 | 440 | 454 |
| DH - 228 | 450 | 420 | 435 |
| DH - 236 | 515 | 390 | 453 |
| DH - 240 | 475 | 390 | 433 |
| DH - 244 | 515 | 400 | 458 |
| DH - 266 | 405 | 390 | 398 |

Guntur

The programme was started in 1975. At present the centre maintains 120 genotypes. During 2002-03, rabi season, 110 accessions were evaluated. Among them LCC - 219 recorded highest yield of 795 kg ha⁻¹ followed by LCC - 213, LCC - 229, LCC - 210, LCC - 160 with 753, 711, 662 and 612 kg ha⁻¹ respectively. The check, Sadhana recorded an yield of 390 kg ha⁻¹.

Jobner

The centre maintains 182 accessions. Out of 12 entries screened against diseases (wilt and powdery mildew) RCr - 41 (check), RCr - 684 (check) and UD - 262 were found promising for higher yield and minimum disease incidence (Table 134).

Table 134. Screening of coriander entries under CVT against diseases - Jobner

| Entry | Wilt (%) | Powdery mildew(0-5) | Yield (kg ha ⁻¹) |
|----------|----------|---------------------|------------------------------|
| UD - 262 | 0.00 | 1.00 | 1075 |
| UD - 743 | 4.00 | 3.00 | 738 |
| UD - 744 | 4.00 | 3.00 | 757 |
| DH - 208 | 5.00 | 5.00 | 739 |

| | | | |
|--------------|--------|------|------|
| DH - 246 | 4.00 | 3.00 | 639 |
| J.Co - 283 | 3.00 | 4.00 | 544 |
| J.Co - 387 | 3.00 | 5.00 | 308 |
| LCC - 128 | 2.00 | 5.00 | 237 |
| LCC - 129 | 2.00 | 5.00 | 213 |
| RCr - 684 Ch | 0.00 | 1.00 | 1183 |
| RCr - 41 Ch | 3.00 | 1.00 | 1278 |
| Local Check | 8.00 | 4.00 | 592 |
| CD (5%) | 1.11 | - | 113 |
| CV % | 23.86- | - | 965 |

Out of the 20 entries of coriander screened against wilt and powdery mildew disease, NS - 2, RCr - 435 and UD - 728 were found promising for yield with minimum disease incidence (Table 135)

Table 135. Screening of coriander entries under IET against diseases - Jobner

| Entry | Wilt (%) | Powdery mildew(0-5) | Yield (kg ha ⁻¹) |
|-------------|----------|---------------------|------------------------------|
| UD - 36 | 3.00 | 3.00 | 486 |
| UD - 42 | 2.75 | 3.00 | 469 |
| UD - 92 | 3.00 | 3.00 | 469 |
| UD - 119 | 4.00 | 4.00 | 277 |
| UD - 310 | 2.25 | 4.00 | 260 |
| UD - 317 | 2.00 | 4.00 | 417 |
| UD - 380 | 2.00 | 4.00 | 417 |
| UD - 426 | 4.00 | 3.00 | 382 |
| UD - 483 | 4.00 | 3.00 | 277 |
| UD - 529 | 4.25 | 3.00 | 330 |
| UD - 530 | 3.00 | 3.00 | 313 |
| UD - 728 | 0.00 | 1.00 | 764 |
| UD - 748 | 3.00 | 4.00 | 326 |
| NS - 1 | 4.00 | 5.00 | 208 |
| NS - 2 | 0.00 | 1.00 | 868 |
| RCr - 435 | 0.00 | 1.00 | 830 |
| RCr - 436 | 1.00 | 3.00 | 277 |
| RCr - 446 | 0.00 | 1.00 | 555 |
| RCr - 684 | 0.00 | 1.00 | 483 |
| Local check | 3.25 | 5.00 | 243 |
| CD (5%) | 1.25 | - | 096 |
| CV % | 29.35 | - | 1349 |

Out of 20 entries of coriander screened against stem gall disease, RCr - 41, RCi - 435 and RCr - 436 were found immune. UD - 446, UD - 684, UD - 685 and UD - 686 were found moderately resistant to highly susceptible to the disease (Table 136).

Table 136. Screening of coriander entries against stem gall disease (2001-2002) at Danta

| Disease reaction | Entries |
|-----------------------------|---|
| Immanue (I) - 0 | RCi - 41, UD - 435 and UD - 436 |
| Resistant (R) - 1 | RCi - 262, RCi - 446, RCi - 684, RCr - 685, RCr - 686 |
| Moderate resistant (MR) - 2 | UD - 118, UD - 358, UD - 480 and UD - 747 |
| Susceptible - 3 | UD - 88, UD - 340, UD - 742, UD - 743, UD - 746, UD - 749, UD - 752, UD - 753 |
| Highly susceptible - 4 | Nil |

Out of 20 entries screened against root knot nematode, RCr - 41, UD - 262, RCr - 446, and UD - 751 were found resistant and rest were moderately resistant to highly susceptible to the nematode (Table 137).

Table 137. Screening of coriander germplasm against root knot nematode (2001-2002) – Jobner

| Category | Galling | Entry |
|-------------------------|--------------|--|
| Immanue (I) | No galls | Nil |
| Resistant (R) | 1-10 galls | RCr - 41, UD - 262, UD - 446, UD - 751 |
| Moderate resistant (MR) | 11-30 galls | RCr - 435, RCr - 436, UD - 118, UD - 358, UD - 480, UD - 747 |
| Susceptible | 31-100 galls | UD - 88, UD - 340, UD - 742, UD - 743, UD - 746, UD - 749 UD - 752, UD - 753 |
| Highly susceptible | > 100 galls | Nil |

Kumarganj

At present this centre maintained and evaluated 65 accessions during 2002-03. Out of this, K selection produced maximum seed yield of 20.22 q ha⁻¹. ND Cor - 2 and Pant Haritma were at par with K selection, yielding 19.45 and 19.27 q ha⁻¹ of seed yield, respectively. On the basis of three years yield data, K selection produced maximum seed yield of 19.16 q ha⁻¹ followed by ND Cor - 2 (18.88 q ha⁻¹) (Table 138).

Table 138. Performance of coriander germplasm - Kumarganj

| Germplasm | Yield (q ha ⁻¹) | | | Mean |
|--------------|-----------------------------|---------|---------|-------|
| | 2000-01 | 2001-02 | 2002-03 | |
| NDCor - 1 | 16.10 | 18.00 | 18.97 | 17.52 |
| NDCor - 2 | 17.33 | 19.73 | 19.45 | 18.88 |
| NDCor - 3 | 15.13 | 12.67 | 13.58 | 13.79 |
| NDCor - 4 | 16.00 | 10.39 | 11.86 | 12.75 |
| NDCor - 5 | 13.64 | 10.33 | 10.42 | 11.46 |
| NDCor - 6 | 15.33 | 8.33 | 13.48 | 12.38 |
| NDCor - 7 | 15.13 | 16.33 | 16.25 | 15.90 |
| NDCor - 8 | 15.20 | 17.33 | 15.28 | 15.93 |
| NDCor - 9 | 13.00 | 12.33 | 13.80 | 13.04 |
| NDCor - 10 | 14.60 | 12.00 | 13.96 | 13.52 |
| NDCor - 11 | 15.73 | 10.00 | 11.81 | 12.51 |
| NDCor - 12 | 15.67 | 10.68 | 15.97 | 14.10 |
| NDCor - 13 | 15.27 | 17.00 | 13.50 | 15.25 |
| NDCor - 14 | 15.10 | 17.33 | 18.75 | 17.06 |
| NDCor - 15 | 15.53 | 13.00 | 14.77 | 14.43 |
| NDCor - 16 | 15.03 | 13.00 | 15.43 | 14.48 |
| NDCor - 17 | 14.90 | 17.33 | 16.08 | 16.10 |
| NDCor - 18 | 13.67 | 17.33 | 15.28 | 15.43 |
| NDCor - 19 | 16.37 | 15.67 | 15.99 | 16.01 |
| NDCor - 20 | 15.97 | 17.00 | 16.85 | 16.60 |
| NDCor - 21 | 15.20 | 16.00 | 16.03 | 15.74 |
| NDCor - 22 | 16.40 | 11.67 | 15.97 | 14.68 |
| NDCor - 23 | 15.20 | 15.47 | 17.35 | 16.00 |
| NDCor - 24 | 13.80 | 10.33 | 12.50 | 12.21 |
| NDCor - 25 | 13.83 | 15.33 | 14.94 | 14.70 |
| NDCor - 26 | 15.33 | 18.67 | 18.08 | 17.36 |
| NDCor - 27 | 15.60 | 11.00 | 14.06 | 13.55 |
| NDCor - 280 | 14.93 | 11.33 | 13.74 | 13.33 |
| NDCor - 29 | 14.67 | 9.67 | 11.11 | 11.81 |
| NDCor - 30 | 15.13 | 19.33 | 18.64 | 17.77 |
| NDCor - 31 | 10.56 | 18.13 | 18.36 | 15.68 |
| NDCor - 32 | 16.03 | 17.00 | 17.37 | 16.79 |
| NDCor - 33 | 11.00 | 18.33 | 18.46 | 15.93 |
| NDCor - 34 | 16.07 | 18.00 | 17.36 | 17.14 |
| NDCor - 35 | 9.13 | 19.33 | 15.04 | 14.49 |
| NDCor - 36 | 16.73 | 18.67 | 15.17 | 16.85 |
| NDCor - 37 | 15.73 | 18.00 | 16.57 | 16.76 |
| NDCor - 380 | 11.80 | 18.67 | 14.44 | 14.97 |
| Pant Haritma | 17.10 | 12.67 | 19.27 | 16.34 |
| K selection | 17.28 | 20.00 | 20.22 | 19.16 |
| CD (5%) | 1.03 | 5.66 | 1.09 | |
| CV% | - | 22.52 | 4.44 | |

Dholi

The trial was started during 2002-03 in RBD. Out of eighty five genotypes evaluated, six accessions RD - 120, RD - 121, RD - 154, RD - 366, RD - 365 and RD - 373 were found to be promising for yield and hence were selected for IET.

COR/CI/2 Coordinated Varietal Trial (CVT)

COR/CI/2.1 CVT 1993 Series II

(*Raigarh and Kumarganj*)

Raigarh

Trial was conducted with fourteen entries including two local checks. J Cor - 360 gave maximum yield (1628.1 kg ha⁻¹), followed by LCC - 133, MD Cor - 2, UD - 480, UD - 118, DH - 234 and DH - 205 (Table 139).

Table 139. Performance of coriander accessions under CVT (pooled data) - Raigarh

| Entry | Yield (g 3 m ² , plot) | Converted yield (kg ha ⁻¹) | | | | | Mean |
|--------------|--------------------------------------|--|------|------|------|------|-------|
| | | 2002 | 2001 | 2000 | 1999 | 1998 | |
| JCO - 283 | - | - | 593 | 453 | 1200 | - | 7.48 |
| LCC - 133 | 518.00 | 1427.10 | 436 | 677 | 911 | 870 | 7.23 |
| JCO - 387 | - | - | 609 | 1644 | 1144 | - | 11.32 |
| LCC - 128 | 445.00 | 894.45 | 237 | 371 | 900 | 810 | 5.77 |
| UD - 744 | 169.65 | - | 341 | 1488 | 1000 | - | 9.43 |
| DH - 208 | 234.32 | - | 471 | 588 | 988 | 460 | 6.26 |
| DH - 246 | 265.07 | - | 534 | 733 | 1416 | 900 | 8.96 |
| UD - 743 | 149.75 | - | 301 | 1255 | 1080 | - | 8.78 |
| IC - 01-1 | 575.00 | 1155.70 | 816 | | | | |
| IC - 01-2 | 325.00 | 653.20 | 1032 | | | | |
| DH - 205 | 655.00 | 1316.50 | | | | | |
| DH - 234 | 660.00 | 1326.60 | | | | | |
| UD - 118 | 665.00 | 1336.50 | | | | | |
| UD - 480 | 695.00 | 1396.90 | | | | | |
| KGS | 535.00 | 1075.30 | | | | | |
| MD - Cor - 2 | 675.00 | 1406.70 | | | | | |
| Jcor - 328 | 595.00 | 1195.90 | | | | | |
| Jcor - 360 | 810.00 | 1628.10 | | | | | |
| LCC - 174 | 595.00 | 1195.90 | | | | | |
| LCC - 1225 | 330.00 | | | | | | |
| CD (5%) | 340.69 | | | | | | |
| CV % | 13.24 | | | | | | |

Kumarganj

The project is closed. Final report not submitted.

COR/CI/2.2 CVT 1996 Series III (Kumarganj, Dhohi, Jobner and Hisar)

Kumarganj

The trial was initiated during 1996 in RBD. On the basis of four years data it is

concluded that UD - 685 produced maximum seed yield of 17.46 q ha⁻¹ followed by DH - 48, RD - 23, Rajendra Swati (17.28, 17.26, 17.27 q ha⁻¹ respectively) which were at par with UD - 685 (Table 140)

Table 140. Performance of coriander accessions under CVT (1996-2000) -Kumarganj

| Entry | Yield (q ha ⁻¹) | | | | Mean |
|----------------|-----------------------------|---------|---------|-----------|-------|
| | 1996-97 | 1997-98 | 1998-99 | 1999-2000 | |
| UD - 685 | 14.22 | 16.81 | 19.58 | 19.25 | 17.46 |
| UD - 686 | 16.10 | 20.11 | 15.44 | 15.64 | 16.82 |
| DH - 48 | 14.04 | 18.07 | 18.50 | 18.51 | 17.28 |
| DH - 52 | 16.10 | 17.61 | 14.52 | 14.90 | 15.78 |
| RD - 23 | 18.95 | 17.12 | 16.38 | 16.57 | 17.26 |
| RD - 120 | 15.18 | 20.42 | 15.91 | 16.10 | 16.90 |
| Rajendra swati | 16.47 | 18.56 | 16.94 | 17.12 | 17.27 |

Jobner

The trial was started during 1999-2000 rabi with 12 entries in RBD. Plant height, varied from 47.3 (LCC - 133) to 87.9 cm (local check), umbels per plant from 12.6 (LCC - 128 to 44.5 (JCO - 283), umbellets per umbel from 3.7 (LCC - 128) to 6.8 (RCr - 41, check), seeds per umbel from 12.1 (LCC

- 128) to 48.6 (RCr - 41, check). RCr - 41 (check) recorded maximum seed yield of 1278 kg ha⁻¹ followed by RCr - 684 (check, 1183 kg ha⁻¹), UD - 262 (1075 kg ha⁻¹), UD - 744 (757 kg ha⁻¹) and DH - 208 (739 kg ha⁻¹), while the lowest yield of 213 kg ha⁻¹ was recorded in LCC - 133 (Table 141).

Table 141. Performance of coriander accessions under CVT – Jobner

| Entry | Days to flowering | Plant - height (cm) | Branches plant ⁻¹ | Umbels plant ⁻¹ | Umbellets umbel ⁻¹ | Seeds umbel ⁻¹ | Test weight (g) | Seed yield (kg ha ⁻¹) |
|-------------|-------------------|---------------------|------------------------------|----------------------------|-------------------------------|---------------------------|-----------------|-----------------------------------|
| RCr - 41 | 87.3 | 75.9 | 8.3 | 27.1 | 6.8 | 48.6 | 8.6 | 1278 |
| RCr - 684 | 73.3 | 75.9 | 9.2 | 35.3 | 5.4 | 27.2 | 14.4 | 1183 |
| UD - 262 | 69.3 | 65.0 | 8.7 | 43.1 | 4.5 | 18.6 | 10.8 | 1075 |
| UD - 744 | 77.7 | 73.1 | 7.0 | 29.8 | 5.0 | 18.9 | 14.2 | 757 |
| DH - 208 | 73.3 | 78.3 | 7.3 | 33.3 | 4.5 | 18.7 | 13.0 | 739 |
| UD - 743 | 79.3 | 82.3 | 6.3 | 23.9 | 4.5 | 17.4 | 10.7 | 738 |
| DH - 246 | 74.3 | 78.9 | 8.3 | 35.4 | 5.0 | 23.3 | 12.8 | 639 |
| Local check | 74.3 | 87.9 | 5.5 | 18.1 | 4.1 | 18.3 | 8.6 | 592 |
| JCO - 283 | 69.7 | 80.7 | 9.1 | 44.5 | 5.0 | 21.7 | 13.7 | 544 |
| JCO - 387 | 70.3 | 71.9 | 7.1 | 26.6 | 3.9 | 20.3 | 13.5 | 308 |
| LCC - 128 | 58.7 | 51.5 | 4.6 | 12.6 | 3.7 | 12.1 | 15.1 | 237 |
| LCC - 133 | 59.0 | 47.3 | 4.9 | 19.0 | 4.2 | 14.1 | 14.8 | 213 |
| CD (5%) | 2.76 | 5.91 | 0.66 | 6.62 | 0.64 | 7.13 | 0.81 | 113 |
| CV% | 2.25 | 4.82 | 5.45 | 13.4 | 8.0 | 19.5 | 3.78 | 965 |

Dholi and Hisar

The project is concluded. Final report not submitted.

COR/CI/2.3 CVT 1998 - Series IV

(*Jobner, Jagudan, Guntur, Hisar, and Dholi*)

Jagudan

A trial was undertaken for three seasons during 1999-2000 to 2001-02. Nine entries (DH - 208 & 246 from Hisar; J.Cori - 283 & 287 from Jagudan, LCC - 128 & 133 from Guntur and UD - 743 & 744 from Jobner) including G.Cori-2 as a check were evaluated in RBD with three replications. The trial was concluded.

Significant yield differences were found among entries during all the years and pooled data. J.Cori - 387 gave significantly superior yield (1923 kg ha⁻¹) during 1999-2000. During 2000-01, J.Cori - 283 and LCC - 13 had given higher yield (1713 kg ha⁻¹ and 1653 kg ha⁻¹ respectively) than G.Cori - 2. However, during 2001-02, none of the entries recorded significantly more yield than check

The pooled data over three years revealed that none of the entries was found significantly superior to check for yield. However J.Cori - 283 gave 8.85 % higher yield (1734 kg ha⁻¹) than control (Table 142).

Table 142. Performance of coriander accessions under CVT (pooled data) - Jagudan

| Entry | Yield (kg ha ⁻¹) | | | Average yield (kg ha ⁻¹) | Increase over control (%) |
|---------------------|------------------------------|---------|---------|--------------------------------------|---------------------------|
| | 1999-00 | 2000-01 | 2001-02 | | |
| DH - 208 | 1634 | 1623 | 1465 | 1574 | - |
| DH - 246 | 1481 | 1460 | 1176 | 1372 | - |
| J.Cori. - 283 | 1868 | 1713 | 1620 | 1734 | 8.85 |
| J.Cori. - 387 | 1923 | 1547 | 1514 | 1661 | 4.27 |
| LCC - 128 | 1727 | 1476 | 1457 | 1553 | - |
| LCC - 133 | 1629 | 1653 | 1629 | 1637 | 2.76 |
| UD - 743 | 1307 | 1152 | 1133 | 1197 | - |
| UD - 744 | 1634 | 1171 | 1269 | 1358 | - |
| G.Cori. - 2 (check) | 1678 | 1528 | 1574 | 1593 | - |
| CD (5%) | 197 | 346 | 244 | 150 | |
| CV% | 6.88 | 13.48 | 9.87 | 10.23 | |

Hisar

The trial was initiated during 1999-2000 with 10 genotypes in RBD. Significant differences were observed for all the parameters. Plant height ranged from 53.8 to 86.1 cm; number of branches from 5.6 to

7.5; umbel per plant 38.7 to 77.0; umbellets per umbel 3.9 to 6.2 and seeds per umbel from 17.3 to 34.8. Maximum seed yield (1950 kg ha⁻¹) was recorded in DH - 246, followed by DH - 208 and JCO - 283.

During 1999-2000 to 2001-2002, significant differences were obtained for all the parameters except for umbellets per umbel. Plant height among different cultivars ranged from 45.7 to 77.7 cm, number of branches from 5.4 to 7.3, umbels per plant from 44.3 to 84.7 and seeds per umbellet from 23.0 to 33.5. Maximum number seeds per umbellet and seeds per umbel were recorded

for the variety DH - 246, followed by Narnaul Selection and DH - 208.

On the basis of average yield for three years (Table 143), maximum seed yield was recorded in DH - 246 (19.97 q ha⁻¹), which was significantly higher than all other cultivars followed by DH - 208 (18.37 q ha⁻¹) and JCO - 283 (16.63 q ha⁻¹).

Table 143. Performance of coriander accessions under CVT (1999-2000 to 2000-2001) - Hisar

| Entry | Seed yield (kg ha ⁻¹) | | | | Increase/decrease over check (%) |
|-----------------|-----------------------------------|---------|---------|-------|----------------------------------|
| | 1999-00 | 2000-01 | 2001-02 | Mean | |
| LCC - 128 | 11.8 | 12.4 | 11.9 | 12.03 | -19.8 |
| LCC - 133 | 12.2 | 13.1 | 14.6 | 13.30 | -11.3 |
| DH - 208 | 17.8 | 19.9 | 17.4 | 18.37 | 22.5 |
| DH - 246 | 18.6 | 21.8 | 19.5 | 19.97 | 33.1 |
| JCO - 283 | 16.6 | 16.4 | 16.9 | 16.63 | 10.9 |
| JCO - 387 | 16.1 | 17.3 | 16.4 | 16.60 | 10.7 |
| UD - 743 | 16.1 | 16.6 | 16.3 | 16.33 | 8.9 |
| UD - 744 | 16.7 | 15.8 | 14.3 | 15.60 | 4.0 |
| Hisar Anand | 15.0 | 16.2 | 15.3 | 15.50 | 3.3 |
| Narnaul Sel.(C) | 13.6 | 16.5 | 14.9 | 15.00 | - |
| CD (5%) | 1.4 | 2.1 | 1.9 | 1.52 | - |

Guntur

The CVT was initiated during 1999-2000 with 9 genotypes in RBD. During 2002-03 rabi season, nine promising accessions from different coordinating centers were evaluated in Randomized Block Design, replicated thrice. Due to heavy rainfall and prolonged drought in the kharif and rabi seasons, germination was affected resulting in poor yields. However, significant differences for all the characters were observed except for plant height. Number of primary branches was maximum in LCC - 128

(6.8) and low in UD - 744 (4.0). LCC - 128 (8.8) and LCC - 133 (8.1) recorded significantly more number of secondary branches than all other entries. Number of umbels per plant was more in LCC - 128 (11.3) and least in DH - 246 (7.4). More number of umbellets per umbel and number of mericarps were recorded in LCC - 128 (8.1 and 46.8, respectively) than other entries. With regards to yield, LCC - 128 recorded significantly higher yield (575 kg ha⁻¹) than all other entries and lowest yield was recorded in DH - 246 (108 kg ha⁻¹).

Jobner

The trial was conducted with 12 entries including three from Jobner (UD - 262, UD - 743 and UD - 744), two from Hissar (DH - 208 and DH - 246), two from Jagudan (JCO - 283 and JCO - 387) and two from Guntur (LCC - 128 and LCC - 133) with three checks (RCr - 41, RCr - 684 and local) were evaluated in RBD with three replications. The project is closed.

During 2001-2002, the mean days to flowering ranged from 58.7 (LCC - 128) to 87.3 days (RCr - 41 check), plant height from 47.3 (LCC - 133) to 87.9 cm (local check), branches per plant from 4-6 (LCC - 128) to 9.2 (RCr - 684), umbels per plant from 12.6 (LCC - 128) to 44.5 (JCO - 283), umbellets per umbel from 3.7 (LCC - 128) to 6.8 (RCr

- 41, check), seeds per umbel from 12.1 (LCC - 128) to 48.6 (RCr - 41, check), test weight from 8.6 (RCr - 41, check) to 15.1 g (LCC - 128). RCr - 41 (check) recorded maximum seed yield of 1278 kg ha⁻¹ followed by RCr - 684 (check, 1183 kg ha⁻¹), UD - 262 (10.75 kg ha⁻¹), UD - 744 (757 kg ha⁻¹) and DH - 208 (739 kg ha⁻¹), while lowest yield of 213 kg ha⁻¹ was recorded in LCC - 133.

The mean seed yield of pooled data (1999-2000, 2000-2001 and 2001-2002) indicated superior performance of RCr - 41 (check) with 1183 kg ha⁻¹, followed by RCr - 684 (check, 1078 kg ha⁻¹), DH - 246 (996 kg ha⁻¹), UD - 743 (992 kg ha⁻¹) and UD - 744 (983 kg ha⁻¹), while lowest yield of 270 kg ha⁻¹ was recorded in JCO - 387 (Table 144).

Table 144. Performance of coriander entries under CVT (pooled data) - Jobner

| Entry | Yield (kg ha ⁻¹) | | | Mean |
|-----------|------------------------------|-----------|-----------|------|
| | 1999-2000 | 2000-2001 | 2001-2002 | |
| RCr - 41C | 1308 | 962 | 1278 | 1183 |
| RCr - 684 | - | 973 | 1183 | 1078 |
| DH - 246 | 1576 | 772 | 639 | 996 |
| UD - 743 | 1420 | 819 | 738 | 992 |
| UD - 744 | 1641 | 417 | 757 | 983 |
| UD - 262 | - | 805 | 1075 | 940 |
| DH - 208 | 1204 | 755 | 739 | 899 |
| Jco - 283 | - | 875 | 544 | 710 |
| L. check | 905 | 278 | 592 | 592 |
| LCC - 128 | 482 | 243 | 237 | 321 |
| LCC - 133 | 482 | 191 | 213 | 295 |
| Jco - 387 | - | 232 | 308 | 270 |
| CD (5%) | 363 | 071 | 113 | - |
| CV % | 112.91 | 6.90 | 9.65 | - |

Dholi

The trial was started during 1999-2000 with 7 genotypes in RBD. Data showed non-significant differences among the entries regarding plant height, but JCC - 283 proved significantly superior to check for number of branches and number of umbels per plant (8.73 and 37.33, respectively). LCC - 128

and LCC - 133 are early maturing types (133 days). JCO - 283 and JCO - 287 were late maturing types (152 and 150 days, respectively). No significant differences were observed for yield but DH - 246 gave 2.41% higher grain yield over check (Rajendra Swati) (Table 145).

Table 145. Performance of coriander entries under CVT (2002-2003) – Dholi

| Genotype | Days to maturity | Grain yield | | Increase/decrease in yield over check (%) |
|-----------------|------------------|-----------------------|--------------------|---|
| | | kg plot ⁻¹ | t ha ⁻¹ | |
| JCO - 283 | 152.00 | 0.50 | 0.69 | -16.87 |
| JCO - 387 | 150.00 | 0.33 | 0.46 | -44.58 |
| LCC - 128 | 133.00 | 0.33 | 0.46 | -44.58 |
| LCC - 133 | 133.00 | 0.35 | 0.49 | -40.96 |
| DH - 208 | 149.33 | 0.35 | 0.49 | -4.96 |
| DH - 246 | 146.67 | 0.61 | 0.85 | 2.41 |
| R.Swati (check) | 136.00 | 0.60 | 0.83 | - |
| CD (5%) | 3.08 | 0.13 | 0.15 | - |
| CV (%) | 1.00 | 16.14 | 14.66 | - |

COR/CI/2.4 CVT 2001 Series V

(*Dholi, Guntur, Kumarganj, Coimbatore and Jagudan*)

Dholi

The trial was started during 2002-03 in RBD with 14 genotypes. LCC - 128 matured

early (133.33 days) while local check Pant Haritima was a late maturity (153 days) type. Non-significant differences were recorded for grain yield, but RD - 120 was superior to check (Pant Haritima) with 6.48% higher grain yield (Table 146).

Table 146. Performance of coriander entries under CVT - Dholi

| Genotype | No. of days to maturity | Yield | | Increase/decrease in yield over check (%) |
|-----------|-------------------------|-----------------------|--------------------|---|
| | | kg plot ⁻¹ | t ha ⁻¹ | |
| LCC - 128 | 133.33 | 0.28 | 0.93 | -71.94 |
| LCC - 133 | 137.00 | 0.28 | 0.39 | -71.94 |
| LCC - 174 | 135.00 | 0.25 | 0.35 | -74.82 |
| LCC - 225 | 135.00 | 0.25 | 0.35 | -74.00 |
| JCO - 328 | 146.00 | 0.52 | 0.72 | -48.20 |
| JCO - 360 | 146.00 | 0.27 | 0.37 | -73.38 |
| DH - 205 | 150.00 | 0.60 | 0.83 | -40.29 |
| DH - 234 | 150.00 | 0.60 | 0.83 | -40.29 |

| | | | | |
|-----------------------|--------|-------|-------|--------|
| RD - 12000 | 135.00 | 1.07 | 1.48 | 6.48 |
| RD - 121 | 137.00 | 0.93 | 1.29 | -7.19 |
| RD - 154 | 137.00 | 0.92 | 1.27 | -8.63 |
| ND Cor.- 2 | 145.00 | 0.65 | 0.90 | -35.25 |
| Kumarganj Sel. | 145.00 | 0.73 | 1.02 | -26.62 |
| Pant Haritima (check) | 153.00 | 1.00 | 1.39 | |
| CD (5%) | 2.21 | 0.11 | 0.18 | |
| CV% | 0.93 | 10.63 | 12.05 | |

Guntur

During 2002-03 rabi season, ten genotypes were tested with Sadhana as check in Randomized Block Design with three replications. Due to heavy rainfall and prolonged drought in the kharif and rabi seasons germination was affected resulting in poor yields. No significant differences were observed in plant height and number of mericarps. Number of primary and secondary branches were significantly more in LCC - 174 (5.9, 5.7) than check Sadhana (3.7, 3.9) and on par with LCC - 225 (4.3, 4.5). Regarding number of umbels and umbellets per umbel, LCC - 174 (11.3, 8.1) and LCC - 225 (10.9, 8.0)

were significantly superior to check Sadhana (9.0, 6.4) LCC - 174 recorded highest yield of 389 kg ha⁻¹ and on par with LCC - 225 (346 kg ha⁻¹) and significantly superior to the check variety, Sadhana (256 kg ha⁻¹).

Kumarganj

The trial was initiated during 2001 in RBD with 11 genotypes. During the year 2002-03, DH - 234 and ND Cor - 2 produced maximum yield of 21.57 q ha⁻¹ followed by K. selection (20.87 q ha⁻¹). Analysis of three years pooled data revealed that K. selection out yielded other entries, yielding 21.08 q ha⁻¹ of seed, followed by UD - 743 (Table 147).

Table 147. Performance of coriander accessions under CVT (2000 to 03) - Kumarganj

| Entry | Yield (q ha ⁻¹) | | | |
|----------------------|-----------------------------|---------|---------|-------|
| | 2000-01 | 2001-02 | 2002-03 | Mean |
| Rcr - 41 | 18.88 | 22.78 | 20.13 | 20.59 |
| UD - 743 | 16.19 | 26.68 | 19.44 | 20.77 |
| LCC - 135 | 10.41 | 14.12 | 13.88 | 12.80 |
| LCC - 128 | 11.80 | 12.96 | 12.22 | 12.32 |
| UD - 744 | 18.79 | 20.16 | 18.79 | 19.24 |
| JCO - 387 | 15.92 | 22.45 | 17.36 | 18.57 |
| JCO - 283 | 15.73 | 22.45 | 14.58 | 17.58 |
| DH - 208 | 16.47 | 20.83 | 18.28 | 18.52 |
| DH - 246 | 16.94 | 15.24 | 16.66 | 16.28 |
| K.selection (check) | 19.71 | 22.68 | 20.87 | 21.08 |
| CD (5%) | 1.05 | 4.11 | - | - |
| CV % | 16.05 | 5.07 | | |

Coimbatore

An experiment was conducted with 14 entries including the check CO - 3 in RBD with three replications during rabi 2002-2003, the second year. The results revealed that JCO - 283 registered the highest yield of 705 kg ha⁻¹ and it was on par with JCO - 387 which recorded an yield of 687 kg ha⁻¹. UD - 744 recorded the lowest yield of 427.3 kg ha⁻¹ (Table 148)

Table 148. Performance of coriander accessions under CVT - Coimbatore

| Accession | Yield (g plot ⁻¹) | Yield (kg ha ⁻¹) | Increase over check (%) |
|-----------|----------------------------------|---------------------------------|----------------------------|
| LCC - 128 | 265 | 530.30 | - |
| UD - 743 | 245 | 490.00 | - |
| JCO - 387 | 344 | 687.00 | 9.85 |
| DH - 246 | 247 | 493.00 | - |
| UD - 744 | 214 | 427.30 | - |
| DH - 208 | 279 | 558.30 | - |
| JCO - 283 | 353 | 705.00 | 12.73 |
| LCC - 133 | 227 | 454.00 | - |
| UD - 118 | 239 | 478.30 | - |
| DH - 205 | 269 | 537.00 | - |
| DH - 234 | 269 | 538.30 | — |
| JCO - 328 | 274 | 547.20 | - |
| JCO - 36 | 265 | 529.40 | - |
| CO - 3 | 333 | 665.40 | - |
| CD (5%) | - | 54.93 | - |

Jagudan

The trial was initiated with 12 entries during 2002-03. Significant differences were observed for yield but none was found superior to check. However, J Cori - 360, J Cori - 328 gave more yield of 1591 kg ha⁻¹ and 1573 kg ha⁻¹ respectively (Table 149)

Table 149. Performance of coriander accessions under CVT - Jagudan

| Entry | Days 50 % flowering | Days to maturity | Plant ht (cm) | No of bran-ches plant ⁻¹ | No of umbels plant ⁻¹ | No of latesumbel ⁻¹ | No of seeds umbellate ⁻¹ | Volatile oil(%) | 1000seeds wt (g) | Yield (kg ha ⁻¹) | Increase over control (%) |
|------------|---------------------------|---------------------|------------------|---|--|-----------------------------------|---|--------------------|---------------------|---------------------------------|---------------------------------|
| Jcon - 328 | 63 | 116 | 62.7 | 5.4 | 21.1 | 5.7 | 5.6 | - | 15.2 | 1573 | 1.48 |
| Jcon - 360 | 59 | 112 | 69.3 | 6.3 | 39.1 | 6.4 | 6.7 | - | 16.0 | 1591 | 2.12 |
| LCC - 174 | 39 | 94 | 56.5 | 5.3 | 35.6 | 4.8 | 5.4 | - | 18.6 | 950 | - |
| LCC - 225 | 38 | 94 | 58.8 | 5.1 | 24.5 | 5.1 | 6.0 | - | 18.3 | 1005 | - |
| UD - 118 | 69 | 113 | 71.9 | 7.2 | 35.9 | 6.2 | 5.9 | - | 15.4 | 1223 | - |

| | | | | | | | | | | | |
|-----------------|----|-----|------|-----|------|-----|-----|---|------|-------|---|
| UD - 480 | 73 | 114 | 79.4 | 7.2 | 29.7 | 6.2 | 6.3 | - | 11.6 | 982 | - |
| NDCo - 2 | 75 | 120 | 83.1 | 7.3 | 33.4 | 5.7 | 6.1 | - | 13.0 | 1127 | - |
| K.Selection | 68 | 108 | 76.6 | 7.6 | 27.3 | 7.0 | 7.5 | - | 8.4 | 1181 | - |
| DH - 205 | 68 | 110 | 59.8 | 5.5 | 17.9 | 6.1 | 6.7 | - | 13.8 | 1256 | - |
| DH - 234 | 74 | 121 | 74.8 | 6.5 | 37.5 | 6.5 | 6.0 | - | 12.4 | 1401 | - |
| Gco - 2 (check) | 60 | 107 | 74.8 | 6.5 | 36.2 | 6.6 | 5.8 | - | 14.2 | 1558 | - |
| GCo - 1(check) | 55 | 109 | 62.2 | 5.3 | 23.4 | 5.6 | 6.3 | - | 14.0 | 1442 | - |
| CD (5%) | | | | | | | | | | 251 | |
| CV% | | | | | | | | | | 13.68 | |

COR/CI/3.2 Initial Evaluation Trial

(Dholi, Jobner, Guntur, Hisar and Jagudan)

Dholi

The trial was initiated during 2002-03 in RBD with 7 entries. Data showed that RD - 366 had significantly more number of branches per plant (8.27), number of umbels per plant (41.13), grain yield (0.68 kg plot⁻¹ and 1.73 t ha⁻¹) (Table 150).

Table 150. Performance of coriander accessions under (IET) - Dholi

| Genotype | Yield | |
|----------------|-----------------------|--------------------|
| | kg plot ⁻¹ | t ha ⁻¹ |
| RD - 120 | 0.38 | 0.99 |
| RD - 121 | 0.49 | 1.28 |
| RD - 154 | 0.59 | 1.54 |
| RD - 365 | 0.43 | 1.13 |
| RD - 366 | 0.68 | 1.78 |
| RD - 373 | 0.51 | 1.33 |
| R. Swati check | 0.36 | 0.94 |
| SEm ± | 0.03 | 0.08 |
| CD (5%) | 0.10 | 0.25 |
| CV% | 11.11 | 11.05 |

Hisar

The trial was initiated during 1999-2000 in RBD, replicated thrice with 10 entries. The results indicated that DH - 205 and DH - 234 were found significantly superior to check during all the three years (Table 151). DH - 234 produced maximum mean seed yield (20.6 q ha⁻¹) showing 28.4% increase over the check (Hisar Anand), followed by DH - 205 (21.8%). These lines (DH - 205 and DH - 234) have been included in CVT for further evaluation.

Table 151. Performance of coriander accessions under IET (1999-2000 to 2001-2002) – Hisar

| Accession | Yield (q ha ⁻¹) | | | | Increase over check (%) |
|-------------|-----------------------------|-----------|-----------|------|-------------------------|
| | 1999-2000 | 2000-2001 | 2001-2002 | Mean | |
| DH - 205 | 18.4 | 19.4 | 20.9 | 19.6 | 21.8 |
| DH - 211 | 15.9 | 19.1 | 17.9 | 17.6 | 9.8 |
| DH - 218 | 13.9 | 18.9 | 16.7 | 16.5 | 2.8 |
| DH - 229 | 16.0 | 16.5 | 17.8 | 16.8 | 4.4 |
| DH - 234 | 19.4 | 20.6 | 21.9 | 20.6 | 28.4 |
| DH - 242 | 17.8 | 19.3 | 19.9 | 19.0 | 18.3 |
| DH - 245 | 15.7 | 17.2 | 17.9 | 16.9 | 5.4 |
| DH - 256 | 16.9 | 17.9 | 17.7 | 17.5 | 8.9 |
| DH - 267 | 14.8 | 17.6 | 16.6 | 16.3 | 1.7 |
| Hisar Anand | 14.4 | 16.8 | 16.9 | 16.1 | - |
| CD (5%) | 2.4 | 2.1 | 1.7 | | |

Jagudan

The trial was undertaken with eight genotypes including G.Cori - 2 as a check during 1999-2000 to 2001-2002, in RBD with three replications and the trial was concluded.

Significant yield differences were observed among entries during 1999-2000 and

the results were non-significant during 2000-01 and 2001-02. During 1999-2000, no entry was found significantly superior to check (G.cori - 2), except J.cori - 380. Pooled data over three years revealed significant yield differences. But none of the entries gave higher yield than the check (G.Cori - 2.). J.Cori - 360 ranks first for yield (1597 kg ha⁻¹), followed by J.Cori - 328 and Dhana - 25 (Table 152).

Table 152. Performance of coriander accessions - Jagudan

| Entry | Yield (kg ha ⁻¹) | | | | Increase over control (%) |
|---------------|------------------------------|---------|---------|---------|---------------------------|
| | 1999-00 | 2000-01 | 2001-02 | Average | |
| J.Cori. - 328 | 1797.00 | 1321.00 | 1618.00 | 1579.00 | 7.20 |
| J.Cori. - 344 | 1443.00 | 1547.00 | 1405.00 | 1465.00 | - |
| J.Cori. - 360 | 1667.00 | 1550.00 | 1574.00 | 1597.00 | 8.42 |
| J.Cori. - 372 | 1683.00 | 1435.00 | 1316.00 | 1478.00 | 0.34 |
| J.Cori. - 380 | 1198.00 | 1264.00 | 1187.00 | 1216.00 | - |
| Dhana - 25 | 1776.00 | 1580.00 | 1375.00 | 1577.00 | 7.06 |
| Dhana - 89 | 1552.00 | 1590.00 | 1476.00 | 1539.00 | 4.48 |
| G.Cori. - 2 | 1580.00 | 1457.00 | 1383.00 | 1473.00 | - |
| SEm ± | 106.00 | 118.00 | 103.00 | 064.00 | |
| CD (5%) | 321.00 | NS | NS | 182.00 | |
| CV% | 11.54 | 13.95 | 12.64 | 12.70 | |

Guntur

The trial was started during 2001-02 with 11 genotypes in RBD. During 2002-03 due to heavy rainfall and prolonged drought in the kharif and rabi seasons, germination was affected resulting in poor yields. Among the eleven entries evaluated, LCC - 216 recorded highest plant height of 42.1 cm, which was on par with LCC - 170 (40.9 cm) and check (Sadhana, 38.8 cm). LCC - 172 recorded significantly more number of primary branches (4.4). Number of secondary branches was more in LCC - 170 and Sadhana (2.93) and low in LCC - 170 (1.3). Number of umbels was more in LCC - 172 (25.1) and lowest in LCC - 173 (13.4). Umbellets per umbel ranged from 5.96 (LCC - 216) to 4.36 (LCC - 143). Among the genotypes evaluated, LCC - 216 recorded significantly highest yield of 426 kg ha⁻¹ followed by LCC - 212 (396 kg ha⁻¹) and LCC - 170 (391 kg ha⁻¹). The check (Sadhana) recorded an yield of 274 kg ha⁻¹.

Jobner

The trial was initiated during 2001-02 with 20 genotypes in RBD. Significant differences were observed among entries for all the characters studied. The mean days to flowering ranged from 58.7 (UD - 529) to 94.7 (UD - 728), plant height from 44.6 (UD - 310) to 89.6 cm (RCr - 435, check), branches per plant from 5.5 (local check) to 9.8 (RCr - 684 check), umbels per plant from 13.9 (UD - 529) to 43.4 (RCr - 435 check), umbellets per umbel from 3.4 (NS - 1) to 6.6 (NS - 2) and test weight from 6.87 (UD - 728) to 15.00 g (UD - 483). The entry NS - 2 recorded maximum seed yield of 868 kg ha⁻¹ followed by RCr - 435 (check, 830 kg ha⁻¹), UD - 728 (764 kg ha⁻¹), RCr - 446 (check, 555 kg ha⁻¹), UD - 36 (486 kg ha⁻¹), RCr - 684 check (483 kg ha⁻¹), UD - 42 & UD - 92 (469 kg ha⁻¹) and UD - 317 (417 kg ha⁻¹), while lowest yield of 208 kg ha⁻¹ was recorded in NS - 1 (Table 153).

Table 153. Performance of coriander accessions under IET - Jobner

| Entry | Days to flowering | Plant height (cm) | Branches plant ⁻¹ | Umbels plant ⁻¹ | Umbellets umbel ⁻¹ | Seeds umbel | Test weight (g) | Seed yield (kg ha ⁻¹) | Increase over check (%) |
|-----------|-------------------|-------------------|------------------------------|----------------------------|-------------------------------|-------------|-----------------|-----------------------------------|-------------------------|
| NS - 2 | 81.00 | 73.10 | 9.40 | 31.10 | 6.60 | 29.50 | 8.83 | 868.00 | 213.36 |
| RCr - 435 | 76.00 | 89.60 | 8.50 | 43.40 | 5.90 | 28.10 | 9.03 | 830.00 | 199.64 |
| UD - 728 | 94.70 | 88.30 | 8.50 | 34.40 | 5.90 | 42.20 | 6.87 | 764.00 | 175.81 |
| RCr - 446 | 74.70 | 81.30 | 8.70 | 30.80 | 5.10 | 25.80 | 10.93 | 555.00 | 100.36 |
| UD - 36 | 72.70 | 64.20 | 7.50 | 16.30 | 5.30 | 22.80 | 11.23 | 486.00 | 75.45 |
| RCr - 684 | 73.00 | 60.40 | 9.80 | 27.30 | 5.30 | 26.70 | 12.20 | 483.00 | 74.37 |
| UD - 42 | 70.70 | 55.00 | 7.40 | 28.70 | 5.60 | 26.40 | 13.97 | 469.00 | 69.31 |
| UD - 92 | 72.70 | 56.30 | 7.60 | 17.70 | 5.90 | 23.20 | 12.43 | 469.00 | 69.31 |
| UD - 317 | 62.70 | 50.70 | 7.70 | 21.70 | 4.50 | 19.10 | 12.27 | 417.00 | 50.54 |
| UD - 380 | 64.00 | 61.90 | 7.30 | 28.30 | 4.30 | 18.70 | 14.80 | 417.00 | 50.54 |
| UD - 426 | 63.30 | 51.70 | 8.40 | 18.50 | 4.30 | 17.70 | 12.53 | 382.00 | 37.91 |
| UD - 529 | 58.70 | 46.10 | 5.90 | 13.90 | 4.40 | 21.40 | 12.07 | 330.00 | 19.13 |

| | | | | | | | | | |
|-------------|-------|-------|------|-------|------|-------|-------|--------|-------|
| UD - 748 | 64.30 | 74.10 | 7.20 | 27.30 | 4.60 | 24.50 | 10.60 | 326.00 | 35.74 |
| UD - 530 | 57.30 | 56.90 | 6.00 | 25.10 | 4.30 | 25.10 | 12.37 | 313.00 | 12.99 |
| UD - 119 | 73.30 | 56.50 | 7.70 | 19.40 | 3.80 | 20.20 | 12.20 | 277.00 | - |
| UD - 483 | 63.30 | 57.70 | 6.50 | 25.40 | 3.90 | 12.10 | 15.00 | 277.00 | - |
| RCr - 436 | 57.00 | 48.00 | 6.10 | 27.60 | 4.60 | 25.30 | 12.60 | 277.00 | Check |
| UD - 310 | 62.70 | 44.00 | 7.10 | 16.80 | 3.60 | 24.50 | 12.40 | 260.00 | - |
| Local check | 75.30 | 67.90 | 5.50 | 14.00 | 4.00 | 13.10 | 9.33 | 243.00 | - |
| NS - 1 | 91.70 | 87.90 | 9.40 | 24.80 | 3.40 | 22.50 | 8.40 | 208.00 | - |
| CD (5%) | 2.45 | 4.04 | 0.68 | 3.88 | 0.69 | 4.87 | 2.10 | 096.00 | |
| CV% | 2.11 | 3.84 | 5.41 | 9.55 | 8.79 | 12.33 | 10.65 | 13.49 | |

COR/CI/4 Quality Evaluation Trial

COR/CI/4.1 Quality evaluation in coriander .

(Jobner)

Jobner

The volatile oil content of 12 entries of under CVT ranged from 0.35% to 0.55%. Maximum volatile oil of 0.55% was observed in JCO - 283 followed by 0.50%

in UD - 744, 0.45% in UD - 262, RCr - 684, DH - 246, DH - 208 and LCC-128 and 0.4% in UD - 743 & RCr - 41 and minimum of 0.35% in JCO - 387 and LCC - 133. The total yield of volatile oil per hectare depends upon the grain yield. The volatile oil yield was found to be maximum 5.32 l ha⁻¹ in RCr - 684, followed by 5.11 l ha⁻¹ in RCr - 41 and 4.83 l ha⁻¹ in UD - 262 (Table 154).

Table 154. Volatile oil content of coriander accessions under CVT 2001-2002

| Entry | Grain yield (kg ha ⁻¹) | Volatile oil (%) | Volatile oil yield (l ha ⁻¹) |
|-------------|------------------------------------|------------------|--|
| JCO - 283 | 544 | 0.55 | 2.99 |
| UD - 744 | 757 | 0.50 | 3.78 |
| UD - 262 | 1075 | 0.45 | 4.83 |
| RCr - 684 | 1183 | 0.45 | 5.32 |
| DH - 246 | 639 | 0.45 | 2.87 |
| DH - 208 | 739 | 0.45 | 3.32 |
| LCC - 128 | 237 | 0.45 | 1.06 |
| UD - 743 | 738 | 0.40 | 2.95 |
| RCr - 41 | 1278 | 0.40 | 5.11 |
| Local check | 592 | 0.38 | 2.24 |
| JCO - 387 | 308 | 0.35 | 1.07 |
| LCC - 133 | 213 | 0.35 | 0.74 |
| Range | 213-1278 | 0.35-0.55 | 0.745-5.32 |

The mean of volatile oil content of the entries evaluated under CVT over three years (1999-2000 to 2001-2002) indicated that the highest mean volatile

oil of 4.58 l ha⁻¹ was recorded in UD - 744 followed by 4.14 l ha⁻¹ in RCr - 41 and DH - 246 and 4.04 l ha⁻¹ in RCr - 684 (Table 155).

Table 155. Volatile oil content of coriander accessions under CVT (1999-2000 to 2001-2002)

| Entry | Mean grain yield (kg ha ⁻¹) | Volatile oil (%) | | | | Mean oil yield (l ha ⁻¹) |
|-----------|--|------------------|---------|---------|-------------|---|
| | | 1999-2000 | 2000-01 | 2001-02 | Mean | |
| UD - 744 | 983 | 0.45 | 0.45 | 0.50 | 0.466 | 4.580 |
| DH - 246 | 996 | 0.40 | 0.40 | 0.45 | 0.416 | 4.140 |
| LCC -128 | 321 | 0.40 | 0.32 | 0.45 | 0.391 | 1.250 |
| DH - 208 | 899 | 0.30 | 0.35 | 0.45 | 0.366 | 3.290 |
| RCr - 41 | 1183 | 0.30 | 0.35 | 0.40 | 0.350 | 4.140 |
| UD - 743 | 992 | 0.30 | 0.35 | 0.40 | 0.350 | 3.470 |
| Local ch. | 592 | 0.35 | 0.35 | 0.38 | 0.360 | 2.070 |
| LCC -133 | 295 | 0.30 | 0.32 | 0.35 | 0.325 | 0.950 |
| JCO - 283 | 710 | - | 0.35 | 0.55 | 0.450 | 3.190 |
| UD - 262 | 940 | - | 0.40 | 0.45 | 0.425 | 3.995 |
| RCr - 684 | 1078 | - | 0.30 | 0.45 | 0.375 | 4.042 |
| JCO - 387 | 270 | - | 0.37 | 0.35 | 0.362 | 0.978 |
| Range | 270-1183 | | | | 0.325-0.466 | 0.97-4.578 |

In IET, 8 entries along with 5 checks were evaluated during 2001-2002 for volatile oil content. The volatile oil ranged from 0.41% to 0.575%. The promising entries with respect to volatile oil are UD - 380 (0.575%), UD - 483 (0.55%), UD - 42 (0.54%), UD - 317 (0.48%), UD - 36 (0.46%) and UD - 728 (0.45%) (Table 156)

Table 156. Volatile oil content of coriander accessions under IET (2001-2002)

| Entry | Seed yield (kg ha ⁻¹) | Volatile oil (%) |
|-------------|--------------------------------------|---------------------|
| UD - 380 | 417 | 0.575 |
| UD - 483 | 277 | 0.550 |
| UD - 42 | 469 | 0.540 |
| UD - 317 | 417 | 0.485 |
| UD - 36 | 486 | 0.460 |
| UD - 728 | 764 | 0.450 |
| UD - 748 | 326 | 0.420 |
| UD - 310 | 260 | 0.415 |
| RCr - 435 | 830 | 0.450 |
| RCr - 446 | 555 | 0.575 |
| RCr - 684 | 483 | 0.410 |
| RCr - 436 | 277 | 0.500 |
| Local check | 243 | 0.500 |
| Range | 243-830 | 0.41-0.575 |

Twelve entries of coriander were received from Hisar centre for evaluating volatile oil content. The volatile oil content ranged from 0.3% to 0.525%. Some of the common entries, which were also grown at Jobner, were compared for volatile oil content (Table 157). There was not much variation in volatile oil content in these accessions grown at Jobner and Hisar.

Table 157. Volatile oil of coriander entries at Hisar and Jobner

| Entry | Volatile oil (%) | |
|--------------|------------------|-------|
| | Jobner | Hisar |
| JCO - 283 | 0.55 | 0.500 |
| UD - 744 | 0.50 | 0.400 |
| DH - 246 | 0.45 | 0.450 |
| DH - 208 | 0.45 | 0.425 |
| UD - 743 | 0.40 | 0.400 |
| LCC - 128 | 0.45 | 0.300 |
| LCC - 133 | 0.35 | 0.350 |
| JCO - 387 | 0.35 | 0.400 |
| DH - 266 | - | 0.525 |
| DH - 259 | - | 0.475 |
| DH - 5 | - | 0.400 |
| Narnaul Sel. | - | 0.400 |

The effect of biofertilizer on volatile content of coriander was studied and it was found that biofertilizer did not affect the volatile oil content in coriander (Table 158).

Table 158. Effect of biofertilizer on volatile oil content of coriander

| Treatment | Volatile oil (%) |
|---------------------------|------------------|
| T1 - N 100% + A + FYM 5 t | 0.500 |
| T2 - N 75% + A + FYM 5 t | 0.425 |
| T3 - N 50% + A + FYM 5 t | 0.450 |
| T4 - N 0 + A + FYM 5 t | 0.466 |
| T5 - N 0 + A 0 + FYM 5 t | 0.450 |
| T6 - N 0 + A + FYM 10 t | 0.500 |
| T7 - N 0 + A 0 + FYM 10 t | 0.460 |
| T8 - N 100% + A 0 + FYM 0 | 0.400 |
| T9 - N 0 + A + FYM 0 | 0.400 |
| T10 - N 0 + A 0 + FYM 0 | 0.425 |

N- Inorganic nitrogen, A- *Azospirillum*

COR/CM/1 Nutrient Management Trial COR/CM/1.1 Response of coriander to micronutrients (Kumarganj)

Kumarganj

The trial was initiated during 2001 with 13 treatments in RBD. Maximum seed yield was obtained in T13 followed by T1 during 2002-03. The three years data revealed non significant differences in yield among the treatments T13, T9 and T7 (Table 159).

Table 159. Effect of micronutrients on the yield of coriander - Kumarganj

| Treatment | Yield (q ha ⁻¹) | | | |
|--|-----------------------------|---------|---------|-------|
| | 2000-01 | 2001-02 | 2002-03 | Mean |
| T1 - Control | 13.35 | 19.76 | 19.20 | 17.43 |
| T2 - Zinc sulphate 20 kg ha ⁻¹ as soil application | 14.25 | 17.45 | 16.89 | 16.19 |
| T3 - Zinc sulphate 0.5% as foliar spray | 14.30 | 19.53 | 16.19 | 16.67 |
| T4 - Zinc sulphate 10 kg ha ⁻¹ + 0.25% foliar application | 15.50 | 18.61 | 17.58 | 17.23 |
| T5 - Ferrous sulphate 10 kg ha ⁻¹ as soil application | 14.65 | 19.30 | 18.51 | 17.48 |
| T6 - Ferrous sulphate 0.25% as foliar application | 14.46 | 19.07 | 16.42 | 16.65 |
| T7 - Ferrous sulphate 5 kg ha ⁻¹ + 0.125% as foliar application | 15.85 | 22.54 | 17.12 | 18.50 |
| T8 - Magnese sulphate 25 kg ha ⁻¹ as soil application | 14.56 | 22.08 | 16.43 | 17.68 |
| T9 - Mangnese sulphate 0.25% as foliar application | 14.20 | 21.85 | 18.51 | 18.18 |
| T10 - Mangnese sulphate 12.5 kg ha ⁻¹ + 0.25% as foilar application | 14.65 | 19.53 | 16.20 | 16.79 |
| T11 - Copper sulphate 25 kg ha ⁻¹ as soil application | 13.30 | 20.92 | 17.81 | 17.34 |
| T12 - Copper sulphate 0.5% foliar application | 13.45 | 19.53 | 18.28 | 17.08 |
| T13 - Copper sulphate 12.5 kg ha ⁻¹ + 0.25% foliar application | 13.20 | 22.20 | 21.05 | 18.81 |
| CD (5 %) | 0.15 | 2.68 | 4.45 | |
| CV% | - | 19.00 | 14.91 | |

COR/CM/1.2 Efficacy of biofertilizer using *Azospirillum* on coriander
(Coimbatore, Jobner, Kumarganj and Guntur)

Jobner

The trial was initiated during 2000-2001 rabi with 10 treatments. Results during

2001-02 revealed that application of 100, 75 and 50% of recommended dose of inorganic N + *Azospirillum* 1.5 kg ha⁻¹ + FYM 10 t ha⁻¹, FYM 10 t ha⁻¹ and N 100% alone produced significantly higher number of umbels plant⁻¹, number of seeds umbel⁻¹, and seed yield ha⁻¹ over control. Maximum seed yield of 942 kg ha⁻¹ was obtained with

the application of inorganic N 75% + *Azospirillum* + FYM 5 t ha⁻¹ and was at par with inorganic N 100% + *Azospirillum* + FYM 5 t ha⁻¹, inorganic N 50% + *Azospirillum* + FYM 5 t ha⁻¹ but significantly higher over rest of the treatments.

Pooled analysis of two years data (Table

160) revealed that all the treatments except *Azospirillum* and FYM 5 t ha⁻¹ alone recorded significantly higher seed yield over control. Application of N 100% + *Azospirillum* + FYM 5 t ha⁻¹ recorded maximum mean seed yield of 790 kg ha⁻¹, closely followed by N 75% and N 50% + *Azospirillum* + FYM 5 t ha⁻¹ and inorganic N 100% alone.

Table 160. Effect biofertilizer, *Azospirillum* on seed yield of coriander - Jobner

| Treatment | Seed yield (kg ha ⁻¹) | | |
|---|-----------------------------------|-----------|------|
| | 2000-2001 | 2001-2002 | Mean |
| Inorganic N 100% + <i>Azospirillum</i> + FYM 5 t ha ⁻¹ | 662 | 918 | 790 |
| Inorganic N 75% + <i>Azospirillum</i> + FYM 5 t ha ⁻¹ | 586 | 941 | 764 |
| Inorganic N 50% + <i>Azospirillum</i> + FYM 5 t ha ⁻¹ | 555 | 926 | 741 |
| <i>Azospirillum</i> + FYM 5 t ha ⁻¹ | 509 | 732 | 621 |
| FYM 5 t ha ⁻¹ alone | 477 | 648 | 563 |
| <i>Azospirillum</i> + FYM 10 t ha ⁻¹ | 601 | 730 | 666 |
| FYM 10 t ha ⁻¹ | 555 | 707 | 631 |
| Inorganic N 100% alone | 623 | 810 | 717 |
| <i>Azospirillum</i> 1.5 kg ha ⁻¹ alone | 524 | 633 | 579 |
| Control | 431 | 602 | 517 |
| CD (5%) | 094 | 100 | 089 |

Coimbatore

The trial is in the third year of progress with 10 treatments. The highest yield of 738.3 kg ha⁻¹ was registered by the application of inorganic N 50% + *Azospirillum* 1.5 kg ha⁻¹ as seed treatment + FYM 5 t ha⁻¹ (T3) compared to 543 kg ha⁻¹ in the control (recommended dose of fertilizer). The yield recorded in T3 was on par with the treatments

T2 (inorganic N 75% + *Azospirillum* 1.5 kg ha⁻¹ as seed treatment + FYM 5 t ha⁻¹) and T1 (inorganic N 100% + *Azospirillum* 1.5 kg ha⁻¹ as seed treatment + FYM 5 t ha⁻¹), which respectively recorded yield of 717 and 710 kg ha⁻¹. Seed treatment with *Azospirillum* 1.5 kg ha⁻¹ alone gave the lowest yield (304 kg ha⁻¹) (Table 161).

Table 161. Effect of biofertilizer, *Azospirillum* on growth, yield attributes and yield of coriander - Coimbatore

| Treatment | Plant height (cm) | No. of primary branches | No. of secondary branches | No. of umbels plant ⁻¹ | No. of umbelets umbel ⁻¹ | No. of seeds umbel ⁻¹ | Yield (g plot ⁻¹) | Yield (kg ha ⁻¹) |
|--|-------------------|-------------------------|---------------------------|-----------------------------------|-------------------------------------|----------------------------------|-------------------------------|------------------------------|
| T1 - Inorganic N 100% + <i>Azospirillum</i> 1.5 kg ha ⁻¹ ST+ FYM 5 t ha ⁻¹ | 64.2 | 7.3 | 18.7 | 35.0 | 7.1 | 61.8 | 355.0 | 710.0 |
| T2 - Inorganic N 75% + <i>Azospirillum</i> 1.5 kg ha ⁻¹ ST+ FYM 5 t ha ⁻¹ | 66.0 | 7.7 | 18.0 | 37.7 | 7.1 | 66.3 | 358.5 | 717.0 |
| T3 - Inorganic N 50% + <i>Azospirillum</i> 1.5 kg ha ⁻¹ ST+ FYM 5 t ha ⁻¹ | 68.6 | 8.0 | 22.3 | 39.0 | 7.2 | 69.4 | 369.15 | 738.3 |
| T4 - FYM 5 t ha ⁻¹ + <i>Azospirillum</i> 1.5 kg ha ⁻¹ ST ha ⁻¹ | 61.6 | 6.7 | 15.3 | 31.7 | 7.0 | 59.3 | 236.5 | 473.0 |
| T5 - FYM 5 t ha ⁻¹ alone | 55.1 | 6.7 | 16.3 | 29.7 | 6.3 | 45.4 | 215.0 | 430.0 |
| T6 - FYM 10 t ha ⁻¹ + <i>Azospirillum</i> 1.5 kg ha ⁻¹ ST ha ⁻¹ | 63.6 | 7.0 | 17.0 | 30.3 | 6.7 | 43.7 | 252.5 | 505.0 |
| T7 - FYM 10 t ha ⁻¹ alone | 59.6 | 7.0 | 16.7 | 30.7 | 6.5 | 45.8 | 226.0 | 452.0 |
| T8 - <i>Azospirillum</i> 1.5 kg ha ⁻¹ ST alone | 50.1 | 5.3 | 13.7 | 27.3 | 5.5 | 35.4 | 152.0 | 304.0 |
| T9 - Inorganic N 100% alone | 57.7 | 6.3 | 16.0 | 30.0 | 6.5 | 41.7 | 230.0 | 460.0 |
| T10 - Control | 63.6 | 7.3 | 17.0 | 33.0 | 6.8 | 59.9 | 271.5 | 543.0 |
| CD (5%) | 6.1 | | 1.7 | 3.2 | 0.7 | 5.3 | | 48.7 |

Kumarganj

The experiment was initiated during 2000-01 with 7 treatments. Maximum seed yield of 24.76 q ha⁻¹ was obtained in T6. The yield obtained in T4 and T3 were at par

with T6 during the year 2002-03. However, pooled mean yield of three years showed maximum seed yield of 25.85 q ha⁻¹ in T4 (Table 162).

Table 162. Effect of biofertilizer, *Azospirillum* on the yield of coriander (2000 to 2003) - Kumarganj

| Treatment | Yield (q ha ⁻¹) | | | |
|---|-----------------------------|---------|---------|-------|
| | 2000-01 | 2001-02 | 2002-03 | Mean |
| T1 - N 100% + <i>Azospirillum</i> 50 g + FYM 5 t ha ⁻¹ | 18.05 | 12.96 | 20.60 | 17.20 |
| T2 - N 75% + <i>Azospirillum</i> 50 g + FYM 5 t ha ⁻¹ | 17.85 | 10.88 | 23.14 | 17.29 |
| T3 - N 50% + <i>Azospirillum</i> 50 g + FYM 5 t ha ⁻¹ | 17.72 | 17.59 | 24.53 | 19.94 |
| T4 - FYM 5 t ha ⁻¹ + <i>Azospirillum</i> 50 g | 15.97 | 18.98 | 22.68 | 25.85 |
| T5 - FYM 5 t ha ⁻¹ alone | 15.65 | 15.74 | 24.30 | 18.56 |
| T6 - FYM 10 t ha ⁻¹ + <i>Azospirillum</i> 50 g | 15.66 | 19.90 | 24.76 | 20.10 |
| T7 - FYM 10 t ha ⁻¹ alone | 15.80 | 25.50 | 23.15 | 21.46 |
| CD (5 %) | 1.65 | 4.32 | 3.81 | |
| CV% | | 9.50 | 9.31 | |

Guntur

The programme was started during 2000-2001. During 2002-03 rabi season, ten different treatment combinations of inorganic N, FYM and *Azospirillum* were evaluated with three replications in Randomized Block Design. During 2002-03 due to heavy rainfall and prolonged drought in the kharif and rabi seasons, germination was affected resulting in poor yields. Among the ten treatments evaluated, T1 recorded maximum plant

height, number of primary and secondary branches (50.1 cm, 6 and 6.5, respectively). T1, T2 and T3 were on par and recorded significantly more umbels per plant (9.1, 8.7 and 8.5, respectively) and umbellets per umbel (6.2, 5.1 and 5.4 respectively). Among the ten treatment combinations, T1 recorded highest yield (354 kg ha⁻¹) and on par with T2 (335 kg ha⁻¹) and T3 (325 kg ha⁻¹) but significantly superior to control (229 kg ha⁻¹) (Table 163).

Table 163. Efficacy of biofertilizer, *Azospirillum* on the yield of coriander - Guntur

| Treatment | Plant height (cm) | No. of primary branches | No. of secondary branches | No. of umbels plant ⁻¹ | No. of umbellets umbel ⁻¹ | Yield (g plot ⁻¹) | Yield (kg ha ⁻¹) |
|--|-------------------|-------------------------|---------------------------|-----------------------------------|--------------------------------------|-------------------------------|------------------------------|
| T1 - N 100% + <i>Azospirillum</i> + FYM 5 t ha ⁻¹ | 50.1 | 6.0 | 6.5 | 9.1 | 5.9 | 426.0 | 354.0 |
| T2 - N 75% + <i>Azospirillum</i> + FYM 5 t ha ⁻¹ | 48.3 | 5.8 | 6.4 | 8.7 | 5.8 | 404.0 | 335.0 |
| T3 - N 50% + <i>Azospirillum</i> + FYM 5 t ha ⁻¹ | 47.4 | 5.4 | 6.3 | 8.5 | 5.8 | 392.0 | 325.0 |

| | | | | | | | |
|---|------|------|------|------|------|-------|-------|
| T4 - <i>Azospirillum</i> + FYM 5 t ha ⁻¹ | 44.7 | 5.2 | 5.4 | 7.6 | 5.3 | 360.0 | 290.0 |
| T5 - FYM 5 t ha ⁻¹ alone | 40.3 | 5.1 | 5.1 | 7.4 | 5.1 | 364.0 | 275.0 |
| T6 - <i>Azospirillum</i> + FYM 10 kg | 48.3 | 5.4 | 5.8 | 7.7 | 5.7 | 371.0 | 308.0 |
| T7 - FYM 10 kg alone | 42.7 | 5.3 | 5.3 | 7.8 | 5.5 | 342.0 | 284.0 |
| T8 - N 100% | 50.1 | 5.5 | 5.8 | 8.0 | 5.4 | 352.0 | 292.0 |
| T9 - <i>Azospirillum</i> only | 42.6 | 4.3 | 4.6 | 5.1 | 5.0 | 312.0 | 259.0 |
| T10 - Absolute control | 36.3 | 3.8 | 3.6 | 4.4 | 4.7 | 275.0 | 229.0 |
| CD (5%) | 8.5 | 0.98 | 1.3 | 1.7 | 0.68 | 51.8 | 45.7 |
| CV% | 11.0 | 11.1 | 13.5 | 13.2 | 7.4 | 8.4 | 9.0 |

COR/CP/1 Disease Management Trial
COR/CP/1.1 Survey to identify disease incidence, collection and identification of causal organisms

(Dholi)

Dholi

Report not received.

COR/CP/1.2 Management of wilt and powdery mildew diseases in coriander
 (Coimbatore, Kumarganj, Dholi, Jagudan, Raigarh and Jobner)

Coimbatore

Wilt disease: The trials were initiated

during 2000-01. The results of the trial on coriander wilt revealed that seed treatment with *Pseudomonas fluorescens* (10 g kg⁻¹) + soil application (5 kg ha⁻¹) recorded the lowest disease incidence of 27.05% with the highest disease reduction of 60.51%. This was followed by seed treatment with *Trichoderma viride* (4 g kg⁻¹) + soil application which reduced the disease by 59.81%. These two treatments recorded the yield of 691.7 and 686.7 kg ha⁻¹ respectively compared to 565 kg ha⁻¹ in the treatment with *Bacillus subtilis* + soil application which recorded the highest disease incidence (40.25%) (Table 164).

Table 164. Effect of biocontrol agents on coriander wilt disease - Coimbatore

| Treatment | Wilt disease incidence (%) | Disease reduction (%) | Yield (g plot ⁻¹) | Yield (kg ha ⁻¹) |
|---|----------------------------|-----------------------|-------------------------------|------------------------------|
| T1 - ST with carbendazium 2 g kg ⁻¹ | 24.78 (31.80) | 63.82 | 347.65 | 695.3 |
| T2 - ST with <i>Trichoderma viride</i> 4 g kg ⁻¹ + SA 5 kg ha ⁻¹ | 27.53 (31.60) | 59.81 | 343.35 | 686.7 |
| T3 - ST with <i>T. harzianum</i> 4 g kg ⁻¹ + soil application 5 kg ha ⁻¹ | 34.75 (36.10) | 49.27 | 337.75 | 675.5 |
| T4 - ST with <i>Bacillus subtilis</i> + soil application | 40.25 (39.40) | 41.24 | 311.85 | 623.7 |
| T5 - ST with <i>Pseudomonas fluorescens</i> 10 g kg ⁻¹ + SA with carbendazim 5 kg ha ⁻¹ | 27.05 (31.30) | 60.51 | 345.50 | 691.7 |
| T6 - ST 2 g kg ⁻¹ + soil drenching | 20.37 (26.80) | 70.26 | 350.03 | 700.05 |
| T7 - Control | 68.50 (55.50) | - | 282.50 | 565.0 |
| CD (5%) | 2.05 | | | 43.5 |

ST - Seed treatment, SA - Soil application, Values in parentheses are arc-sine transformed values

Powdery mildew disease: A field trial was conducted during 2002-2003 rabi season with seven treatments and three replications in RBD to evolve effective disease management strategy using botanicals in coriander. A total of five plant products were used. Except neem seed kernel (5%) all the other extracts were used at 10 per cent concentration. Tridemorph (0.1%) was used as chemical check. Plants were sprayed thrice i.e. first spray at 30 days after sowing and the second and third sprays at 15 days intervals. Observations on disease incidence were recorded 15 days after third spray.

The treatment T2, three sprays with neem seed kernel extract (NSKE) 5% was effective in reducing the incidence by 65.40% and increasing the yield by 48.18% (711.30 kg ha⁻¹). This was followed by T3, leaf extracts 10% of *Vitex negundo* and T5 (*Prosopis juliflora*) which reduced the disease incidence by 55.97 and 53.77% respectively and increased the yield by 31.94% (633.33 kg ha⁻¹) and 29.18% (620.05 kg ha⁻¹), respectively. Tridemorph (0.1%) registered lowest disease incidence (19.97) and the highest yield of 737.40 kg ha⁻¹ (Table 165).

Table 165. Effect of plant extracts on powdery mildew disease of coriander (2002-2003 rabi season) - Coimbatore

| Treatment | Disease index (PDI) | Disease reduction over control (%) | Yield plot ⁻¹ (g) | Yield (kg ha ⁻¹) | Increase over control (%) |
|--------------------------------------|---------------------|------------------------------------|------------------------------|------------------------------|---------------------------|
| T1 - Neem cake | 48.45 (44.10) | 50.17 | 295.28 | 590.56 | 23.03 |
| T2 - Neem seed kernel extract (NSKE) | 33.65 (35.44) | 65.40 | 355.65 | 711.30 | 48.18 |
| T3 - <i>Vitex negundo</i> | 42.70 (40.78) | 55.97 | 316.67 | 633.33 | 31.94 |
| T4 - <i>Ipomea carnea</i> | 55.06 (47.90) | 43.38 | 289.30 | 578.59 | 20.53 |
| T5 - <i>Prosopis juliflora</i> | 44.95 (42.08) | 53.77 | 310.03 | 620.05 | 29.18 |
| T6 - Tridemorph | 19.97 (26.54) | 79.50 | 368.7 | 737.40 | 53.621 |
| T7 - Control (unsprayed) | 97.25 (80.58) | - | | 480.0 | - |
| CD | 2.17 | | | 55.30 | |

Values in parenthesis are arc-sine transformed values

Kumarganj

The experiment was started in 2000-01 with 7 treatments in RBD. Incidence of wilt disease was not high during the year. Seed treatment (T6) with carbendazim 0.2% and soil drenching had lowest wilt incidence of 5.83% over control (17.50%) with maximum seed yield of 21.06 q ha⁻¹. T6 reduced

(53.36%) wilt disease increasing yield by 46.45% over controls (Table 166). Minimum powdery mildew disease of 14.16% was observed in seeds treated with carbendazim 0.2% (T1) whereas minimum stem gall disease of 7.06% was observed in (T6) seed treatment with carbendazim 0.2% and soil drenching. Maximum reduction in disease was observed

in T6 for wilt (53.96%) and powdery mildew (42.37%) with increase in seed yield of 46.45%.

On the basis of two years pooled data it

was revealed that treatment T6 is effective in reducing the wilt and stem gall diseases and increasing yield in coriander (Table 166).

Table 166. Effect of fungicides and biocontrol agents on the incidence of wilt and powdery mildew diseases and yield in coriander - Kumargang

| Treatment | Wilt | Powdery | PDI | Stem | Reduction in disease incidence (%) | | | Seed | Increase |
|--|-------|---------------|-------|---------------------------|------------------------------------|-------------------|-------|--------------------------------|-----------------|
| | (%) | mildew (%) | | gall disease (Seed) | Wilt | Powdery mildew | Seed | yield (q ha ⁻¹) | in yield (%) |
| T1 - Seed treatment with carbendazim 0.2% | 9.16 | 14.16 | 20.00 | 7.73 | 47.65 | 32.20 | 6.77 | 20.13 | 39.98 |
| T2 - Seed treatment with <i>T. viride</i> & soil application | 14.16 | 30.83 | 20.5 | 8.4 | 19.08 | 30.50 | - | 18.05 | 25.52 |
| T3 - Seed treatment with <i>T. harzianum</i> & soil application | 11.66 | 36.66 | 20.16 | 9.86 | 33.37 | 31.66 | - | 18.97 | 31.91 |
| T4 - Seed treatment with <i>Bacillus subtilis</i> soil application | 12.5 | 37.5 | 23.66 | 8.53 | 31.47 | 19.79 | - | 18.79 | 30.66 |
| T5 - Seed treatment with <i>P. fluorescence</i> & soil application | 14.16 | 36.66 | 25.50 | 8.26 | 19.05 | 13.55 | - | 17.82 | 23.92 |
| T6 - Seed treatment with carbendazim 0.2% & soil drenching | 5.83 | 27.5 | 17.00 | 7.06 | 53.96 | 42.37 | 14.52 | 21.06 | 46.45 |
| T7 - control | 17.50 | 46.66 | 29.5 | 8.26 | - | - | | 14.38 | |
| CD (5 %) | 6.66 | 9.31 | | 0.97 | | | | 2.80 | |
| CV% | 16.73 | 15.93 | | 6.59 | | | | 8.52 | |

Jobner

The trial was started during 2001-02 with 7 treatments in RBD. Out of seven treatments, minimum wilt incidence of 3.5% with the maximum seed yield of 863 kg ha⁻¹ was observed in the treatment where *Trichoderma harzianum* was applied through seed treatment

as well as soil application, followed by seed treatment with carbendazim and soil application of carbendazim having 4.0% wilt with the seed yield of 810 kg ha⁻¹. The control resulted in maximum disease incidence (10.0%) and lowest yield (543 kg ha⁻¹) (Table 167).

Table 167. Biocontrol of wilt of coriander – Jobner

| Treatment | Disease (%) | Yield (kg ha ⁻¹) |
|--|-------------|------------------------------|
| Treatment with carbendazim @ 0.1% | 6.75 | 626 |
| Treatment with <i>Trichoderma viride</i> + soil application @ 0.4% | 5.00 | 710 |
| Treatment with <i>T. harzianum</i> + soil application @ 0.4% | 3.50 | 863 |
| Treatment with <i>Bacillus subtilis</i> + soil application @ 0.4% | 8.00 | 585 |
| Treatment with <i>Pseudomonas fluorescense</i> + soil application @ 0.4% | 7.00 | 576 |
| Seed Treatment with soil drenching of carbendazim 0.1% | 4.00 | 810 |
| Control | 10.00 | 543 |
| CD (5%) | 1.06 | 054 |
| CV% | 11.05 | 531 |

Dholi, Jagudan and Raigarh

Reports not received.

| | | |
|---|---------------|-------|
| CUMIN | JC - 2000-11 | 5.00 |
| CUM/CI/1 Genetic Resources | JC - 96-7 | 18.75 |
| CUM/CI/1.1 Germplasm collection, characterization, evaluation, conservation and screening against diseases | JC - 2000-20 | 7.50 |
| <i>(Jobner and Jagudan)</i> | JC - 96-37 | 15.00 |
| <i>Jagudan</i> | JC - 2000-21 | 15.00 |
| | JC - 96-42 | 10.00 |
| | JC - 2000-22 | 90.00 |
| | JC - 96-53 | 12.50 |
| | JC - 2000-27 | 70.00 |
| This centre maintains 183 accessions under germplasm. Among the 183 genotypes, promising lines viz., JC - 94-61, 95 - 10, 95 - 11, 95 - 12, 95 - 22, 95 - 28, 95 - 30, 95 - 32, 95 - 35, 95 - 37, 95 - 90, 95 - 104, 95 - 113, 95 - 127, 95 - 128, 96 - 18, 96 - 34, 96 - 38, 96 - 47, 99 - 24, 99 - 40, 99 - 42, 99 - 43, JC - 2000-28, JC - 2000-55, JC - 2000-56, JG - 2000-58, JC - 2000-60, JC - 2000-65, JC - 2000-66 and JC - 2000-72 with yield ranging from 362 to 1544 kg ha ⁻¹ , were identified. | JC - 96-54 | 8.75 |
| | JC - 2000-28 | 40.00 |
| | JC - 96-57 | 8.75 |
| | JC - 2000-29 | 95.00 |
| | JC - 99-16 | 12.50 |
| | JC - 2000-68 | 50.00 |
| | JC - 99-17 | 15.00 |
| | JC - 2000-71 | 30.00 |
| | JC - 99-19 | 12.50 |
| | JC - 2000-72 | 95.00 |
| | JC - 99-22 | 15.00 |
| | JC - 94-167 | 60.00 |
| | JC - 99-35 | 17.50 |
| | JC - 95-9 | 10.00 |
| | JC - 99-44 | 35.00 |
| | JC - 95-24 | 10.00 |
| | JC - 2000-70 | 30.00 |
| | JC - 95-77 | 7.50 |
| | GC - 2(check) | 30.00 |
| | JC - 95-138 | 12.50 |
| | GC - 3(check) | 20.00 |
| | JC - 96-5 | 10.00 |

Table 168. Screening of germplasm against powdery mildew disease - Jagudan

| Entry | PDI |
|-------------|-------|
| JC - 2000-3 | 10.00 |
| JC - 96-6 | 12.50 |

During the year, 12 entries were tested in wilt sick plot and wilt affected field separately. In wilt sick plot, JC - 2000-3, JC - 2000-21, JC - 2000-22, JC - 2000-29, JC - 2000-72 and GC - 3 showed lower incidence of wilt disease compared to GC - 2 (check) (Table 169).

Table 169. Screening of germplasm against wilt disease - Jagudan

| Entry | Wilt (%) |
|----------------|-----------|
| JC - 2000-3 | 45.07 |
| JC - 2000-20 | 85.15 |
| JC - 2000-21 | 68.33 |
| JC - 2000-22 | 75.45 |
| JC - 2000-27 | 83.05 |
| JC - 2000-28 | 85.91 |
| JC - 2000-29 | 71.28 |
| JC - 2000-68 | 79.17 |
| JC - 2000-71 | 83.47 |
| JC - 2000-72 | 77.57 |
| GC - 2 (check) | 100.00 |
| GC - 3 (check) | 77.89 |

Jobner

This centre maintains 376 accessions at present. In field conditions out of the ten entries evaluated, minimum incidence of wilt and powdery mildew diseases i.e. 5.00% and 1 score, respectively was observed in UC - 223 (check) with the maximum seed yield of 516 kg ha⁻¹, followed by RZ - 19 (check, 456 kg ha⁻¹). and RZ - 209 (check, 466 kg ha⁻¹), whereas maximum wilt (35%) and powdery mildew (4 score), were observed in local check with minimum seed yield of 169 kg ha⁻¹. There was no incidence of blight disease during the year (Table 170).

Table 170. Screening of cumin entries against diseases - Jobner

| Entry | Wilt (%) | Powdery mildew (0-5 score) | Blight (0-5 score) | Yield (kg ha ⁻¹) |
|----------------|----------|----------------------------|--------------------|------------------------------|
| JC - 94-148 | 05 | 1 | 0 | 366 |
| RZ - 19 check | 05 | 1 | 0 | 466 |
| UC - 223 check | 05 | 1 | 0 | 516 |
| UC - 231 | 10 | 1 | 0 | 365 |
| UC - 310 | 10 | 1 | 0 | 336 |
| RZ - 209 check | 10 | 1 | 0 | 456 |
| JC - 94-128 | 20 | 3 | 0 | 229 |
| JC - 94-37 | 25 | 3 | 0 | 248 |
| JC - 94-262 | 25 | 3 | 0 | 288 |
| Local check | 35 | 4 | 0 | 169 |
| CD (5%) | 3.97 | - | - | 071 |
| CV% | 18.09 | - | - | 1429 |

CUM/CI/2 Hybridization Trial**CUM/CI/2.1 Mutation studies and hybridization programme in cumin***(Jagudan)**Jagudan*

No standard breeding method is available in cumin. Hence, to determine the

optimum day and time for emasculation and pollination for more seed set, two trials on pollination are being conducted in the cross GC - 2 X Hairy cumin since 1998-99 (GC - 2 was selected for non-hairy with high yielding character and Hairy cumin was selected for marker gene) with the following treatments.

Experiment -1: To determine optimum day of pollination after emasculation

T1 - Pollination on 2nd day after emasculation

T2 - Pollination on 3rd day after emasculation

T3 - Pollination on 4th day after emasculation

T4 - Pollination on 2nd and 3rd day after emasculation

T5 - Pollination on 3rd and 4th day after emasculation

T6- Pollination on 2nd, 3rd and 4th day after emasculation

T7- No Pollination (only emasculation)

Experiment - 2: To find out proper time of pollination in cumin hybridization programme

T1 - Pollination after emasculation at a time

T2 - Pollination same day at 11.00 AM

T3 - Pollination same day at 12.00 AM

T4 - Pollination same day at 13.00 PM

T5 - Pollination same day at 14.00 PM

T6 - Pollination same day at 15.00 PM

T7 - Pollination next day at 10.00 AM

T8 - Pollination next day at 11.00 AM

T9 - Pollination next day at 12.00 AM

T10 - Pollination next day at 13.00 PM

T11 - Pollination next day at 14.00 PM

T12 - Pollination next day at 15.00 PM

During the experimental years (1998-2002), 7 to 23 seeds were harvested from various treatments under both the trials. Due to poor quality of seeds only one or two seeds of F1 germinated and hairy type plant matured in the treatment T8 (1999 - experiment-2), T5 (1999- experiment-1), T2, T4, T6 (2001- experiment-1), T10 (2002- experiment-2). F2 seeds of hybrid plant were sown in subsequent season and segregation was observed in all F1 plants. It is concluded that emasculation should be done before 10 AM in slightly pink unopened flower bud and pollination next day or third day or 2 and 3 day (twice) between 11 AM to 1 PM for successful hybridization programme (Table 171).

Table 171. Hybridization in cumin (2001-2002) - Jagudan

| Parents | No. of Crosses | F1 seeds harvested (best) | Seeds germinated | Hybrid plants observed (hairy) |
|-------------|----------------|---------------------------|------------------|--------------------------------|
| GC - 2 X HC | 698 | 263 | 60 | 33 (4.7%) |

To improve the quality of seed and crosses were made during 2001-02 resistance to wilt disease, the following (Table 172).

Table 172. Hybridization to improve seed quality and resistance to wilt disease

| Parents | No. of crosses | F1 seeds harvested (best) | Seeds germinated | Non-splitting plants in F2 |
|--------------------|----------------|---------------------------|------------------|----------------------------|
| GC - 3 X GC - 2 | 101 | 68 | 2 | 1 |
| GC - 3 X W. Flower | 30 | 7 | 2 | 1 |

CUM/CI/3 Coordinated Varietal Trial CUM/CI/3.2 CVT 1999 - Series IV

(Jagudan and Jobner)

Jagudan

The trial was conducted during rabi 1999-2000 to 2001-02 with eight entries i.e. JC - 94-37, JC - 94-128, JC - 94 -148, JC - 94-262 (Jagudan) and UC - 231, UC - 310 (Jobner) including checks, GC - 2 and GC - 3 (WR). The trial was laid out in a randomized block design. The experiment was concluded during 2001-02.

The yield differences among the entries were found significant during all the years. JC - 94-37 recorded significantly higher yield (557 and 1056 kg ha⁻¹) than check variety GC - 2 during 1999-2000 and 2001-02, respectively. In the pooled data, yield differences were found non-significant among entries. However, JC - 94-37 gave 16.62 % and 6.56% higher yield than GC - 2 and GC - 3 (WR), respectively. It is concluded that none of the entries was better than the wilt resistant variety, GC - 3 (Table 173).

Table 173. Performance of cumin varieties under CVT - Jagudan

| Entry | Yield (kg ha ⁻¹) | | | | Increase over control (%) | |
|----------------|------------------------------|---------|---------|---------|---------------------------|--------|
| | 1999-2000 | 2000-01 | 2001-02 | Average | GC - 2 | GC - 3 |
| JC - 94-37 | 557 | 1165 | 1056 | 926 | 16.62 | 6.56 |
| JC - 94-128 | 503 | 1124 | 850 | 826 | 4.03 | - |
| JC - 94-148 | 473 | 994 | 922 | 796 | - | - |
| JC - 94-262 | 535 | 824 | 741 | 700 | - | - |
| UC - 231 | 420 | 1084 | 883 | 796 | - | - |
| UC - 310 | 541 | 1056 | 855 | 817 | 2.90 | - |
| JGC - 2(check) | 436 | 1058 | 889 | 794 | - | - |
| GC - 3(check) | 476 | 1177 | 953 | 869 | 9.45 | - |
| CD (5%) | 87 | 188 | 128 | N S | | |
| CV% | 12.03 | 12.08 | 9.73 | 11.73 | | |

Jobner

The trial was conducted during rabi 1999 and 2001 with 10 entries in RBD. The entries differed significantly for all the characters studied. The mean days to flowering ranged from 84.3 (JC - 94-262)

to 94.8 days (UC - 223, check), plant height from 30.7 cm (JC - 94-262) to 37.8 cm (UC - 223, check), branches per plant from 3.3 (JC - 94-262) to 5.7 (UC - 223, check), umbels per plant from 18.2 (JC - 94-262) to 30.9 (UC - 223, check), umbellets per

umbel from 3.9 (JC - 94-262) to 5.7 (UC - 223, check), seeds per umbel from 22.2 (JC - 94-262) to 34.5 (UC - 223, check). The check variety, UC - 223 recorded the maximum seed yield of 516 kg ha⁻¹, followed by RZ - 19 (check, 466 kg ha⁻¹), RZ - 209 (check, 452 kg ha⁻¹), JC - 94-148 (366 kg ha⁻¹) and UC - 231 (365 kg ha⁻¹), while lowest yield of 169 kg ha⁻¹ was recorded in local check.

The data on mean seed yield of the entries evaluated during 1999-2000, 2000-2001 and 2001-2002 indicated superior performance of UC - 223 (check, 386 kg ha⁻¹) followed by RZ - 19 (check, 302 kg ha⁻¹), RZ - 209 (check, 301 kg ha⁻¹), UC - 231 (272 kg ha⁻¹), UC - 310 (269 kg ha⁻¹), JC - 94-148 (255 kg ha⁻¹) and JC - 94-37 (201 kg ha⁻¹), while lowest yield of 178 kg ha⁻¹ was recorded in JC - 94-128 (Table 174).

Table 174. Performance of cumin accessions (1999-2000) - Jobner

| Entry | Yield (kg ha ⁻¹) | | | |
|------------------|------------------------------|-----------|------------|------|
| | 1999-2000 | 2000-2001 | 20001-2002 | Mean |
| UC - 223 (check) | - | 255 | 516 | 386 |
| RZ - 19 (check) | 265 | 174 | 466 | 302 |
| RZ - 209 (check) | - | 151 | 452 | 301 |
| UC - 231 | 285 | 167 | 365 | 272 |
| UC - 310 | 328 | 143 | 336 | 269 |
| JC - 94-148 | 242 | 158 | 366 | 255 |
| JC - 94-37 | 236 | 119 | 248 | 201 |
| JC - 94-262 | 168 | 113 | 288 | 190 |
| Local check | 271 | 102 | 169 | 181 |
| JC - 94 -128 | 181 | 125 | 229 | 178 |
| CD (5%) | 055 | 039 | 071 | - |
| CV% | 15.21 | 17.7 | 14.29 | - |

CUM/CI/3.3 CVT 2001 – Series IV

(Jagudan)

Jagudan

The new CVT was started during 2002-03 in RBD with 8 entries. The yield

differences among the entries were found significant. JC - 2000-72 gave significantly higher yield (1126 kg ha⁻¹) which was 15.96% and 10.28 % higher than GC - 2 and GC - 3 (checks), respectively (Table 175).

Table 175. Performance of cumin accessions under CVT - Jagudan

| Entry | Days to 50 %flowering | Days to maturity | Plant ht. (cm) | No. of bran -ches plant ⁻¹ | No. of umbels plant ⁻¹ | No. of umbel -lates umbel | No. of seeds umbel -late | Volatile oil (%) | 1000 seeds wt.(g) | Yield (kg ha ⁻¹) | Increase over control (%) | |
|----------------|-----------------------|------------------|----------------|---------------------------------------|-----------------------------------|---------------------------|--------------------------|------------------|-------------------|------------------------------|---------------------------|-------|
| | | | | | | | | | | | GC-2 | GC-3 |
| JC - 2000-21 | 59 | 109 | 23.3 | 7.0 | 27.6 | 5.3 | 6.2 | 3.6 | 4.700 | 963 | - | - |
| JC - 2000-22 | 60 | 110 | 24.8 | 8.5 | 31.4 | 5.4 | 6.5 | 4.1 | 4.680 | 978 | - | - |
| JC - 2000-27 | 58 | 108 | 25.9 | 7.1 | 24.6 | 5.3 | 6.3 | 4.2 | 4.800 | 1035 | 6.59 | 1.37 |
| JC - 2000-72 | 57 | 108 | 25.7 | 7.8 | 33.2 | 5.2 | 6.3 | 4.4 | 5.160 | 1126 | 15.96 | 10.28 |
| UC - 341 | 54 | 102 | 29.7 | 5.7 | 28.3 | 5.1 | 6.6 | 3.5 | 4.800 | 856 | - | - |
| UC - 342 | 56 | 102 | 31.0 | 6.3 | 28.3 | 5.1 | 6.3 | 3.8 | 4.700 | 951 | - | - |
| GC - 2 (check) | 53 | 98 | 31.1 | 6.5 | 26.7 | 5.2 | 6.2 | 3.0 | 5.200 | 971 | - | - |
| GC - 3 (check) | 56 | 105 | 29.8 | 6.5 | 33.6 | 5.1 | 6.2 | 3.6 | 4.400 | 1021 | 5.15 | - |
| CV% | | 4.78 | | | | | | | | | | |
| CD (5%) | | 69 | | | | | | | | | | |

CUM/CI/4 Varietal Evaluation Trial **CUM/CI/4.1 Initial evaluation trial**

(Jagudan)

Jagudan

The trial was started during 2001-02 with 12 entries in RBD. The yield differences were found significant among the entries. The entries JC - 2000-72 and JC - 2000-27 gave significantly higher yield (949 kg ha⁻¹),

followed by JC - 2000-21 (941 kg ha⁻¹).

Two years pooled data indicated that six entries viz JC - 2000-72, JC - 2000-28, JC - 2000-27, JC - 2000-71, JC - 2000-21 and JC - 2000-22 gave significantly higher yield compared to the best checks. The yield of JC - 2000-72 was 38.03% and 21.43 % higher than GC - 2 and GC - 3 (WR), respectively (Table 176).

Table 176. Performance of cumin accessions under IET (2001-02 to 2002-03) – Jagudan

| Entry | Yield (kg ha ⁻¹) | | | Increase over control (%) | |
|--------------|------------------------------|---------|---------|---------------------------|--------|
| | 2001-02 | 2002-03 | Mean | GC - 2 | GC - 3 |
| JC - 2000-3 | 1067.00 | 827.00 | 947.00 | 19.27 | 5.69 |
| JC - 2000-20 | 1120.00 | 802.00 | 961.00 | 21.03 | 7.25 |
| JC - 2000-21 | 1086.00 | 941.00 | 1014.00 | 27.70 | 13.17 |
| JC - 2000-22 | 1120.00 | 896.00 | 1008.00 | 27.00 | 12.50 |
| JC - 2000-27 | 1180.00 | 949.00 | 1065.00 | 34.13 | 18.86 |
| JC - 2000-28 | 1207.00 | 888.00 | 1048.00 | 32.00 | 16.96 |
| JC - 2000-29 | 1050.00 | 781.00 | 916.00 | 15.37 | 2.23 |
| JC - 2000-68 | 999.00 | 750.00 | 875.00 | 10.20 | - |

| | | | | | |
|----------------|---------|--------|---------|-------|-------|
| JC - 2000-71 | 1138.00 | 914.00 | 1026.00 | 29.22 | 14.50 |
| JC - 2000-72 | 1227.00 | 949.00 | 1088.00 | 37.03 | 21.43 |
| GC - 2 (check) | 823.00 | 764.00 | 794.00 | - | - |
| GC - 3 (check) | 961.00 | 830.00 | 896.00 | 12.85 | - |
| CD (5%) | 205.00 | 109.00 | 112.00 | | |
| CV% | 11.21 | 7.48 | 10.00 | | |

CUM/CI/5 Quality Evaluation Trial
CUM/CI/5.1 Quality evaluation in cumin
(Jobner)

Jobner

The volatile oil content of 10 entries of cumin accessions under CVT was evaluated, which ranged from 3.2% to 4.4% (Table 177). The maximum volatile oil (4.4%) was recorded in UC - 310 followed by 4.2% in JC - 94-128; 4.0% in JC - 94-148 and JC - 94-262; 3.8% in JC - 94-37, RZ - 19 and RZ - 209 and minimum (3.2%) in UC - 223.

The total yield of volatile oil ha⁻¹ depends upon the grain yield. The volatile oil yield was found to be maximum (17.7 l ha⁻¹) in RZ - 19, followed by 17.17 l ha⁻¹ in RZ - 209, 16.51 l ha⁻¹ in UC - 223 and 14.78 l ha⁻¹ in UC - 310 and minimum (6.08 l ha⁻¹) in local check (Table 177).

The mean volatile oil content in cumin entries in CVT over three years (1999-2000 to 2001-2002) indicated that highest mean volatile

Table 177. Volatile oil content of cumin accessions under CVT (2001-2002)

| Entry | Grain yield (kg ha ⁻¹) | Volatile oil | |
|----------------|---------------------------------------|--------------|-----------------------------|
| | | (%) | Yield (l ha ⁻¹) |
| UC - 310 | 336 | 4.4 | 14.78 |
| JC - 94-128 | 229 | 4.2 | 9.61 |
| JC - 94-148 | 366 | 4.0 | 14.64 |
| JC - 94-262 | 288 | 4.0 | 11.52 |
| RZ - 19 check | 466 | 3.8 | 17.70 |
| RZ - 209 check | 452 | 3.8 | 17.17 |
| JC - 94-37 | 248 | 3.8 | 9.42 |
| Local check | 169 | 3.6 | 6.08 |
| UC - 231 | 365 | 3.6 | 13.14 |
| UC - 223 | 516 | 3.2 | 16.51 |
| Range | 169-516 | 3.2-4.4 | 6.08-17.70 |

oil (10.03 l ha⁻¹) was recorded in UC - 223 followed by 9.84 l ha⁻¹ in RZ - 19, 9.68 l ha⁻¹ in UC - 310, 9.18 l ha⁻¹ in JC - 94-148 (Table 178).

Table 178. Volatile oil content of cumin accessions under CVT (1999-2000 to 2001-2002)

| Entry | Grain yield (kg ha ⁻¹) | Volatile oil (%) | | | | Yield (l ha ⁻¹) |
|-------------|---------------------------------------|------------------|-------|-------|------|-----------------------------|
| | | 99-00 | 00-01 | 01-02 | Mean | |
| JC - 94-37 | 201 | 4.4 | 3.0 | 3.8 | 3.73 | 7.49 |
| UC - 310 | 269 | 3.6 | 2.8 | 4.4 | 3.60 | 9.68 |
| JC - 94-148 | 255 | 4.2 | 2.6 | 4.0 | 3.60 | 9.18 |
| JC - 94-128 | 178 | 3.7 | 2.8 | 4.2 | 3.56 | 6.33 |
| RZ - 19 | 302 | 3.6 | 2.4 | 3.8 | 3.26 | 9.84 |

| | | | | | | |
|-------------|---------|-----|-----|-----|----------|------------|
| UC - 231 | 272 | 3.5 | 2.6 | 3.6 | 3.23 | 8.78 |
| Local check | 181 | 3.4 | 2.6 | 3.6 | 3.20 | 5.79 |
| JC - 94-262 | 190 | 3.1 | 2.4 | 4.0 | 3.16 | 6.00 |
| RZ - 209 | 301 | - | 2.1 | 3.8 | 2.95 | 8.87 |
| UC - 223 | 386 | - | 2.0 | 3.2 | 2.60 | 10.03 |
| Range | 178-386 | | | | 2.6-3.73 | 5.79-10.03 |

CUM/CM/1 Nutrient Management Trial
CUM/CM/1.1 Efficacy of biofertilizer
using *Azospirillum* on cumin
(Jobner and Jagudan)

Jobner

The experiment was conducted in RBD with 10 treatments during 2000-01 and 2001-2002. All the treatments recorded

significantly higher seed yield over control (Table 179). Maximum seed yield (218 kg ha⁻¹) was recorded with the application of N 100% + *Azospirillum* + FYM 5 t ha⁻¹ which was at par with that of N 75% and 50% + *Azospirillum* + FYM 5 t ha⁻¹, *Azospirillum* + FYM 5 t ha⁻¹, N 100% and *Azospirillum* alone but significantly higher over rest of the treatments (Table 179).

Table 179. Effect biofertilizer, *Azospirillum* on growth and yield of cumin - Jobner

| Treatment | Plant height (cm) | Bran-ches plant ⁻¹ | Umbels plant ⁻¹ | Umbell ets umbel ⁻¹ | Seeds umbel ⁻¹ | Test weigh (g) | Biologi-cal yield (kg ha ⁻¹) | Seed yield (kg ha ⁻¹) |
|---|-------------------|-------------------------------|----------------------------|--------------------------------|---------------------------|----------------|--|-----------------------------------|
| Inorganic N (100%) + <i>Azospirillum</i> + FYM 5 t ha ⁻¹ | 37.30 | 6.40 | 20.30 | 5.50 | 30.80 | 4.33 | 913.00 | 218.00 |
| Inorganic N (75%) + <i>Azospirillum</i> + FYM 5 t ha ⁻¹ | 39.60 | 6.40 | 19.30 | 5.00 | 26.60 | 4.33 | 843.00 | 198.00 |
| Inorganic N (50%) + <i>Azospirillum</i> + FYM 5 t ha ⁻¹ | 37.20 | 5.60 | 19.10 | 5.10 | 27.60 | 4.33 | 794.00 | 190.00 |
| <i>Azospirillum</i> + FYM 5 t ha ⁻¹ | 41.40 | 6.20 | 20.80 | 5.10 | 31.20 | 4.10 | 794.00 | 196.00 |
| FYM 5 t ha ⁻¹ alone | 39.90 | 5.90 | 18.50 | 4.90 | 28.90 | 4.10 | 764.00 | 145.00 |
| <i>Azospirillum</i> + FYM 10 t ha ⁻¹ | 41.70 | 5.70 | 18.90 | 5.20 | 27.20 | 4.07 | 764.00 | 169.00 |
| FYM 10 t ha ⁻¹ | 38.70 | 5.70 | 18.50 | 5.00 | 28.80 | 4.20 | 675.00 | 182.00 |
| Inorganic N (100%) alone | 42.10 | 6.70 | 20.90 | 4.70 | 25.20 | 4.07 | 823.00 | 188.00 |
| <i>Azospirillum</i> 1.5 kg ha ⁻¹ alone | 40.50 | 5.90 | 18.60 | 4.80 | 30.70 | 3.97 | 753.00 | 200.00 |
| Control | 40.10 | 5.20 | 15.10 | 5.00 | 24.70 | 4.00 | 568.00 | 107.00 |
| CD (5%) | NS | 0.44 | NS | NS | NS | NS | 112.00 | 31.00 |
| CV% | 5.23 | 4.29 | 9.84 | 6.75 | 9.92 | 4.76 | 8.40 | 8.80 |

Pooled analyses of two years data which could not give significant increase in expressed similar trend except FYM 5 t ha⁻¹, seed yield (Table 180).

Table 180. Effect of biofertilizer, *Azospirillum* on seed yield of cumin (pooled data) – Jobner

| Treatment | Seed yield (kg ha ⁻¹) | | |
|---|-----------------------------------|-----------|------|
| | 2000-2001 | 2001-2002 | Mean |
| Inorganic N 100% + <i>Azospirillum</i> + FYM 5 t ha ⁻¹ | 196 | 218 | 207 |
| Inorganic N 75% + <i>Azospirillum</i> + FYM 5 t ha ⁻¹ | 183 | 198 | 191 |
| Inorganic N 50% + <i>Azospirillum</i> + FYM 5 t ha ⁻¹ | 183 | 190 | 187 |
| <i>Azospirillum</i> + FYM 5 t ha ⁻¹ | 142 | 196 | 169 |
| FYM 5 t ha ⁻¹ alone | 114 | 145 | 130 |
| <i>Azospirillum</i> + FYM 10 t ha ⁻¹ | 153 | 169 | 161 |
| FYM 10 t ha ⁻¹ | 144 | 182 | 163 |
| Inorganic N 100% alone | 178 | 188 | 183 |
| <i>Azospirillum</i> 1.5 kg ha ⁻¹ alone | 198 | 200 | 199 |
| Control | 144 | 107 | 126 |
| CD (5%) | 025 | 031 | 026 |

Jagudan

Report not received.

CUM/CP/1 Disease Management Trial
CUM/CP/1.2 Epidemiological study of
***Alternaria* blight of cumin**
 (Jobner)

Jobner

Final report not received.

CUM/CP/2 Pest Management Trial
CUM/CP/2.1 Integrated Management of
pests and disease of cumin
 (Jagudan and Jobner)

Jagudan

The experiment was conducted with the following treatments.

Main treatments

- S1 - Seed treatment & soil application of *Trichoderma harzianum*
 S2 - Seed treatment of carbendazim @ 0.1% + soil application of *Trichoderma harzianum*

S3 - Control**Sub treatments**

- T1 - Mancozeb 0.3%
 T2 - Mancozeb 0.3% + Neem Oil 1 % + Tipol 1%
 T3 - Mancozeb 0.3% + Monocrotophos 0.04%
 T4 - Mancozeb 0.3% + Acephate 0.075 %
 T5 - Hexaconazole 0.05%
 T6 - Hexaconazole 0.05% + Neem Oil 1 % + Tipol 1%
 T7 - Hexaconazole 0.05% + Monocrotophos 0.04%
 T8 - Hexaconazole 0.05% + Acephate 0.075%
 T9 - Thiophenate methyl 0.07%
 T10- Thiophenate methyl 0.07% + Monocrotophos 0.04%
 T11 - Control

The results on blight disease showed that seed treatment and soil application were not found effective in checking the disease. The different sprayings showed significant effect on the control of blight. Among them, T1 (Mancozeb alone) gave significantly higher control and it

was at par with rest of the treatments of Mancozeb. Remaining treatments were also found effective over control. The interaction was non-significant. The pooled data on blight disease and their interaction were non-significant (Tables 181 & 182).

Table 181. Effects of fungicides and biocontrol agents on wilt disease of cumin (1999-2000 to 2002-03) - Jagudan

| Treatment | Wilt (%) | | | | Mean |
|---------------------|----------|-------|-------|-------|-------|
| | 99-00 | 00-01 | 01-02 | 02-03 | |
| (A) Main treatments | | | | | |
| S1 | 47.30 | 29.10 | 33.70 | 22.50 | 33.10 |
| S2 | 81.40 | 17.90 | 38.50 | 27.40 | 41.30 |
| S3 | 97.30 | 27.80 | 35.70 | 39.00 | 50.00 |
| CD (5%) | 15.70 | NS | NS | 5.10 | NS |
| (B) Sub treatments | | | | | |
| T1 | 76.50 | 13.50 | 39.20 | 22.90 | 38.00 |
| T2 | 81.00 | 29.10 | 41.40 | 28.40 | 44.90 |
| T3 | 69.20 | 20.40 | 43.60 | 26.40 | 39.90 |
| T4 | 56.90 | 23.50 | 38.30 | 26.60 | 36.30 |
| T5 | 86.80 | 32.40 | 24.60 | 30.90 | 43.70 |
| T6 | 78.80 | 20.10 | 31.50 | 24.10 | 38.60 |
| T7 | 74.60 | 24.10 | 16.60 | 28.10 | 35.90 |
| T8 | 70.60 | 27.50 | 27.50 | 25.80 | 37.10 |
| T9 | 71.00 | 32.80 | 37.70 | 32.60 | 47.70 |
| T10 | 87.80 | 21.90 | 38.80 | 29.30 | 39.00 |
| T11 | 68.20 | 28.80 | 58.90 | 50.80 | 54.10 |
| CD (5%) | 15.50 | NS | NS | 5.10 | 8.50 |
| S x T | NS | NS | NS | 8.80 | NS |
| CV% | 21.75 | 70.62 | 75.11 | 18.26 | 44.11 |

Table 182. Effects of fungicides and biocontrol agents on blight disease of cumin - Jagudan

| Treatment | PD 1 | | | | Mean |
|---------------------|-------|-------|-------|-------|-------|
| | 99-00 | 00-01 | 01-02 | 02-03 | |
| (A) Main treatments | | | | | |
| S1 | 61.70 | 11.30 | 34.50 | 25.20 | 33.10 |
| S2 | 72.20 | 9.50 | 34.90 | 33.10 | 37.40 |
| S3 | 95.20 | 9.80 | 32.50 | 32.20 | 42.40 |

| | | | | | |
|--------------------|-------|-------|-------|-------|-------|
| CD (5%) | 10.70 | NS | NS | NS | NS |
| (B) Sub treatments | | | | | |
| T1 | 83.60 | 5.70 | 19.30 | 28.70 | 34.30 |
| T2 | 87.60 | 9.60 | 23.30 | 27.10 | 36.90 |
| T3 | 51.10 | 9.40 | 23.40 | 26.40 | 27.60 |
| T4 | 50.00 | 9.00 | 23.60 | 33.10 | 28.20 |
| T5 | 89.60 | 9.60 | 35.10 | 31.30 | 41.40 |
| T6 | 96.90 | 9.40 | 32.10 | 27.60 | 41.50 |
| T7 | 72.20 | 7.50 | 41.10 | 33.30 | 38.50 |
| T8 | 67.80 | 10.70 | 35.40 | 33.10 | 36.80 |
| T9 | 96.80 | 10.80 | 42.50 | 31.10 | 45.40 |
| T10 | 54.60 | 9.90 | 33.40 | 29.30 | 31.80 |
| T11 | 90.00 | 20.10 | 66.80 | 30.70 | 51.90 |
| CD (5%) | 16.20 | 3.00 | 5.60 | NS | NS |
| S x T | 28.10 | NS | 9.60 | NS | NS |
| CV% | 22.55 | 31.05 | 17.40 | 39.46 | 29.18 |

Aphid infestation before spraying was similar in all the treatments. After second spray, main treatments showed non-significant effect on aphid infestation, while all the sub-treatments were found significantly superior over control. Among the spraying treatments, T10 (Thiophenate methyl 0.07% + Monocrotophos 0.04%) showed significantly minimum aphid infestation. However, it was at par with treatments T7 (Heconazole 0.05%

+ Monocrotophos 0.04%) T3 (Mancozeb 0.3% + Monocrotophos 0.04%) and T₄ (Mancozeb 0.3% + Acephate 0.075%). The interaction was found non-significant.

Pooled data on aphid infestation before spraying were non-significant. After second spray, treatment T7 (Heconazole 0.05% + Monocrotophos 0.04%) was found significantly superior to all other treatments. The interaction effect was found non-significant (Table 183).

Table 183. Effects of agrochemicals and biocontrol agent on aphid infestation in cumin - Jagudan

| Treatment | Aphid index | | | | | | | | | |
|---------------------|--------------|-------------|--------------|-------------|--------------|-------------|--------------|-------------|--------------|-------------|
| | 99-00 | | 00-01 | | 01-02 | | 02-03 | | Mean | |
| | Before spray | After spray | Before spray | After spray | Before spray | After spray | Before spray | After spray | Before spray | After spray |
| (A) Main treatments | | | | | | | | | | |
| S1 | 1.70 | 1.30 | 1.80 | 1.40 | 1.70 | 1.30 | 0.60 | 0.70 | 1.50 | 1.20 |
| S2 | 1.90 | 1.70 | 1.70 | 1.40 | 1.70 | 1.40 | 0.40 | 0.60 | 1.40 | 1.30 |
| S3 | 1.90 | 1.40 | 1.80 | 1.50 | 1.60 | 1.50 | 0.40 | 0.60 | 1.40 | 1.20 |

| | | | | | | | | | | |
|--------------------|-------|-------|-------|-------|-------|-------|-------|-------|------|-------|
| CD (5%) | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS |
| (B) Sub treatments | | | | | | | | | | |
| T1 | 2.20 | 2.00 | 1.60 | 1.50 | 1.60 | 1.40 | 0.40 | 0.60 | 1.40 | 1.40 |
| T2 | 2.40 | 2.30 | 1.90 | 1.40 | 1.80 | 1.50 | 0.20 | 0.60 | 1.60 | 1.50 |
| T3 | 1.00 | 0.50 | 2.00 | 1.40 | 1.90 | 1.20 | 0.40 | 0.20 | 1.30 | 0.80 |
| T4 | 1.80 | 1.60 | 1.90 | 1.20 | 1.90 | 1.10 | 0.60 | 0.20 | 1.50 | 1.00 |
| T5 | 2.20 | 2.10 | 2.00 | 1.80 | 1.80 | 1.70 | 0.60 | 1.20 | 1.60 | 1.70 |
| T6 | 2.20 | 1.90 | 1.70 | 1.40 | 1.40 | 1.30 | 0.50 | 0.90 | 1.40 | 1.40 |
| T7 | 0.90 | 0.10 | 1.20 | 0.20 | 1.30 | 0.80 | 0.40 | 0.20 | 0.90 | 0.30 |
| T8 | 1.80 | 1.10 | 1.80 | 1.30 | 1.60 | 1.10 | 0.60 | 0.30 | 1.50 | 1.00 |
| T9 | 2.10 | 2.00 | 1.70 | 1.90 | 1.60 | 1.60 | 0.60 | 1.10 | 1.50 | 1.70 |
| T10 | 1.10 | 0.50 | 1.90 | 1.50 | 1.80 | 1.40 | 0.40 | 0.10 | 1.30 | 0.90 |
| T11 | 2.60 | 1.90 | 1.70 | 2.10 | 1.60 | 2.20 | 0.60 | 1.60 | 1.60 | 1.90 |
| CD (5%) | 0.40 | 0.50 | NS | 0.50 | NS | 0.40 | NS | 0.30 | NS | 0.50 |
| S x T | NS | NS | NS | NS | NS | NS | 0.46 | 0.52 | NS | NS |
| CV% | 22.37 | 36.38 | 31.75 | 37.46 | 28.44 | 32.78 | 58.77 | 50.01 | 3.09 | 38.12 |

Effect of main treatments on yield was non-significant. Among the spraying treatments, treatment T3 (Mancozeb 0.3% + Monocrotophos 0.04%) gave higher yield and it was at par with T4 (Mancozeb 0.3% + Acephate 0.075%), T1 (Mancozeb 0.3%), T6 (Heconazole 0.05% + Neem oil 1% + Tipol 1%), T5 (Heconazole 0.05%), T2 (Mancozeb

0.3% + Neem oil 1% + Tipol 1%) and T8 (Heconazole 0.05% + Acephate 0.075%) treatments but significantly higher than rest of treatments. The interaction effect was also found significant. In pooled data, seed yield of cumin was non-significant among different treatments. The interaction effect was also found non-significant (Table 184).

Table 184. Effects of fungicides and biocontrol agents on yield of cumin - Jagudan

| Treatment | Yield (kg ha ⁻¹) | | | |
|---------------------|------------------------------|-------|-------|------|
| | 00-01 | 01-02 | 02-03 | Mean |
| (A) Main treatments | | | | |
| S1 | 273 | 56 | 195 | 175 |
| S2 | 342 | 54 | 178 | 192 |
| S3 | 312 | 89 | 187 | 196 |
| CD (5%) | NS | NS | NS | NS |
| (B) Sub treatments | | | | |
| T1 | 446 | 65 | 204 | 238 |
| T2 | 285 | 53 | 188 | 175 |
| T3 | 332 | 68 | 226 | 209 |

| | | | | |
|---------|-------|-------|-------|-------|
| T4 | 282 | 103 | 225 | 203 |
| T5 | 285 | 71 | 192 | 182 |
| T6 | 282 | 70 | 195 | 182 |
| T7 | 268 | 60 | 174 | 167 |
| T8 | 261 | 71 | 187 | 173 |
| T9 | 301 | 47 | 170 | 173 |
| T10 | 326 | 60 | 163 | 183 |
| T11 | 332 | 80 | 133 | 175 |
| CD (5%) | 96 | NS | 45 | NS |
| S x T | NS | NS | NS | NS |
| CV% | 32.85 | 94.18 | 25.62 | 39.57 |

From the pooled results, it can be concluded that the seed treatment and soil application of *T. harzianum* were not effective for controlling wilt and blight diseases and aphid infestation. For the control of aphid, two sprays of monocrotophos and acephate were found more effective. Further it can be also

concluded that in this integrated experiment neither integration nor individual treatments were effective for the control of wilt and blight diseases.

Jobner

Report not received.

FENNEL**FNL/CI/1 Genetic Resources****FNL/CI/1.1 Germplasm collection, characterization, evaluation, conservation and screening against diseases**

(Jobner, Jagudan, Hisar, Kumarganj and Dholi)

Kumarganj

The programme was started during 1996-97. At present, the centre holds 27 accessions.

Evaluation of 27 germplasm for three years showed NDF - 5 as the highest seed yielder (25.34 q ha⁻¹) followed by NDF - 6 and NDF - 25 (22.91 and 22.21 q ha⁻¹) during the year 2002-03. NDF - 1, 2, 4, 10 to 18, 20, 21, 23, 24 and 27 had lowest incidence of blight after one spray of fungicide under field conditions. Maximum of 10% blight incidence was observed in NDF - 19 during the year 2002-03. Three years pooled data revealed that NDF - 5 was maximum seed yielder (21.74 q ha⁻¹), followed by NDF - 6 (20.10 q ha⁻¹) (Table 185).

Table 185. Performance of fennel germplasm accessions (2000-03) – Kumarganj

| Germplasm | Yield (q ha ⁻¹) | | | |
|-----------|-----------------------------|---------|---------|-------|
| | 2000-01 | 2001-02 | 2002-03 | Mean |
| NDF - 1 | 15.60 | 12.92 | 13.54 | 14.02 |
| NDF - 2 | 16.20 | 17.50 | 13.88 | 15.86 |
| NDF - 3 | 15.56 | 16.25 | 15.97 | 15.92 |
| NDF - 4 | 16.33 | 8.75 | 13.19 | 12.75 |
| NDF - 5 | 16.96 | 22.92 | 25.34 | 21.74 |
| NDF - 6 | 16.53 | 20.83 | 22.91 | 20.10 |
| NDF - 7 | 15.66 | 13.33 | 6.94 | 11.97 |
| NDF - 8 | 15.83 | 16.25 | 11.80 | 14.62 |
| NDF - 9 | 15.0 | 11.25 | 9.72 | 11.99 |
| NDF - 10 | 16.26 | 20.42 | 16.66 | 17.78 |
| NDF - 11 | 15.66 | 14.17 | 16.21 | 15.34 |
| NDF - 12 | 15.90 | 12.08 | 21.17 | 16.38 |
| NDF - 13 | 15.50 | 16.67 | 9.37 | 13.84 |
| NDF - 14 | 16.20 | 15.42 | 14.92 | 15.91 |
| NDF - 15 | 15.20 | 12.92 | 14.23 | 14.11 |

Jagudan

The centre maintains 202 accessions under germplasm. Among the 202 genotypes evaluated, promising lines viz., JF - 472-5, 546, 597, 529-3, 530, 563, 569, 582, 592-1, 192, 275, 351-1-1, 351-2-1, 351-5, 351-5-1, 412, 420-3-4-1, 442-1, 444-1, 456-2, 461-1, 472-2-2, 490, 494, 497, 499, 500-1, 501-2,

513-1, 513-2, 519, 535-1, 536, 551, 571, 574, EC - 243383 and 206924 were identified with grain yield ranging from 55 to 350 g plant⁻¹.

In fennel, 47 plants selected during the 2001-02 from segregating materials of this centre, were sown and evaluated during 2002-03. Among them 30 true type and good

performed entries were selected for next generation. Fifty three plants having earliness and dwarfness were selected from nursery during kharif season, selfed them and sufficient seeds were collected for further study. Based on different useful characters, 105 plants were selected in kharif season, selfed them and sufficient seeds were collected for next generation. During the year, *Ramularia* blight disease was not observed.

Hisar

This centre holds 74 accessions. Seventy accessions of fennel were evaluated using PF - 35, GF - 1 and Local as checks during 2001-2002. The seed yield of the germplasm ranged from 245 g (HF - 173) to 925 g (HF - 154) per plot. Thirty four lines gave higher seed yield than the highest yielding check (PF - 35). The most promising lines were HF - 102, HF - 104, HF - 107, HF - 116, HF - 119, HF - 154, HF - 162 and HF - 164. These lines were maintained by sib mating under muslin cloth and self seed of all the lines have been harvested.

Jobner

This centre maintains 203 germplasm accessions. Eleven accessions along with checks local, RF - 101 and RF - 125 were evaluated for volatile oil content. The volatile oil content ranged from 1.85% to 2.35% (Table 186). The promising entries with respect to volatile oil were UF - 41 (2.35%), UF - 40 (2.2%), UF - 84 (2.1%), UF - 165 (2.0%), UF - 126 (2.0%) and Jhola local (2.0%) (Table 186).

Table 186. Volatile oil of germplasm accessions of fennel - Jobner

| Entry | Yield (g plant ⁻¹) | Volatile oil (%) |
|---------|--------------------------------|------------------|
| UF - 41 | 40.0 | 2.35 |
| UF - 40 | 58.0 | 2.20 |

| | | |
|------------------|-----------|-----------|
| UF - 84 | 44.0 | 2.10 |
| UF - 165 | 58.0 | 2.00 |
| UF - 126 | 48.0 | 2.00 |
| Jhola local | 46.0 | 2.00 |
| UF - 11 | 58.0 | 1.85 |
| RF - 101 (check) | 27.2 | 2.00 |
| RF - 125 (check) | 40.0 | 2.10 |
| UF - 143 | 27.0 | 1.95 |
| Local check | 23.2 | 2.00 |
| Range | 23.2-58.0 | 1.85-2.35 |

Eleven entries of fennel received from Hisar centre were also evaluated for volatile oil content. The volatile oil content was found in the range of 2.2% to 2.4%. Some of the common entries, which were also grown at Jobner, were compared for volatile oil content. The volatile oil content was found to be much higher in entries grown at Jobner compared to those grown at Hisar (Table 187).

Table 187. Volatile oil content in fennel grown at Jobner and Hisar

| Entry | Volatile oil (%) | |
|----------|------------------|-------|
| | Jobner | Hisar |
| UF - 177 | 2.80 | 2.40 |
| HF - 116 | 2.80 | 2.40 |
| UF - 179 | 2.60 | 2.20 |
| JF - 234 | 2.60 | 2.15 |
| JF - 332 | 2.53 | 2.25 |
| UF - 178 | 2.50 | 2.40 |
| JF - 303 | 2.46 | 2.40 |
| Local | 2.46 | 2.20 |
| GF - 1 | - | 2.30 |
| PF - 35 | - | 2.30 |
| HF - 107 | - | 2.20 |

Dholi

The centre maintains forty four germplasm accessions and tested for identifying promising lines for higher yield. Out of forty four genotypes, only five namely, RF - 55, RF - 27, RF - 39, RF - 31 and RF - 23 produced higher yield which varied from 0.15 kg to 0.20 kg plant⁻¹.

FNL/CI/2 Hybridization trial

| Parents | No. of crosses | F1 seeds harvested | Purpose |
|-----------------------|----------------|--------------------|----------------------------------|
| GF - 399-2 X GF-2 | 100 | 43 | To study Heterosis and sterility |
| GF - 427-1-3-3 X GF-2 | 50 | 17 | |
| GF - 427-1-3-1 X GF-2 | 50 | 13 | |

FNL/CI/2.2 Inter-varietal hybridization for evolving high yielding varieties*(Jobner)***Jobner**

In fennel, varietal diallel was made among 9 diverse varieties in 2000-2001 and evaluated in 2001-2002. Among 36 crosses, 14 crosses recorded better yield than the best check variety (RF - 101) (Table 188).

Table 188. Evaluation of F1's in fennel For Yield - Jobner

| Cross | Seed yield (g plot ⁻¹) |
|---------------------|------------------------------------|
| UF - 90 X HF - 71 | 200 |
| UF - 90 X JF - 25 | 200 |
| UF - 90 X HF - 104 | 225 |
| UF - 90 X UF - 133 | 150 |
| UF - 90 X Local | 200 |
| RF - 101 X HF - 104 | 150 |
| RF - 101 X JF - 25 | 250 |
| RF - 101 X UF - 133 | 150 |
| RF - 101 X Local | 150 |

FNL/CI/2.1 Mutation studies and crossing programme in fennel*(Jagudan)***Jagudan**

F1 seeds of [JF - 399-1-2 X GF-2 (38 seeds) and JF - 427-3-1 X GF - 2 (29 seeds)], collected during 2001-02 were sown in nursery but none of the seeds germinated. The following crosses were made during 2002-03.

| | |
|----------------------|-----|
| UF(M) - 1 X HF - 104 | 175 |
| UF(M) - 1 X RF - 101 | 200 |
| UF(M) - 1 X UF - 90 | 220 |
| UF - 133 X JF - 25 | 175 |
| UF - 133 X Local | 300 |
| RF - 101 (check) | 140 |

FNL/CI/3 Coordinated Varietal Trial**FNL/CI/3.1 CVT 1994/1997-Series III***(Jobner, Jagudan and Hisar)***Jagudan**

The trial was undertaken with eight entries i.e. JF - 186, JF - 192 and JF - 200 from Jagudan (Gujarat); UF - 143 and UF - 144 from Jobner (Rajasthan) and HF - 33 and HF - 39 from Hisar (Haryana) including GF - 2 as check for five years (1997-98 to 2001-02) in randomized block design with four replications.

The grain yield differences were found significant during all five years, except in 1999-2000. During 1997-98,

1998-99, JF - 192 did not differ significantly for yield over check (GF - 2). However, during 2000-01 and 2001-02, JF - 192 recorded significantly higher grain yield than check. Average grain yield was highest in JF - 192 (2489 kg ha⁻¹) followed by JF - 200 (2355 kg ha⁻¹). JF - 192 gave 12.17 % higher yield than GF - 2 (Table 189).

Table 189. Performance of fennel accessions (1997-1998 to 2001-2002) - Jagudan

| Entry | Yield (kg ha ⁻¹) | | | | | Average yield (kg ha ⁻¹) | Increase over control (%) |
|----------------|------------------------------|---------|---------|---------|---------|--------------------------------------|---------------------------|
| | 1997-98 | 1998-99 | 1999-00 | 2000-01 | 2001-02 | | |
| JF - 186 | 2766.00 | 2606.00 | 2181.00 | 1925.00 | 1619.00 | 2219.00 | - |
| JF - 192 | 2618.00 | 2743.00 | 2645.00 | 2287.00 | 2153.00 | 2489.00 | 12.17 |
| JF - 200 | 2833.00 | 2606.00 | 2489.00 | 2038.00 | 1788.00 | 2351.00 | 5.95 |
| UF - 143 | 2360.00 | 2307.00 | 2181.00 | 2183.00 | 1740.00 | 2154.00 | - |
| UF - 144 | 2650.00 | 2402.00 | 1790.00 | 2077.00 | 1966.00 | 2177.00 | - |
| HF - 33 | 1737.00 | 2079.00 | 1838.00 | 1651.00 | 1675.00 | 1796.00 | - |
| HF - 39 | 2140.00 | 1947.00 | 2285.00 | 1608.00 | 1719.00 | 1940.00 | - |
| GF - 2 (check) | 2539.00 | 2554.00 | 2185.00 | 1940.00 | 1879.00 | 2219.00 | - |
| CD (5%) | 577.00 | 316.00 | N S | 330.00 | 243.00 | 247.00 | |
| CV% | 15.97 | 8.92 | 18.72 | 11.41 | 9.10 | 13.79 | |

In CVT during 2000-01 at Hisar, JF - 192 recorded 29.30% higher yield (2030 kg ha⁻¹) than their local checks. Trials were conducted at different locations of the state. The results showed that the JF - 192 recorded 6.71 and 28.57% higher yield compared to GF - 2 at Anand and Ladol, respectively (Table 190). The trial was concluded in 2001-02. JF - 192 is proposed for release for Gujarat State and was recommended in AGRESCO meeting during 2002-03.

Table 190. Performance of JF - 192 at different locations (2000-01) - Jagudan

| Centre | Yield (kg ha ⁻¹) | | CD (5%) | Increase over check (%) | Remarks |
|-----------|------------------------------|-------------|---------|-------------------------|----------|
| | JF - 192 | Local check | | | |
| Hisar | 2030* | 1570 | 310 | 29.30 | In CVT |
| Jagudan | 2153* | 1870 | 243 | 14.58 | In CVT |
| Anand | 1177 | 1103 | - | 6.71 | - |
| Ladol | 450 | 350 | - | 28.57 | - |
| S.K.Nagar | - | - | - | - | Vitiated |
| Aseda | - | - | - | - | Vitiated |

Jobner and Hisar

Final reports were not submitted.

FNL/CI/3.2 CVT 2001 - Series IV

(*Jagudan, Jobner, Hisar and Kumarganj*)

Jagudan

The trial was initiated during 2001-2002 with 14 entries in RBD. The yield differences were found significant among the

entries. JF - 332 gave higher yield (2318 kg ha⁻¹), but it was at par with control. It was 14.13% more than check. The pooled data for two years showed non-significant yield differences among the entries. However, JF - 332 recorded maximum yield (2259 kg ha⁻¹) than control (GF - 2), which was 15.67% higher over check. JF - 332 had also given 12.33 % higher yield than JF - 192 (Table 191).

Table 191. Performance of fennel accessions (2001-02 to 2002-03) - Jagudan

| Genotype | Yield (kg ha ⁻¹) | | | Increase over control (%) | |
|------------------|------------------------------|---------|---------|---------------------------|----------|
| | 2001-02 | 2002-03 | Average | GF - 2 | JF - 192 |
| JF - 234 | 1949.00 | 2155.00 | 2052.00 | 5.07 | 2.04 |
| JF - 303 | 1810.00 | 2198.00 | 2004.00 | - | - |
| JF - 332 | 2201.00 | 2318.00 | 2259.00 | 15.67 | 12.33 |
| UF - 177 | 1649.00 | 1599.00 | 1624.00 | - | - |
| UF - 178 | 1669.00 | 1619.00 | 1644.00 | - | - |
| UF - 179 | 1944.00 | 1912.00 | 1928.00 | - | - |
| HF - 107 | .* | 1682.00 | 1682.00 | - | - |
| HF - 116 | 1797.00 | 1717.00 | 1757.00 | - | - |
| RF - 21 | 1393.00 | 1504.00 | 1449.00 | - | - |
| RF - 31 | 1749.00 | 1934.00 | 1841.00 | - | - |
| NDF - 5 | .** | 1011.00 | 1011.00 | - | - |
| NDF - 6 | .** | 1408.00 | 1408.00 | - | - |
| JF - 192 (check) | 2049.00 | 1973.00 | 2011.00 | 2.97 | |
| GF - 2 (check) | 1875.00 | 2031.00 | 1953.00 | | |
| CD (5%) | 300.00 | 423.00 | NS | | |
| CV% | 12.47 | 15.57 | 14.31 | | |

*Seeds did not germinate

** Seeds were not available

Kumarganj

The trial was initiated during 2001 with 19 entries. Out of 19 genotypes, NDF - 5 showed highest seed yield (19.09 q ha⁻¹) followed by RF - 31 (18.40 q ha⁻¹) during the

year 2002-03 (Table 192). The mean seed yield of three years pooled data showed that J.Fenu - 210 gave maximum (21.13 q ha⁻¹) followed by RMT - 16 (18.48 q ha⁻¹).

Table 192. Performance of fennel germplasm (2001 to 20003) - Kumarganj

| Genotype | Yield (q ha ⁻¹) | | |
|----------|-----------------------------|---------|-------|
| | 2001-02 | 2002-03 | Mean |
| RF - 15 | 22.70 | 16.31 | 19.50 |
| RF - 16 | 19.44 | 13.89 | 16.66 |
| RF - 21 | 6.59 | 11.80 | 9.19 |
| RF - 31 | 9.02 | 18.40 | 13.71 |
| JF - 192 | 9.72 | 5.90 | 7.81 |
| NDF - 5 | 20.76 | 19.09 | 19.92 |
| CD (5 %) | 2.60 | 3.39 | |
| CV % | 6.89 | 16.50 | |

Jobner

The trial was started during rabi 2001-02 with 11 entries. The analysis of the data revealed significant differences among the

entries for all the characters studied. The mean days to flowering ranged from 116.0 (RF - 125, check) to 127.3 days (local check), plant height from 105.7 (RF - 125, check) to 156.3 cm (JF - 234), branches per plant from 6.9 (JF - 332) to 11.7 (UF - 178), umbels per plant from 20.1 (HF - 116) to 45.7 (UF - 178), umbellets per umbel from 20.4 (local check) to 30.0 (RF - 125, check), seeds per umbel from 240.5 (local check) to 381.5 (UF - 177) and test weight from 5.33 (local check and JF - 303) to 7.07 g (UF - 178). UF - 178 recorded maximum seed yield of 1680 kg ha⁻¹ followed by JF - 332 (1390 kg ha⁻¹), UF - 177 (1387 kg ha⁻¹), RF - 101 (check, 1333 kg ha⁻¹) and UF - 179 (1283 kg ha⁻¹). The lowest yield of 733 kg ha⁻¹ was recorded in local check (Table 193).

Table 193. Performance of fennel accessions under CVT - Jobner

| Entry | Days to flowering | Plant height (cm) | Branches plant ⁻¹ | Umbels plant ⁻¹ | Umbellets umbel ⁻¹ | Seeds umbel ⁻¹ | Test weight (g) | Seed yield (g ha ⁻¹) | Increase over check (%) |
|-------------|-------------------|-------------------|------------------------------|----------------------------|-------------------------------|---------------------------|-----------------|----------------------------------|-------------------------|
| UF - 177 | 116.70 | 153.10 | 10.60 | 45.50 | 20.80 | 381.50 | 5.60 | 1387.00 | 4.05 |
| UF - 178 | 116.30 | 140.40 | 11.70 | 45.70 | 22.70 | 380.90 | 7.07 | 1680.00 | 26.03 |
| UF - 179 | 116.30 | 127.50 | 8.00 | 28.90 | 23.20 | 310.30 | 7.07 | 1283.00 | - |
| JF - 234 | 118.30 | 156.30 | 7.50 | 31.90 | 21.70 | 235.30 | 6.27 | 1183.00 | - |
| JF - 303 | 118.30 | 150.70 | 7.20 | 29.70 | 23.70 | 326.30 | 5.33 | 1100.00 | - |
| JF - 332 | 118.30 | 155.30 | 6.90 | 32.10 | 25.60 | 373.70 | 7.06 | 1390.00 | 4.27 |
| HF - 116 | 122.90 | 151.40 | 9.30 | 20.10 | 24.90 | 360.20 | 5.47 | 1200.00 | - |
| RF - 101 C | 119.30 | 139.00 | 9.30 | 31.00 | 21.00 | 267.10 | 6.80 | 1333.00 | Check |
| RF - 125 C | 116.00 | 105.70 | 9.60 | 37.50 | 30.00 | 281.10 | 6.27 | 1233.00 | - |
| UF - 143 C | 118.00 | 132.00 | 9.30 | 29.70 | 21.50 | 278.30 | 6.13 | 1133.00 | - |
| Local check | 127.30 | 144.30 | 8.70 | 24.80 | 20.40 | 240.50 | 5.33 | 733.00 | - |
| CD (5%) | 1.81 | 5.24 | 1.29 | 6.76 | 3.37 | 75.66 | 0.78 | 119.00 | |
| CV% | 0.72 | 2.18 | 8.40 | 12.23 | 8.53 | 14.23 | 7.44 | 5.67 | |

Hisar

The trial was initiated with 13 entries during 2001-02 in RBD. Significant differences were obtained for all the parameters during 2001-2002. Plant height ranged from 102.8 to 117.2 cm, number of

branches from 7.0 to 8.6, umbels per plant from 23.0 to 39.5, umbellets per umbel from 15.9 to 21.4 and seeds per umbel from 206.7 to 309.0. Maximum seed yield (2000 kg ha⁻¹) was recorded in UF - 178, which was at par with HF - 107 and RF - 15. (Table 194).

Table 194. Performance of fennel accessions under CVT - Hisar

| Entries | Plant height(cm) | Branches plant ⁻¹ | Umbels plant ⁻¹ | Umbellets umbel ⁻¹ | Seeds umbel ⁻¹ | Seed yield (kg ha ⁻¹) |
|-------------|------------------|------------------------------|----------------------------|-------------------------------|---------------------------|-----------------------------------|
| RF - 13 | 108.0 | 7.3 | 24.3 | 20.5 | 316.9 | 1595 |
| RF - 15 | 116.8 | 8.2 | 25.5 | 19.4 | 258.7 | 1833 |
| RF - 16 | 109.3 | 7.4 | 23.0 | 17.5 | 269.0 | 1687 |
| HF - 107 | 106.2 | 8.1 | 33.9 | 21.4 | 309.0 | 1883 |
| HF - 116 | 111.8 | 8.6 | 30.3 | 17.9 | 263.5 | 1677 |
| JF - 234 | 104.2 | 7.0 | 30.6 | 18.5 | 274.6 | 1572 |
| JF - 303 | 103.6 | 7.8 | 27.6 | 16.1 | 206.7 | 1330 |
| JF - 332 | 105.1 | 7.0 | 25.4 | 16.6 | 223.5 | 1450 |
| UF - 177 | 102.8 | 8.4 | 32.2 | 16.8 | 242.5 | 1500 |
| UF - 178 | 106.4 | 8.3 | 39.5 | 18.0 | 262.0 | 2000 |
| UF - 179 | 103.0 | 8.1 | 37.1 | 15.9 | 254.3 | 1625 |
| Local check | 117.2 | 7.9 | 30.0 | 17.9 | 301.6 | 1562 |
| GF - 2 | 105.5 | 7.9 | 35.7 | 17.4 | 274.4 | 1521 |
| CD (5 %) | 7.1 | 0.6 | 6.2 | 1.5 | 17.1 | 218 |

FNL/CI/4 Varietal Evaluation Trial

FNL/CI/4.1 Initial evaluation trial

(*Hisar, Jobner and Jagudan*)

Hisar

The trial was conducted with ten

accessions along with PF - 35 as check during 1998-99 to 2001-2002. The result indicated that HF - 107 and HF - 116 gave significantly higher yield over PF - 35 with an increase of 31.4 and 27.7%, respectively over the check (Table 195).

Table 195. Performance of fennel accessions under IET - Hisar

| Accession | Seed yield (q ha ⁻¹) | | | | Increase/decrease over check (%) |
|-----------|----------------------------------|-----------|-----------|------|----------------------------------|
| | 1998-99 | 2000-2001 | 2001-2002 | Mean | |
| HF - 107 | 19.5 | 21.2 | 22.1 | 20.9 | 31.4 |
| HF - 113 | 16.5 | 15.0 | 16.0 | 15.8 | - 0.6 |
| HF - 116 | 19.2 | 20.0 | 21.7 | 20.3 | 27.7 |
| HF - 117 | 22.0 | 17.0 | 19.5 | 19.5 | 22.6 |
| HF - 118 | 17.0 | 15.6 | 20.4 | 17.7 | 11.3 |

| | | | | | |
|-------------|------|------|------|------|-------|
| HF - 122 | 20.2 | 13.5 | 17.2 | 17.0 | 6.9 |
| HF - 125 | 18.2 | 17.0 | 20.8 | 18.7 | 17.6 |
| HF - 127 | 21.0 | 16.0 | 20.1 | 19.0 | 19.5 |
| HF - 129 | 15.0 | 16.2 | 15.6 | 15.6 | - 1.9 |
| HF - 175 | 16.0 | 17.5 | 18.7 | 17.4 | 9.4 |
| PF - 35 (C) | 16.7 | 13.6 | 17.4 | 15.9 | - |
| CD (5%) | 2.4 | 3.2 | 3.0 | - | - |

Jobner

Report not received.

Jagudan

The trial was started during 2001-02 with 10 entries. The results showed non-significant yield differences among the entries. However, JF - 421 and JF - 391 were

promising giving higher yield (3362 kg ha⁻¹ and 3330 kg ha⁻¹, respectively), which were 11.18 and 10.12% higher above the check, respectively. Pooled data for two years revealed that JF - 421 gave significantly superior yield (3119 kg ha⁻¹) than the check GF - 2, which was 12.80% higher than control (Table 196).

Table 196. Performance of fennel accessions (2001-02 to 2002-03) – Jagudan

| Genotype | Yield (kg ha ⁻¹) | | | Increase over control(%) |
|----------------|------------------------------|---------|---------|--------------------------|
| | 2001-02 | 2002-03 | Average | |
| JF - 311 | 2569.00 | 2838.00 | 2704.00 | - |
| JF - 341 | 2650.00 | 2905.00 | 2778.00 | 0.47 |
| JF - 376 | 2928.00 | 3076.00 | 3002.00 | 8.57 |
| JF - 391 | 2517.00 | 3330.00 | 2924.00 | 5.71 |
| JF - 421 | 2876.00 | 3362.00 | 3119.00 | 12.80 |
| JF - 444-1 | 3038.00 | 3131.00 | 3084.00 | 11.54 |
| JF - 444-2 | 2668.00 | 2937.00 | 2802.00 | 1.34 |
| JF - 450 | 2049.00 | 2569.00 | 2309.00 | - |
| JF - 472 | 2211.00 | 2688.00 | 2449.00 | - |
| GF - 2 (check) | 2506.00 | 3024.00 | 2765.00 | |
| CD (5%) | 297.00 | NS | 351.00 | |
| CV% | 6.65 | 13.49 | 11.09 | |

FNL/CI/4.2 Comparative yield trial (CYT)
(*Dholi*)

Dholi

The trial was initiated during 2000-03 with 11 genotypes. There were non-significant

differences among the genotypes for plant height, number of branches and number of umbels per plant and grain yield. RF - 31 gave higher yield (1.19 kg plot⁻¹ and 1.32 t ha⁻¹) which was 17.86 % more than check, Rajendra Saurabh (Table 197).

Table 197. Performance of fennel accessions under CYT (2002-2003) - Dholi

| Genotype | Yield | |
|--------------------|--------------------------|-----------------------|
| | (kg plot ⁻¹) | (t ha ⁻¹) |
| RF - 18 | 0.98 | 1.09 |
| RF - 21 | 1.11 | 1.23 |
| RF - 31 | 1.19 | 1.32 |
| HF - 107 | 0.32 | 0.36 |
| HF - 116 | 0.86 | 0.95 |
| NDF - 5 | 0.28 | 0.31 |
| NDF - 6 | 0.33 | 0.36 |
| JF - 234 | 0.84 | 0.93 |
| JF - 303 | 0.72 | 0.80 |
| JF - 332 | 0.83 | 0.92 |
| R. Saurabh (check) | 1.01 | 1.12 |
| CD (5%) | 0.22 | 0.24 |
| CV% | 16.93 | 16.44 |

FNL/CI/5 Quality Evaluation Trial
FNL/CI/5.1 Quality evaluation in fennel
(Jobner)

Jobner

The volatile oil content of 11 entries of fennel accessions under CVT ranged from 2.4% to 2.8% (Table 198). The maximum volatile oil of 2.8% was recorded in UF - 177, RF - 125 and HF - 116 followed by 2.60% in UF - 179, JF - 234, 2.53% in JF - 332 and 2.50% in UF - 178 and UF - 143 and minimum of 2.40% in RF - 101. The total yield of volatile oil was found to be highest in UF - 178 (4.2 l ha⁻¹) followed by UF - 177 (38.8 l ha⁻¹) JF - 332 (35.1 l ha⁻¹), RF - 125 (34.5 l ha⁻¹) and minimum in local (18.03 l ha⁻¹).

Table 198. Volatile oil content of fennel accessions under CVT (2001-02) - Jobner

| Entry | Grain yield (kg.ha ⁻¹) | Volatile oil (%) | Volatile oil yield (l ha ⁻¹) |
|----------|---------------------------------------|---------------------|---|
| UF - 177 | 1387 | 2.80 | 38.83 |
| RF - 125 | 1233 | 2.80 | 34.52 |
| HF - 116 | 1200 | 2.80 | 33.60 |
| UF - 179 | 1283 | 2.60 | 33.35 |
| JF - 234 | 1183 | 2.60 | 30.75 |
| JF - 332 | 1390 | 2.53 | 35.16 |
| UF - 178 | 1680 | 2.50 | 42.00 |
| UF - 143 | 1130 | 2.50 | 28.32 |
| JF - 303 | 1100 | 2.46 | 27.06 |
| Local | 733 | 2.46 | 18.03 |
| RF - 101 | 1339 | 2.40 | 32.13 |
| Range | 733-1680 | 2.4-2.8 | 18.03-42.00 |

Eight cultivars of fennel were crossed and the F₁'s and their parents were evaluated for seed yield and volatile oil content. The main constituents of volatile oil were also identified using gas chromatography.

It was found that the estimated seed yield and volatile oil yield of UF - 90 were 9.7 q ha⁻¹ and 16.5 l ha⁻¹, respectively and they were higher in the F₁'s of cross between UF - 90 with JF - 25 and HF - 104. The percentage of anethole is equal or at par with the parent (Table 199).

It was observed that the seed yield of RF - 101 is improved when it is crossed with JF - 25. The oil and anethole contents of F₁ were reduced but total yield of oil and anethole were higher because of high seed yield. The yield

of F_1 is almost double than that of the parent. Like wise seed yield is improved when the parent, UF(M) - 1 is crossed with UF - 90. However, the anethole content was drastically reduced. On the other hand, when the parent UF(M) - 1 is crossed with HF - 104, seed and oil yields were almost same as that of the parent but anethole content is quite high. Similarly, it is also found that the yield was improved when UF - 1 is crossed with local check. Though the volatile oil yield is decreased, anethole

content and anethole yield are increased.

It may be concluded that the total seed yield of the parent varied from 7.7 q ha⁻¹ to 12.49 q ha⁻¹ which can be enhanced in F_1 's to 16.66 q ha⁻¹ (UF - 133 X Local), followed by 13.88 q ha⁻¹ (RF - 101 X JF - 25) and 12.49 q ha⁻¹ (UF - 90 X HF-104).

The highest oil yield of 27.47 l ha⁻¹ was observed in parent, UF - 133. Almost same amount of oil (26.37 l ha⁻¹) can also be obtained from F_1 (RF - 101 X JF-25) (Table 199).

Table 199. Volatile oil content and its main constituents of parents and F_1 lines of fennel – Jobner

| Parent/ F_1 | Seed yield plot ⁻¹ (g) | Estimated yield (q ha ⁻¹) | Volatile oil (%) | Estimated yield of oil (l ha ⁻¹) | Fench-one (%) | Methyl chavicol (%) | Anethole (%) | Estimated yield of anethole (l ha ⁻¹) |
|---------------------|-----------------------------------|---------------------------------------|------------------|--|---------------|---------------------|--------------|---|
| UF - 90 | 175 | 9.72 | 1.7 | 16.52 | 18.87 | 16.32 | 38.33 | 6.33 |
| UF - 90 X HF - 71 | 200 | 11.11 | 1.6 | 17.77 | 18.24 | 14.02 | 39.34 | 6.99 |
| UF - 90 X JF - 25 | 200 | 11.11 | 2.0 | 22.22 | 15.90 | 18.38 | 39.24 | 8.72 |
| UF - 90 X HF - 104 | 225 | 12.49 | 1.8 | 22.48 | 17.24 | 19.09 | 36.45 | 8.19 |
| UF - 90 X UF - 133 | 150 | 8.33 | 2.0 | 16.66 | 15.87 | 40.87 | 12.67 | 2.11 |
| UF - 90 X Local | 200 | 11.11 | 1.6 | 17.77 | 15.15 | 21.93 | 37.71 | 6.70 |
| RF - 101 | 140 | 7.77 | 2.3 | 17.87 | 16.44 | 15.65 | 40.51 | 7.24 |
| RF - 101 X HF - 104 | 150 | 8.33 | 2.0 | 16.66 | 14.98 | 19.27 | 37.76 | 6.29 |
| RF - 101 X JF - 25 | 250 | 13.88 | 1.9 | 26.37 | 15.93 | 27.49 | 30.82 | 8.12 |
| RF - 101 X UF - 133 | 150 | 8.33 | 1.8 | 14.99 | 18.40 | 27.32 | 28.63 | 4.29 |
| RF - 101 X Local | 150 | 8.33 | 2.0 | 16.66 | 17.48 | 34.57 | 22.80 | 3.80 |
| UF(M) - 1 | 175 | 9.72 | 2.2 | 21.38 | 12.67 | 31.96 | 29.04 | 6.20 |
| UF(M) - 1 X HF-104 | 175 | 9.72 | 2.0 | 19.44 | 16.71 | 19.13 | 39.53 | 7.68 |
| UF(M) - 1 X RF -101 | 200 | 11.11 | 1.8 | 19.99 | 15.21 | 28.16 | 34.07 | 6.81 |
| UF(M) - 1 X UF - 90 | 220 | 12.22 | 2.0 | 24.44 | 14.44 | 39.69 | 16.27 | 3.97 |
| UF - 133 | 225 | 12.49 | 2.2 | 27.47 | 14.68 | 29.07 | 28.78 | 7.90 |
| UF - 133 X JF - 25 | 175 | 9.72 | 2.2 | 21.38 | 13.93 | 18.67 | 41.07 | 8.78 |
| UF - 133 X Local | 300 | 16.66 | 1.4 | 23.32 | 14.21 | 19.06 | 41.33 | 9.63 |

FNL/CM/1 Nutrient Management Trial Kumarganj**FNL/CM/1.2 Efficacy of biofertilizer using *Azospirillum* and Psolubiliser in fennel**

(Kumarganj, Jobner and Jagudan)

The experiment was started during 2001 with 8 treatments. Highest yield of 15.27 q ha⁻¹ was obtained in T5 followed by 14.92 q ha⁻¹ in T6 (Table 200). The pooled mean yield values for three years showed T3 as the best treatment for obtaining higher yield (1234 q ha⁻¹).

Table 200. Effect of biofertilizer, *Azospirillum* on yield and yield attributes of fennel - Kumarganj

| Treatment | Plant height (cm) | No. of branches plant ⁻¹ | No. of umbels plant ⁻¹ | No. of seeds umbellet ⁻¹ | No. umbellet umbel ⁻¹ | Days to maturity | Yield (q ha ⁻¹) |
|--|-------------------|-------------------------------------|-----------------------------------|-------------------------------------|----------------------------------|------------------|-----------------------------|
| T1 - Inorganic N 100% + <i>Azospirillum</i> + FYM 5 t ha ⁻¹ | 129.30 | 3.73 | 180.50 | 27.27 | 20.53 | 157.0 | 7.29 |
| T2 - Inorganic N 75% + <i>Azospirillum</i> + FYM 5 t ha ⁻¹ | 125.73 | 3.33 | 126.20 | 23.40 | 21.30 | 157.67 | 8.67 |
| T3 - Inorganic N 50% + <i>Azospirillum</i> + FYM 5 t ha ⁻¹ | 122.53 | 3.87 | 147.87 | 28.20 | 21.87 | 158.00 | 11.80 |
| T4 - FYM 5 t ha ⁻¹ + <i>Azospirillum</i> | 124.30 | 3.43 | 166.20 | 25.47 | 19.53 | 158.33 | 9.72 |
| T5 - FYM 5 t ha ⁻¹ alone | 136.43 | 3.77 | 150.53 | 22.47 | 23.10 | 159.33 | 15.27 |
| T6 - FYM 10 t ha ⁻¹ + <i>Azospirillum</i> | 141.73 | 4.10 | 176.40 | 24.27 | 22.87 | 161.33 | 14.92 |
| T7 - FYM 10 t ha ⁻¹ alone | 136.20 | 4.20 | 163.43 | 23.47 | 19.73 | 159.67 | 13.19 |
| T8 - Control | 135.67 | 3.97 | 161.67 | 20.33 | 24.10 | 156.0 | 12.49 |
| CD (5%) | NS | NS | NS | 2.46 | NS | NS | NS |
| CV% | 7.85 | 19.71 | 20.70 | 5.76 | 8.45 | 1.30 | 27.61 |

Jobner

The experiment was started during rabi 2000-2001 with 10 treatments. During 2001-2002 the results (Table 201) revealed that significantly higher number of umbels plant⁻¹, seeds umbel⁻¹ and biological yield over control

were recorded in T1, T2, T3. With respect to seed yield, all the treatments except *Azospirillum* alone recorded significantly higher seed yield over control. Maximum seed yield of 1173 kg ha⁻¹ recorded in T2 was at par with T1 and T3.

Table 201. Effect of biofertilizer, *Azospirillum* on growth, yield attributes and yield of fennel - Jobner

| Treatment | Plant height (cm) | Branches plant ⁻¹ | Umbels plant ⁻¹ | Umbellets | Seeds umbel ⁻¹ | Test wt. (g) | Biological yield (kg ha ⁻¹) | Seed yield (kg ha ⁻¹) |
|---|-------------------|------------------------------|----------------------------|-----------|---------------------------|--------------|---|-----------------------------------|
| Inorganic N 100% + <i>Azospirillum</i> + FYM 5 t ha ⁻¹ | 118.40 | 7.10 | 35.70 | 19.30 | 268.30 | 5.70 | 3735.00 | 1111.00 |
| Inorganic N 75% + <i>Azospirillum</i> + FYM 5 t ha ⁻¹ | 115.30 | 6.30 | 36.40 | 19.50 | 257.30 | 5.60 | 4692.00 | 1173.00 |
| Inorganic N 50% + <i>Azospirillum</i> + FYM 5 t ha ⁻¹ | 114.80 | 6.50 | 31.30 | 19.90 | 263.10 | 5.30 | 4167.00 | 1065.00 |
| <i>Azospirillum</i> + FYM 5 t ha ⁻¹ | 112.50 | 6.30 | 28.50 | 19.50 | 208.70 | 5.60 | 3519.00 | 895.00 |
| FYM 5 t ha ⁻¹ alone | 111.30 | 6.50 | 29.80 | 20.60 | 192.00 | 5.27 | 2963.00 | 903.00 |
| <i>Azospirillum</i> + FYM 10 t ha ⁻¹ | 113.20 | 6.50 | 28.40 | 21.10 | 249.30 | 5.53 | 3272.00 | 872.00 |
| FYM 10 t ha ⁻¹ | 114.50 | 6.70 | 29.50 | 21.10 | 246.30 | 5.27 | 3303.00 | 880.00 |
| Inorganic N 100% alone | 113.30 | 6.90 | 34.60 | 19.20 | 255.40 | 5.57 | 3766.00 | 895.00 |
| <i>Azospirillum</i> 1.5 kg ha ⁻¹ alone | 111.90 | 6.50 | 28.30 | 21.30 | 215.40 | 5.57 | 3519.00 | 826.00 |
| Control | 111.10 | 5.90 | 25.00 | 20.70 | 203.10 | 5.17 | 2932.00 | 733.00 |
| SEm ± | 2.80 | 0.21 | 1.13 | 0.97 | 9.20 | 0.24 | 26.00 | 38.00 |
| CD (5%) | NS | NS | 3.36 | NS | 27.40 | NS | 77.00 | 114.00 |
| CV% | 4.35 | 5.68 | 6.37 | 8.29 | 6.77 | 7.65 | 11.86 | 7.07 |

Two years pooled data (Table 202) showed similar trend with an exception, where T6 also recorded seed yield (1030 kg

ha⁻¹) which was at par with T2 (1130 kg ha⁻¹). The bio-fertilizers did not affect the volatile oil content in fennel.

Table 202. Effect of biofertilizer, *Azospirillum* on the yield of fennel (pooled data) – Jobner

| Treatment | Seed yield (kg ha ⁻¹) | | |
|--|-----------------------------------|-----------|------|
| | 2000-2001 | 2001-2002 | Mean |
| T1 - Inorganic N 100% + <i>Azospirillum</i> + FYM 5 t ha ⁻¹ | 1141 | 1111 | 1126 |
| T2 - Inorganic N 75%+ <i>Azospirillum</i> + FYM 5 t ha ⁻¹ | 1086 | 1173 | 1130 |
| T3 - Inorganic N 50% + <i>Azospirillum</i> + FYM 5t ha ⁻¹ | 1051 | 1065 | 1058 |
| T4 - <i>Azospirillum</i> + FYM 5 t ha ⁻¹ | 999 | 895 | 947 |
| T5 - FYM 5 t ha ⁻¹ alone | 919 | 903 | 911 |
| T6 - <i>Azospirillum</i> + FYM 10 t ha ⁻¹ | 1188 | 872 | 1030 |
| T7 - 10 t FYM ha ⁻¹ | 1077 | 880 | 979 |
| T8 - Inorganic N 100% alone | 925 | 895 | 910 |
| T9 - <i>Azospirillum</i> 1.5 kg ha ⁻¹ alone | 879 | 826 | 853 |
| T10 - Control | 801 | 733 | 767 |
| CD (5%) | 104 | 114 | 102 |

Jagudan

Report not received.

FENUGREEK

FGK/CI/1 Genetic resources

FGK/CI/1.1 Germplasm collection, characterization, evaluation, conservation and screening against diseases

(Jobner, Jagudan, Guntur, Hisar, Dholi and Kumarganj)

Hisar

This centre maintains 86 accessions. Sixty three accessions were evaluated using Hisar Sonali and Pusa Early Bunching as checks during 2001-02. The results indicated that 43 accessions gave higher seed yield than Hisar Sonali and 51 out yielded Pusa Early Bunching. The seed yield of the germplasm accessions ranged from 11.20 q ha⁻¹ (HM - 208) to 30.00 q ha⁻¹ (HM - 219 and HM - 292-6). The most promising lines were HM - 219, HM - 232-3, HM - 292-6, HM - 292-7 and HM - 325 (Table 203).

Table 203. Yield of promising fenugreek germplasm accessions - Hisar

| Accession | Yield (q ha ⁻¹) | | |
|-------------|-----------------------------|---------|-------|
| | 2000-01 | 2001-02 | Mean |
| HM - 202 | 21.50 | 27.00 | 24.25 |
| HM - 219 | 20.00 | 30.00 | 25.00 |
| HM - 232-3 | 22.50 | 29.00 | 25.75 |
| HM - 292-13 | 22.50 | 26.00 | 24.25 |
| HM - 321 | 20.70 | 21.00 | 20.85 |
| HM - 348 | 25.50 | 22.50 | 24.00 |
| HM - 355 | 23.50 | 24.50 | 24.00 |

Guntur

This centre maintains 126 accessions. The programme was started during 1975-76. During 2002-03 rabi, fifty four accessions were evaluated in simple observational plots. Among the accessions evaluated, LFC - 98

and LFC - 87 recorded highest yield of 969 kg ha⁻¹ followed by LFC - 84, LFC - 88, LFC - 124 and LFC - 85 with 872, 858, 852 and 852 kg ha⁻¹ respectively (Table 204).

Table 204. Yield of promising fenugreek germplasm accessions - Guntur

| Accession | Yield (kg ha ⁻¹) |
|-----------|------------------------------|
| LFC - 98 | 969 |
| LFC - 87 | 969 |
| LFC - 84 | 872 |
| LFC - 88 | 858 |
| LFC - 124 | 852 |
| LFC - 85 | 852 |

Kumarganj

The programme was initiated during 1997-98 and at present, the centre maintains 60 accessions. Among them, highest yield of 26.38 q ha⁻¹ was obtained in NDM - 25, followed by NDM - 19 (22.91 q ha⁻¹) during 2002-03 (Table 205). Similar trend was also observed in the pooled data for three years (23.76, 21.02 q ha⁻¹, respectively) (Table 206). No incidence of powdery mildew disease was observed in most of the germplasm screened, exceptur NDM - 16 (6.00%) and PEB (23.44%).

Table 205. Yield of promising fenugreek germplasm - Kumarganj

| Germplasm | Yield (q ha ⁻¹) |
|--------------|-----------------------------|
| NDM - 5 | 20.83 |
| NDM - 7 | 21.52 |
| NDM - 9 | 21.52 |
| NDM - 16 | 20.83 |
| NDM - 19 | 22.91 |
| NDM - 25 | 26.38 |
| Hisar Sonali | 21.52 |
| K.Selection | 21.52 |

Table 206. Yield of promising fenugreek germplasm (2000 to 2003) - Kumarganj

| Germplasm | Yield (q ha ⁻¹) | | | |
|-----------|-----------------------------|---------|---------|-------|
| | 2000-01 | 2001-02 | 2002-03 | Mean |
| NDM - 7 | 16.73 | 22.22 | 21.52 | 20.16 |
| NDM - 18 | 17.36 | 24.99 | 18.74 | 20.36 |
| NDM - 19 | 19.33 | 20.83 | 22.91 | 21.02 |
| NDM - 20 | 18.67 | 22.91 | 20.13 | 20.57 |
| NDM - 25 | 19.21 | 25.69 | 26.38 | 23.76 |

Jobner

Out of the 12 entries, RMt - 143, RMt - 303 and UM - 305 were found promising for yield potential with minimum disease incidence (Table 207).

Table 207. Yield and reaction to diseases of fenugreek accessions - Jobner

| Entry | Root-rot (%) | Downy mildew (%) | Powdery mildew (0-5) | Yield (kg ha ⁻¹) |
|-------------|--------------|------------------|----------------------|------------------------------|
| UM - 305 | 1.00 | 10.0 | 0 | 1356 |
| UM - 321 | 1.00 | 10.0 | 4 | 1111 |
| UM - 322 | 2.00 | 20.0 | 1 | 1302 |
| JF - 195 | 3.00 | 35.0 | 4 | 1094 |
| JF - 204 | 3.00 | 40.0 | 2 | 1337 |
| JF - 210 | 3.00 | 30.0 | 5 | 1059 |
| HM - 346 | 1.00 | 20.0 | 2 | 1356 |
| HM - 350 | 2.00 | 15.0 | 3 | 1077 |
| RMt - 1 | 1.00 | 20.0 | 3 | 1320 |
| RMt - 143 | 1.00 | 30.0 | 2 | 1441 |
| RMt - 303 | 1.00 | 5.0 | 0 | 1407 |
| Local check | 3.00 | 20.0 | 5 | 987 |
| CD (5%) | | | | |

Out of 8 entries, RMt - 143, UM - 351 and RMt - 1 were found promising for yield with minimum disease incidence (Table 208).

Table 208. Yield and reaction to diseases of fenugreek accessions under CVT - Jobner

| Entry | Root-rot (%) | Downy mildew (%) | Powdery mildew (0-5) | Yield (kg ha ⁻¹) |
|----------|--------------|------------------|----------------------|------------------------------|
| UM - 351 | 5.00 | 10.00 | 1 | 1668 |
| UM - 352 | 5.00 | 5.75 | 1 | 1750 |

| | | | | |
|-------------|-------|-------|---|------|
| JF - 244 | 10.00 | 25.25 | 2 | 1600 |
| JF - 270 | 9.25 | 25.00 | 4 | 1500 |
| RMt - 1 | 5.75 | 5.00 | 3 | 1667 |
| RMt - 143 | 5.00 | 20.00 | 2 | 1700 |
| RMt - 303 | 10.00 | 10.00 | 0 | 1617 |
| Local check | 15.00 | 20.00 | 5 | 1000 |
| CD (5%) | 1.46 | 2.99 | - | 137 |
| CV% | 12.23 | 13.44 | - | 501 |

Out of 36 entries, RTP - 4, AL - 1, for yield with minimum disease incidence AL - 8 and AL - 51 were found promising (Table 209).

Table 209. Reaction of fenugreek germplasm to diseases - Jobner

| Entry | Root-rot (%) | Downy mildew (%) | Powdery mildew (0-5) | Yield (kg ha ⁻¹) |
|----------|--------------|------------------|----------------------|------------------------------|
| AL - 1 | 5.00 | 20.00 | 2.00 | 1300 |
| AL - 2 | 1.00 | 5.00 | 1.00 | 1130 |
| AL - 8 | 1.00 | 5.00 | 1.00 | 1147 |
| AL - 18 | 1.00 | 5.00 | 1.00 | 1147 |
| AL - 21 | 4.00 | 10.00 | 1.00 | 1550 |
| AL - 31 | 4.00 | 10.00 | 1.00 | 1500 |
| AL - 45 | 4.00 | 10.00 | 1.00 | 1440 |
| AL - 47 | 4.00 | 10.00 | 1.00 | 1440 |
| AL - 48 | 1.00 | 5.00 | 0.00 | 1667 |
| AL - 49 | 1.00 | 5.00 | 1.00 | 1390 |
| AL - 51 | 1.00 | 5.00 | 0.00 | 1870 |
| AL - 83 | 4.00 | 10.00 | 1.00 | 923 |
| AL - 103 | 1.00 | 5.00 | 0.00 | 850 |
| AL - 106 | 4.00 | 10.00 | 1.00 | 1297 |
| RTP - 1 | 4.00 | 10.00 | 1.00 | 1407 |
| RTP - 2 | 4.00 | 10.00 | 1.00 | 1093 |
| RTP - 4 | 6.00 | 25.00 | 0.00 | 1670 |
| RTP - 5 | 6.00 | 25.00 | 2.00 | 1130 |
| RTP - 6 | 5.00 | 20.00 | 2.00 | 1163 |
| RTP - 7 | 5.00 | 10.00 | 1.00 | 1187 |
| RTP - 8 | 5.00 | 20.00 | 2.00 | 1333 |

| | | | | |
|-------------|------|-------|------|------|
| RTP - 9 | 5.00 | 20.00 | 2.00 | 1187 |
| RTP - 10 | 4.00 | 10.00 | 1.00 | 823 |
| RTP - 11 | 4.00 | 10.00 | 1.00 | 1433 |
| NS - 1 | 4.00 | 15.00 | 1.00 | 1297 |
| NS - 2 | 5.00 | 15.00 | 2.00 | 467 |
| NS - 3 | 5.00 | 15.00 | 2.00 | 787 |
| NS - 4 | 4.00 | 10.00 | 1.00 | 977 |
| NS - 5 | 4.00 | 10.00 | 1.00 | 1090 |
| NS - 6 | 1.00 | 5.00 | 0.00 | 1147 |
| NS - 7 | 5.00 | 20.00 | 2.00 | 1297 |
| RMt - 1 | 4.00 | 10.00 | 4.00 | 1153 |
| RMt - 143 | 6.00 | 30.00 | 3.00 | 1053 |
| RMt - 303 | 0.00 | 0.00 | 0.00 | 1630 |
| UM - 305 | 4.00 | 10.00 | 0.00 | 1447 |
| Local check | 5.00 | 20.00 | 2.00 | 740 |
| CD (5%) | - | - | 165 | |
| CV% | - | - | 825 | |

Out of 20 entries of fenugreek were found resistant and others were screened against root-knot nematodes, UM moderately resistant to highly susceptible. - 34, UM - 127, UM - 304 and UM - 305 (Table 210).

Table 210. Reaction of fenugreek germplasm to root knot nematode (2001-2002) - Jobner

| Category | No. of galls | Entries |
|-------------------------|-----------------|--|
| Immanue (I) | 0 | Nil |
| Resistant (R) | 1-10 | UM - 34, UM - 127, UM - 304 and UM - 305 |
| Moderate resistant (MR) | 11-30 | UM - 43, UM - 32, UM - 118, UM - 128m UM - 138, UM - 301, UM - 302 RMt - 1 and RMt - 143 |
| Susceptible | 31-100 | UM - 112, UM - 116, UM - 117, UM - 129, UM - 144, UM - 321, UM - 322 and UM - 324 |
| Highly susceptible | Above 100 galls | Nil |

Out of 20 entries, screened against powdery mildew disease, UM - 303 and UM - 305 were found free from disease and others were resistant to highly susceptible (Table 211).

Table 211. Reaction of fenugreek varieties to powdery mildew (farmers field, 2001-2002) - Jobner

| Mildew score | Nature of infection | Entries |
|--------------|--|---------------------------------|
| 0 | No disease observed | UM - 303 and UM - 305 |
| 1 | A few scattered plants mildewed; no more than 1 or 2 patches per plant | UM - 32 and UM - 34 |
| 2 | Upto 10 patches per plant | UM - 143 and UM - 304 |
| 3 | Above 50 patches per plant | UM - 118 and UM - 128 |
| 4 | Nearly every leaflet infected | UM - 301, UM - 302 and RMt - 1 |
| 5 | Every plant affected, field appears green flecked with brown patches | UM - 112, UM - 116 and UM - 117 |
| 6 | About 75% of plants infected | UM - 129 and UM - 144 |
| 7 | Only some leaves on plants not infected but stems green | UM - 321 and UM - 322 |
| 8 | Leaves, leaflets and stem are infected | UM - 175, UM - 193 and UM - 324 |
| 9 | All plants infected with mildew | Nil |

Dholi

Ninety seven germplasm accessions were evaluated. Among them, only seven viz., RM - 14, RM - 33, RM - 44, RM - 18, RM - 15, RM - 28 and RM - 70 were selected for IET on the basis of their yield performance. A new trial with 22 genotypes was started during 2002-03 to identify genotypes suitable for unirrigated areas. There were non-significant differences among the genotypes for number of grains per pod. RM - 5/90 produced significantly higher grain yield (0.35 kg plot⁻¹ and 0.97 t ha⁻¹) over check (Rajendra Kanti) (Table 212).

Table 212. Performance of fenugreek entries under unirrigated condition (2002-03) - Dholi

| Genotype | No. of grains per pod | Yield | |
|------------------|-----------------------|-----------------------|--------------------|
| | | kg plot ⁻¹ | t ha ⁻¹ |
| UM - 301 | 15.47 | 0.24 | 0.67 |
| UM - 302 | 13.67 | 0.30 | 0.82 |
| UM - 303 | 16.00 | 0.29 | 0.81 |
| UM - 304 | | 15.33 | 0.26 |
| UM - 305 | | 15.13 | 0.22 |
| UM - 321 | | 15.40 | 0.20 |
| UM - 322 | | 15.07 | 0.27 |
| RM - 1/90 | | 16.20 | 0.31 |
| RM - 5/90 | | 16.60 | 0.35 |
| RM - 15 | | 16.27 | 0.33 |
| HM - 110 | | 16.00 | 0.23 |
| HM - 114 | | 15.87 | 0.27 |
| HM - 291 | | 15.47 | 0.24 |
| HM - 305 | | 15.13 | 0.19 |
| HM - 346 | | 15.07 | 0.17 |
| HM - 350 | | 15.00 | 0.25 |
| J. Fenu. - 58 | | 14.67 | 0.31 |
| J. Fenu. - 102 | | 15.80 | 0.24 |
| J. Fenu. - 195 | | 14.33 | 0.12 |
| J. Fenu. - 204 | | 14.33 | 0.18 |
| J. Fenu. - 210 | | 14.93 | 0.22 |
| R. Kanti (check) | | 15.40 | 0.28 |
| CD (5%) | | NS | 0.05 |
| CV% | | 7.94 | 12.20 |

Jagudan

This centre maintains 43 accessions and were evaluated for yield. Some of the promising genotypes identified were J.fenu - 246, 247 and 259 with an yield over 890 g plant⁻¹. During the year, powdery mildew disease was not observed.

FGK/CI/2 Hybridization Trial**FGK/CI/2.1 Evolving varieties resistant to powdery mildew**

(*Jagudan* and *Jobner*)

Jagudan

Report not received.

Jobner

In fenugreek crosses were made between adaptable varieties and resistant lines and also between determinate and indeterminate types

to get good transgressive segregants. By pedigree method few promising lines were identified and were included in IET. Besides, inheritance of multipodedness and determinate type were also determined.

FGK/CI/3 Coordinated Varietal Trial**FGK/CI/3.1 CVT - 1995 Series III**

(*Guntur* and *Kumarganj*)

Guntur

The project was concluded. Final report not submitted.

Kumarganj

Highest yield of 25.68 q ha⁻¹ and 25.03 q ha⁻¹ was obtained in HM - 114 and UM - 304, respectively among all the entries tested for yield (Table 213).

Table 213. Performance of fenugreek accessions under CVT (pooled data) - Kumarganj

| Entry | Yield (q ha ⁻¹) | | | | Mean. |
|----------------|-----------------------------|---------|---------|-----------|-------|
| | 1996-97 | 1997-98 | 1998-99 | 1999-2000 | |
| HM - 110 | 22.95 | 20.83 | 22.91 | 21.97 | 22.14 |
| HM - 114 | 26.47 | 24.65 | 25.05 | 26.58 | 25.68 |
| HM - 291 | 21.10 | 20.13 | 21.87 | 21.17 | 21.06 |
| HM - 305 | 21.47 | 22.91 | 22.58 | 18.88 | 21.46 |
| UM - 301 | 22.68 | 22.56 | 18.75 | 18.74 | 20.68 |
| UM - 303 | 17.86 | 21.87 | 25.00 | 24.65 | 22.34 |
| UM - 304 | 25.18 | 23.61 | 25.66 | 25.69 | 25.03 |
| RM - 1 | 20.09 | 23.26 | 22.58 | 21.17 | 21.77 |
| RM - 5 | 20.92 | 22.56 | 24.29 | 24.65 | 23.10 |
| Rajendra Kanti | 21.38 | 23.95 | 22.91 | 21.87 | 22.52 |
| CD (5%) | 2.22 | | | 3.06 | |
| CV% | 6.16 | | | | |

FGK/CI/3.2 CVT 1999 - Series IV

(*Hisar*, *Jobner*, *Kumarganj* and *Dholi*)

Hisar

The trial is in the fourth year of progress. Significant differences were obtained for all

the parameters during 2001-2002. Plant height ranged from 65.9 to 88.1 cm, number of branches from 4.8 to 6.1, number of pods per plant from 52.4 to 78.1, length of pods from 8.7 to 10.4 and number of seeds per pod from 13.9 to 16.4. The maximum seed yield

(2017 kg ha⁻¹) was recorded in Hisar Sonali which was statistically at par with HM - 346, while the minimum seed yield was found in RM - 1.

Pooled data for 3 years showed significant differences for all the parameters except number of branches per plant and length of pods (Table 214). Plant height among different entries ranged from 74.00 to

100.05 cm, number of branches from 5.25 to 6.02, pods per plant from 67.77 to 88.12, length of pods from 8.62 to 9.45 and seeds per pod from 15.05 to 16.30. (Table 214)

The pooled data (1998-99 to 2001-02) indicated that maximum seed yield (20.8 q ha⁻¹) was recorded in Hisar Sonali, which was 20.9% higher over local check, followed by HM - 346 (18.0%) (Table 215).

Table 214. Performance of fenugreek accessions under CVT – Hisar

| Entry | Plant height (cm) | Branches plant ⁻¹ | Pods plant ⁻¹ | Length of pod (cm) | Seeds pod ⁻¹ | Seed yield (kg ha ⁻¹) |
|---------------------|-------------------|------------------------------|--------------------------|--------------------|-------------------------|-----------------------------------|
| RM - 1 | 91.75 | 5.85 | 77.07 | 8.72 | 15.42 | 1607 |
| RM - 5 | 93.67 | 5.30 | 74.97 | 8.67 | 15.22 | 1680 |
| HM - 346 | 90.45 | 5.57 | 82.57 | 9.45 | 15.50 | 2027 |
| HM - 350 | 93.60 | 5.80 | 85.30 | 8.62 | 15.22 | 1897 |
| JF - 195 | 97.80 | 5.47 | 73.40 | 8.95 | 15.05 | 1600 |
| JF - 204 | 94.40 | 5.57 | 74.67 | 8.62 | 15.37 | 1747 |
| JF - 210 | 91.92 | 5.25 | 74.47 | 9.15 | 15.65 | 1832 |
| UM - 305 | 74.00 | 5.40 | 67.77 | 8.82 | 15.05 | 1587 |
| UM - 321 | 96.40 | 5.70 | 78.40 | 8.92 | 15.20 | 1840 |
| UM - 322 | 100.05 | 5.47 | 82.67 | 8.97 | 15.72 | 1817 |
| Local check | 88.95 | 5.47 | 73.15 | 8.90 | 15.40 | 1720 |
| Hisar Sonali | 89.47 | 6.02 | 88.12 | 9.17 | 16.30 | 2082 |
| Pusa Early Bunching | 90.37 | 5.67 | 81.15 | 9.12 | 15.85 | 1747 |
| CD (5%) | 10.70 | NS | 9.96 | NS | 0.65 | 172 |

Table 215. Performance of fenugreek genotypes under CVT (pooled data) - Hisar

| Entry | Seed yield (q ha ⁻¹) | | | | | Increase/decrease over local check (%) |
|----------|----------------------------------|---------|---------|---------|------|--|
| | 1998-99 | 1999-00 | 2000-01 | 2001-02 | Mean | |
| RM - 1 | 18.5 | 15.2 | 15.5 | 15.1 | 16.1 | - 6.4 |
| RM - 5 | 15.8 | 15.9 | 19.1 | 16.4 | 16.8 | - 2.3 |
| HM - 346 | 20.4 | 20.1 | 21.9 | 18.7 | 20.3 | 18.0 |
| HM - 350 | 20.7 | 18.0 | 19.1 | 18.1 | 19.0 | 10.5 |
| JF - 195 | 17.5 | 15.9 | 15.5 | 15.1 | 16.0 | - 7.0 |
| JF - 204 | 21.5 | 15.2 | 16.3 | 16.9 | 17.5 | 1.7 |
| JF - 210 | 20.2 | 14.5 | 20.5 | 18.1 | 18.3 | 6.4 |

| | | | | | | |
|--------------|------|------|------|------|------|-------|
| UM - 305 | 16 2 | 15 8 | 15 6 | 15 9 | 15 9 | - 7 5 |
| UM - 321 | 21 2 | 16 3 | 18 9 | 17 2 | 18 4 | 7 0 |
| UM - 322 | 19 3 | 17 9 | 18 1 | 17 4 | 18 2 | 5 8 |
| Local check | 18 0 | 16 5 | 17 1 | 17 2 | 17 2 | - |
| Hisai Sonali | 22 3 | 19 4 | 21 4 | 20 2 | 20 8 | 20 9 |
| PEB | 20 1 | 15 2 | 17 5 | 17 1 | 17 5 | 1 7 |
| CD (5%) | 3 4 | 2 2 | 3 1 | 1 9 | 1 7 | - |

Jobner

The trial was initiated during rabi 1998-99 with 12 entries. The entries differed significantly for all the characters studied. The mean number of days to 50% flowering ranged from 51.7 (UM - 305) to 64.3 days (local check), plant height from 43.3 (UM - 305) to 62.0 cm (RMt - 143), branches per plant from 4.9 (UM - 321) to 6.9 (UM - 305), pods per plant from 20.4 (local check) to 49.1 (UM - 305), pod length from 9.2

(local check) to 12.3 cm (HM - 346), seeds per pod from 17.9 (RMt - 303) to 13.6 (local check) and test weight from 8.10 g (UM - 322) to 13.23 g (UM - 305). RMt - 143 recorded maximum seed yield of 1441 kg ha⁻¹ followed by RMt - 303 (1407 kg ha⁻¹), UM - 305 (1356 kg ha⁻¹), HM - 346 (1356 kg ha⁻¹), RMt - 1 (check, 1320 kg ha⁻¹), while lowest yield of 987 kg ha⁻¹ was recorded in local check (Table 216).

Table 216. Performance of fenugreek accessions under CVT - Jobner

| Entry | Days to flowering | Plant height (cm) | Branches plant ⁻¹ | Pods plant ⁻¹ | Pod length (cm) | Seeds pod ⁻¹ | Test weight (gm) | Seed yield (kg ha ⁻¹) | Increase over check(%) |
|-------------|-------------------|-------------------|------------------------------|--------------------------|-----------------|-------------------------|------------------|-----------------------------------|------------------------|
| UM - 305 | 51.70 | 43.30 | 6.90 | 49.10 | 11.50 | 16.00 | 13.23 | 1356.00 | 2.73 |
| UM - 321 | 61.00 | 53.70 | 4.90 | 39.70 | 10.60 | 16.30 | 9.77 | 1111.00 | - |
| UM - 322 | 63.70 | 51.70 | 5.80 | 40.80 | 9.80 | 14.50 | 8.10 | 1302.00 | - |
| JF 195 | 59.30 | 51.90 | 4.80 | 25.40 | 10.80 | 16.50 | 11.63 | 1094.00 | - |
| JF 204 | 59.00 | 60.80 | 5.50 | 32.20 | 11.50 | 15.30 | 11.43 | 1337.00 | 12.88 |
| JF - 210 | 58.00 | 56.40 | 5.30 | 28.40 | 10.70 | 16.10 | 10.87 | 1059.00 | - |
| HM - 346 | 56.30 | 53.20 | 5.10 | 29.10 | 12.30 | 17.30 | 13.07 | 1356.00 | 2.73 |
| HM - 350 | 64.00 | 45.80 | 6.20 | 37.40 | 10.40 | 14.10 | 9.17 | 1077.00 | - |
| RMt - 1 | 63.30 | 53.80 | 6.10 | 23.20 | 10.30 | 15.40 | 8.57 | 1320.00 | Check |
| RMt - 143 | 58.60 | 62.00 | 5.20 | 38.40 | 12.30 | 15.70 | 10.80 | 1441.00 | 9.17 |
| RMt - 303 | 63.30 | 49.10 | 5.60 | 37.10 | 11.10 | 17.90 | 8.67 | 1407.00 | 6.59 |
| Local check | 64.30 | 54.00 | 5.20 | 20.40 | 9.20 | 13.60 | 8.27 | 987.00 | - |
| CD (5%) | | 1.92 | 4.26 | 0.57 | 4.08 | 0.95 | 1.09 | 0.76 | 104.00 |
| CV% | 1.88 | 4.75 | 6.04 | 7.21 | 5.17 | 4.09 | 4.36 | 4.98 | |

Kumarganj

The trial was started during 1997-98 with 19 entries. Two years data showed that

J Fenu - 195 gave highest yield of 21.89 q ha⁻¹ followed by F Fenu - 210 (Table 217).

Table 217. Performance of fenugreek accessions under CVT - Kumarganj

| Entry | Yield (q ha ⁻¹) | | |
|--------------|------------------------------|---------|-------|
| | 1999-00 | 2000-01 | Mean. |
| UM - 321 | 18.33 | 18.35 | 18.33 |
| UM - 305 | 20.48 | 20.82 | 20.65 |
| UM - 322 | 21.45 | 21.60 | 21.52 |
| RMt - 1 | 19.79 | 19.00 | 19.39 |
| J.fenu - 195 | 21.87 | 21.91 | 21.89 |
| J.Fenu - 204 | 20.48 | 20.67 | 20.57 |
| J.Fenu - 210 | 21.52 | 21.75 | 21.63 |
| CD (5%) | 0.5 | 0.90 | |

Dholi

Report not received.

FGK/CI/3.3 CVT 2001 - Series V*(Guntur, Kumarganj, Coimbatore, Jobner, Jagudan)**Guntur*

The trial was initiated with 11 genotypes during 2002-03. Among the entries, tested HM - 376 (42.3 cm) and JF - 244 (38.6 cm) recorded significantly higher plant height than check (Lam Selection, 1 35.1 cm). Number of branches and number of pods were more in JF - 244 (7.6 and 22.9) and low in HM - 444 (5.2) and NDM - 25 (14.0), respectively. No significant differences were observed with regard to pod length among the genotypes tested. Number of seeds per pod was more in JF - 244 (14.1) and low in NDM - 19 (9.1). JF - 244 recorded highest yield of 568 kg ha⁻¹. All other entries recorded less yield than the check (Lam Selection, 479 kg ha⁻¹) (Table 218).

Table 218. Performance of fenugreek accessions under CVT - Guntur

| Entry | Plant height | No. of branches | No. of days to 50% flowering | No. of days to maturity | No. of pods | Length of pod (cm) | No. of seeds pod ⁻¹ | Yield plot ⁻¹ (g) | Yield (kg ha ⁻¹) | increase over check % |
|----------|--------------|-----------------|------------------------------|-------------------------|-------------|--------------------|--------------------------------|------------------------------|------------------------------|-----------------------|
| HM - 65 | 41.63 | 5.60 | 43.667 | 102.667 | 14.5 | 10.06 | 10.7 | 157.0 | 262.0 | -45.3 |
| HM - 372 | 38.78 | 6.30 | 44.667 | 86.667 | 18.0 | 10.23 | 12.5 | 262.0 | 438.0 | -8.6 |
| HM - 376 | 42.30 | 6.10 | 43.333 | 86.000 | 17.1 | 10.40 | 12.0 | 241.0 | 403.0 | -15.9 |
| HM - 444 | 36.50 | 5.20 | 44.667 | 89.333 | 18.2 | 9.10 | 9.6 | 258.0 | 431.0 | -10.0 |
| NDM - 19 | 33.90 | 5.80 | 41.333 | 89.000 | 13.3 | 9.70 | 9.1 | 113.0 | 189.0 | -60.5 |
| NDM - 25 | 36.10 | 5.10 | 42.667 | 88.667 | 14.0 | 9.40 | 10.2 | 143.0 | 239.0 | -50.1 |
| JF - 244 | 38.56 | 7.60 | 44.667 | 84.000 | 22.9 | 12.00 | 14.1 | 332.0 | 568.0 | 18.6 |
| JF - 270 | 40.30 | 6.30 | 46.333 | 82.000 | 20.6 | 10.10 | 12.7 | 263.0 | 439.0 | -8.4 |
| UM - 351 | 36.90 | 6.06 | 42.667 | 88.667 | 17.0 | 9.40 | 11.9 | 197.3 | 329.0 | -31.3 |
| UM - 352 | 36.50 | 6.13 | 42.000 | 84.667 | 17.3 | 9.83 | 11.6 | 239.0 | 399.0 | -16.7 |
| LS - 1 | 35.10 | 6.46 | 43.333 | 80.667 | 21.3 | 10.13 | 13.0 | 287.0 | 479.0 | |
| CD (5%) | NS | 1.17 | 1.577 | 4.809 | 4.3 | NS | 2.51 | 42.6 | 72.6 | |
| CV% | | 11.4 | 2.100 | 3.200 | 14.4 | | 12.8 | 10.9 | 11.1 | |

Kumarganj

The trial was started with 18 entries in RBD during 2001. NDM - 19 was the highest yielder in CVT out of 18 entries tested, yielding 21.17 q ha⁻¹ of seed, followed by NDM - 25 (20.48 q ha⁻¹) during the year 2002-2003. Three years pooled data for seed yield showed maximum yield in J.Fenu - 210 (21.13 q ha⁻¹) (Table 219).

Table 219. Performance fenugreek accessions under CVT (pooled data) - Kumarganj

| Entry | Yield (q ha ⁻¹) | | | |
|---------------------|-----------------------------|---------|---------|-------|
| | 2000-01 | 2001-02 | 2002-03 | Mean |
| RMT - 1 | 19.00 | 16.67 | 19.79 | 18.48 |
| J.Fenu - 195 | 21.91 | 18.40 | 11.10 | 17.13 |
| J.Fenu - 204 | 20.67 | 14.93 | 13.19 | 16.26 |
| J.Fenu - 210 | 21.75 | 22.22 | 19.44 | 21.13 |
| K.selection (check) | 21.88 | 13.19 | 12.84 | 15.97 |
| CD (5%) | 0.90 | 4.23 | 4.21 | |
| CV% | | 18.84 | 15.48 | |

Coimbatore

Seventeen fenugreek entries including the check CO - 2 were evaluated for their morphological traits and yield performance during rabi 2002-2003. Among these accessions, the yield varied between 443 to 670 kg ha⁻¹. JF - 195 recorded the highest yield of 670 kg ha⁻¹ as against 527 kg ha⁻¹ in check, CO 2. It was on par with JF - 204, which recorded an yield of 620 kg ha⁻¹. This was followed by HM - 372, UM - 305, and UM - 321 with yield of 600, 575 and 550.70 kg ha⁻¹. The lowest yield of 443 kg ha⁻¹ was registered in HM - 350 (Table 220).

Table 220. Performance of fenugreek accessions under CVT - Coimbatore

| Accession | Yield | | Increase over check (%) |
|-----------|-------------------------|------------------------|-------------------------|
| | (g plot ⁻¹) | (kg ha ⁻¹) | |
| UM - 351 | 233.35 | 466.70 | - |
| J - 270 | 236.2 | 472.40 | - |

| | | | |
|-----------|--------|--------|-------|
| HM - 350 | 221.5 | 443.00 | - |
| HM - 346 | 266.65 | 533.30 | 1.20 |
| UM - 321 | 275.35 | 550.70 | 4.50 |
| UM - 322 | 258.33 | 516.66 | - |
| UM - 305 | 287.5 | 575.0 | 9.11 |
| J - 244 | 250.0 | 500.00 | - |
| UM - 352 | 233.33 | 466.66 | - |
| JF - 204 | 310.00 | 620.0 | 17.65 |
| JF - 195 | 335.00 | 670.0 | 27.13 |
| JF - 210 | 255.00 | 510.0 | - |
| ACC - 65 | 260.00 | 520.0 | - |
| ACC - 376 | 237.5 | 475.0 | - |
| HM - 372 | 300.00 | 600.0 | 13.85 |
| HM - 444 | 275.00 | 550.0 | - |
| CO - 2 | 263.5 | 527.00 | - |
| CD (5%) | 52.91 | | - |

Jobner

The trial was initiated with 8 entries during rabi 2001-02. Significant differences

among the entries for all the characters studied except for pod length were observed (Table 221). The mean days to flowering ranged from 54.0 (RMt - 143 check) to 64.0 days (UM - 351), plant height from 44.8 (UM - 351) to 66.1 cm (JF - 270), branches per plant from 5.2 (Local check) to 6.3 (UM - 352 and JF - 270), pods per plant from 42.1 (Local check) to 64.5 (RMt - 303, check),

pod length from 9.3 (JF - 244) to 10.7 cm (Local check), seeds per pod from 16.8 (Local check) to 18.3 (UM - 352 and test weight from 7.74 (Local check) to 10.72 g (UM - 352). UM - 352 recorded the maximum seed yield of 1750 kg ha⁻¹ followed by RMt - 143 (1700 kg ha⁻¹), UM - 351 (1668 kg ha⁻¹), while lowest yield of 1000 kg ha⁻¹ was recorded in local check.

Table 221. Performance of fenugreek accessions under CVT - Jobner

| Entry | Days to flowering | Plant height (cm) | Branches plant ⁻¹ | Pods plant ⁻¹ | Pod length (cm) | Seeds pod ⁻¹ | Test weight (g) | Seed yield (kg ha ⁻¹) | Increase over check(%) |
|-------------|-------------------|-------------------|------------------------------|--------------------------|-----------------|-------------------------|-----------------|-----------------------------------|------------------------|
| UM - 351 | 64.0 | 44.8 | 6.2 | 48.1 | 9.9 | 17.7 | 9.43 | 1668 | 0.06 |
| UM - 352 | 57.3 | 48.7 | 6.3 | 62.5 | 10.4 | 18.3 | 10.72 | 1750 | 4.98 |
| JF - 244 | 54.7 | 51.6 | 5.7 | 44.1 | 9.3 | 17.5 | 10.32 | 1600 | - |
| JF - 270 | 58.0 | 66.1 | 6.3 | 45.2 | 10.4 | 16.9 | 9.93 | 1500 | - |
| RMt - 1 | 57.0 | 48.1 | 5.9 | 45.7 | 10.4 | 17.2 | 9.45 | 1667 | Check |
| RMt - 143 | 54.0 | 52.7 | 5.9 | 47.5 | 10.5 | 18.1 | 10.32 | 1700 | 1.98 |
| RMt - 303 | 57.7 | 55.9 | 5.5 | 64.5 | 10.4 | 18.2 | 10.25 | 1617 | - |
| Local check | 60.0 | 60.3 | 5.2 | 42.1 | 10.7 | 16.8 | 7.74 | 1000 | - |
| CD (5%) | 1.58 | 3.19 | 0.39 | 5.76 | NS | 0.54 | 0.69 | 137 | - |
| CV% | 1.56 | 3.40 | 3.78 | 6.58 | 3.93 | 1.77 | 4.02 | 5.01 | - |

Jagudan

Yield differences were significant among the entries tested. J. Fen - 244 gave

significantly higher yield (2049 kg ha⁻¹) compared to control (1838 kg ha⁻¹) which was 11.48% higher (Table 222).

Table 222. Performance of fenugreek accessions under CVT - Jagudan

| Entry | Days to 50% Flowering | Days to maturity | Plant ht. (cm) | No. of branches plant ⁻¹ | No. of pods plant ⁻¹ | Length of pod (cm) (%) | No. of grains pod ⁻¹ | 1000 seed wt. (gm) | Yield (kg ha ⁻¹) | Increase over control (%) |
|--------------|-----------------------|------------------|----------------|-------------------------------------|---------------------------------|------------------------|---------------------------------|--------------------|------------------------------|---------------------------|
| J.Fenu - 244 | 53 | 111 | 70.3 | 4.1 | 97.6 | 10.6 | 19.3 | 17.1 | 2049 | 11.48 |
| J.Fenu - 270 | 54 | 111 | 67.0 | 4.3 | 71.0 | 9.5 | 18.2 | 15.5 | 1838 | - |
| UM - 351 | 54 | 110 | 69.0 | 4.4 | 98.9 | 9.8 | 19.0 | 14.8 | 1822 | - |
| UM - 352 | 53 | 108 | 65.6 | 4.8 | 69.0 | 8.8 | 18.0 | 14.1 | 1809 | - |
| HM - 65 | 58 | 116 | 69.8 | 4.8 | 94.4 | 10.3 | 18.4 | 14.0 | 1361 | - |
| HM - 372 | 61 | 119 | 67.0 | 5.1 | 100.0 | 10.0 | 18.5 | 15.0 | 1544 | - |
| HM - 376 | 54 | 112 | 59.3 | 4.7 | 78.0 | 9.8 | 19.5 | 13.6 | 1880 | 2.28 |
| HM - 444 | 53 | 109 | 72.8 | 4.0 | 59.0 | 9.5 | 18.8 | 14.8 | 1931 | 4.83 |
| NDM - 19 | 53 | 109 | 68.3 | 4.4 | 86.6 | 9.4 | 20.0 | 15.8 | 1657 | - |

| | | | | | | | | | |
|----------------|----|------|------|-----|------|------|------|------|------|
| NDM - 25 | 54 | 112 | 64.8 | 4.3 | 93.0 | 10.0 | 17.5 | 15.0 | 1649 |
| GM - 1 (check) | 53 | 112 | 66.5 | 4.3 | 85.6 | 9.9 | 19.0 | 16.0 | 1838 |
| CD (5%) | | 205 | | | | | | | |
| CV% | | 8.08 | | | | | | | |

FGK/CI/4 Varietal Evaluation Trial
FGK/CI/4.1 Comparative yield trial
(Dholi)

Dholi

The trial was initiated with 13 genotypes during 2002-03. Plant height in HM - 65 was significantly higher (119.47 cm) and it was minimum in UM - 351 (78.87 cm). However, number of branches (7.33), number of pods (57.47) and grain yield per plot (1.147 kg) and per hectare (1.59 t) were significantly higher in HM - 444, and this genotype also proved superior with 18.66 % higher grain yield over check. HM - 65 was late in maturity (158.00 days) and UM - 351 was an early maturity type (135.00 days). Over all the maturity of all genotypes was delayed due to severe cold. (Table 223).

Table 223. Performance of fenugreek accessions under CYT - Dholi

| Genotype | Yield (kg plot ⁻¹) | Yield (t ha ⁻¹) |
|-----------------|--------------------------------|-----------------------------|
| RM - 18 | 0.93 | 1.30 |
| RM - 28 | 0.99 | 1.37 |
| NDM - 19 | 0.85 | 1.18 |
| NDM - 25 | 0.77 | 1.06 |
| HM - 65 | 0.90 | 1.25 |
| HM - 372 | 1.08 | 1.50 |
| HM - 376 | 1.01 | 1.41 |
| HM - 444 | 1.15 | 1.59 |
| UM - 351 | 0.97 | 1.34 |
| UM - 352 | 1.02 | 1.42 |
| J.Fenu. - 244 | 0.81 | 1.13 |
| J. Fenu. - 270 | 0.81 | 1.13 |
| R.Kanti (check) | 0.97 | 1.34 |
| CD (5%) | 0.13 | 0.18 |
| CV% | 8.21 | 7.63 |

FGK/CI/4.2 Initial evaluation trial
(Dholi, Jobner, Jagudan and Hisar)
Dholi

The trial was started with 8 genotypes during 2002-03. Data indicated that there was no difference among the genotypes in respect of all the recorded characters. Maximum plant height (94.20 cm) was recorded RM - 44 followed by RM - 33 (94.00 cm). However, maximum number of branches (5.60), number of pods per plant (41.20), number of grains per pod (15.73) and grain yield per plot (0.55 kg) and per hectare (1.63 t) were recorded in RM - 70. RM - 70 proved better to all genotypes and produced 18.9 % higher grain yield over check (Rajendra Kanti) (Table 224).

Table 224. Performance of fenugreek entries under (IET) - Dholi

| Genotype | Grain yield | |
|------------------|--------------------------|-----------------------|
| | (kg plot ⁻¹) | (t ha ⁻¹) |
| RM - 14 | 0.43 | 1.19 |
| RM - 15 | 0.35 | 0.98 |
| RM - 18 | 0.50 | 1.39 |
| RM - 28 | 0.49 | 1.37 |
| RM - 33 | 0.42 | 1.17 |
| RM - 44 | 0.37 | 1.04 |
| RM - 70 | 0.55 | 1.63 |
| R. Kanti (check) | 0.46 | 1.37 |
| CD (5%) | 0.10 | 0.30 |
| CV% | 12.25 | 15.89 |

Hisar

Two initial evaluation trials (IET), one for green seed coat mutant lines and other on yellow seed coat of fenugreek were conducted with nine accessions along with Hisar Sonali as check during 1999-2000 to 2001-2002. The results indicated that maximum seed yield

was recorded in HM - 444 (23.1 q ha⁻¹) for green seed coat mutant and HM - 372 & HM - 376 (33.2 and 32.3 q ha⁻¹) for yellow seed coat (Tables 225 & 226). These three lines i.e. HM - 372, HM - 376 and HM - 444 have been included in coordinated varietal trial for further evaluation.

Table 225. Initial evaluation on green seed coat lines of fenugreek – Hisar

| Accession | Seed yield (q ha ⁻¹) | | | | Increase over check (%) |
|------------------|----------------------------------|---------|---------|------|-------------------------|
| | 1999-00 | 2000-01 | 2001-02 | Mean | |
| HM - 338 | 22.0 | 22.3 | 18.1 | 20.8 | - 4.6 |
| HM - 342 | 23.0 | 22.5 | 20.0 | 21.8 | 0.0 |
| HM - 345 | 21.2 | 23.0 | 20.9 | 21.7 | - 0.4 |
| HM - 354 | 22.0 | 20.5 | 24.0 | 22.2 | 1.8 |
| HM - 361 | 22.3 | 22.7 | 20.0 | 21.7 | - 0.4 |
| HM - 365 | 21.5 | 21.8 | 19.8 | 21.0 | - 3.7 |
| HM - 369 | 22.0 | 23.0 | 20.7 | 21.9 | 0.4 |
| HM - 444* | 23.5 | 24.3 | 21.5 | 23.1 | 6.0 |
| HM - 346 | 23.2 | 23.8 | 24.5 | 23.8 | 9.2 |
| Hisar Sonali (C) | 21.7 | 23.2 | 20.6 | 21.8 | - |
| CD (5%) | 1.7 | 2.0 | 1.9 | - | - |

Table 226. Initial evaluation in fenugreek - Hisar

| Accession | Seed yield (q ha ⁻¹) | | | | Increase over check (%) |
|------------------|----------------------------------|---------|---------|------|-------------------------|
| | 1999-00 | 2000-01 | 2001-02 | Mean | |
| HM - 202 | 30.2 | 29.0 | 22.7 | 27.3 | 22.4 |
| HM - 205 | 30.5 | 29.0 | 24.8 | 28.1 | 26.0 |
| HM - 213 | 28.8 | 30.0 | 24.3 | 27.7 | 24.2 |
| HM - 232 | 30.9 | 32.0 | 23.7 | 28.9 | 29.6 |
| HM - 360 | 31.4 | 30.0 | 26.1 | 29.2 | 30.9 |
| HM - 371 | 27.6 | 28.0 | 25.4 | 27.0 | 21.1 |
| HM - 372 | 32.7 | 35.0 | 31.9 | 33.2 | 48.9 |
| HM - 373 | 30.4 | 32.0 | 28.7 | 30.4 | 36.3 |
| HM - 376 | 32.8 | 32.5 | 31.5 | 32.3 | 44.8 |
| Hisar Sonali (C) | 22.5 | 21.0 | 23.4 | 22.3 | - |
| CD (5%) | 2.1 | 2.2 | 2.1 | | |

Jobner

The trial was started during rabi 2000-01 with 36 entries. The data revealed significant differences among the entries for all the characters studied. The mean days to flowering ranged from 45.0 (NS - 2 and NS - 3) to 79.3 days (Local check), plant height from 34.8 (UM - 305) to 87.0 cm (NS - 3), branches per plant 1.3 (NS - 3) to 6.5 (UM - 305), pods per plant 20.4 (NS - 3) to 48.0 (UM - 305), pod length from 8.8 (RTP - 9)

to 14.4 cm (RTP - 8), seeds per pod from 9.9 (NS - 6) to 17.8 (NS - 3) and test weight from 9.7 (NS - 4) to 14.8 gm (NS - 2). AL - 51 recorded maximum seed yield of 1870 kg ha⁻¹ followed by RTP - 4 (1670 kg ha⁻¹), AL - 48 (1667 kg ha⁻¹), RMt - 303 (1630 kg ha⁻¹), AL - 21 (1550 kg ha⁻¹), AL - 31 (1500 kg ha⁻¹) and UM - 305 (1447 kg ha⁻¹). The lowest yield of 467 kg ha⁻¹ was recorded in NS - 2 (Table 227).

Table 227. Initial evaluation of fenugreek accessions – Jobner

| Entry | Days to flowering | Plant height (cm) | Branches plant ⁻¹ | Pods plant ⁻¹ | Pod length (cm) | Seeds pod ⁻¹ | Test weight (g) | Seed yield (kg ha ⁻¹) | Increase over check(%) |
|-----------|-------------------|-------------------|------------------------------|--------------------------|-----------------|-------------------------|-----------------|-----------------------------------|------------------------|
| AL - 51 | 58.0 | 46.9 | 5.1 | 33.0 | 10.3 | 15.3 | 12.8 | 1870 | 62.19 |
| RTP - 4 | 56.0 | 53.6 | 4.8 | 25.9 | 9.9 | 16.4 | 12.5 | 1670 | 44.84 |
| AL - 48 | 61.7 | 53.9 | 5.8 | 32.7 | 9.8 | 13.9 | 12.3 | 1667 | 44.58 |
| RMt - 303 | 57.7 | 49.5 | 4.7 | 33.3 | 9.7 | 16.2 | 12.9 | 1630 | 41.37 |
| AL - 21 | 58.0 | 57.5 | 5.0 | 38.9 | 10.4 | 17.0 | 11.7 | 1550 | 34.43 |
| AL - 31 | 59.7 | 61.3 | 4.8 | 39.2 | 10.5 | 15.5 | 11.4 | 1500 | 30.09 |
| UM - 305 | 48.0 | 34.8 | 6.5 | 48.0 | 10.2 | 16.3 | 14.3 | 1447 | 25.49 |
| RTP - 11 | 62.0 | 45.5 | 5.8 | 27.5 | 9.2 | 15.1 | 11.3 | 1443 | 25.15 |
| AL - 45 | 61.3 | 52.8 | 5.5 | 41.5 | 10.2 | 15.7 | 11.7 | 1440 | 24.89 |
| AL - 47 | 60.0 | 44.8 | 5.5 | 41.3 | 10.9 | 16.4 | 13.2 | 1440 | 24.89 |
| RTP - 1 | 57.3 | 46.6 | 5.2 | 30.5 | 9.9 | 16.3 | 12.6 | 1407 | 22.03 |
| AL - 1 | 56.7 | 50.0 | 4.9 | 34.7 | 9.9 | 16.1 | 11.6 | 1390 | 20.56 |
| AL - 49 | 62.0 | 60.9 | 5.2 | 28.0 | 10.1 | 16.0 | 12.2 | 1390 | 20.56 |
| RTP - 8 | 57.3 | 52.9 | 5.0 | 25.4 | 14.4 | 15.4 | 13.2 | 1333 | 15.61 |
| AL - 106 | 61.0 | 57.2 | 5.6 | 25.7 | 9.7 | 16.3 | 12.8 | 1297 | 12.49 |
| NS - 1 | 56.0 | 46.2 | 5.0 | 31.7 | 9.6 | 14.1 | 14.0 | 1297 | 12.49 |
| NS - 7 | 56.0 | 48.2 | 5.3 | 38.3 | 9.9 | 16.3 | 12.5 | 1297 | 12.49 |
| RTP - 7 | 60.0 | 57.3 | 4.9 | 29.3 | 9.7 | 14.9 | 12.7 | 1187 | 2.95 |
| RTP - 9 | 57.3 | 52.4 | 4.9 | 37.3 | 8.8 | 15.8 | 12.7 | 1187 | 2.95 |
| RTP - 6 | 57.0 | 48.9 | 5.7 | 37.1 | 10.3 | 16.0 | 13.6 | 1163 | 0.87 |
| RMt - 1 | 57.3 | 47.1 | 5.0 | 29.5 | 9.8 | 17.3 | 13.2 | 1153 | Check |
| AL - 8 | 61.7 | 50.8 | 4.7 | 31.5 | 10.6 | 16.2 | 12.5 | 1147 | - |
| AL - 18 | 59.0 | 55.1 | 4.9 | 43.6 | 10.7 | 19.1 | 12.2 | 1147 | - |
| NS - 6 | 56.7 | 49.9 | 5.1 | 38.3 | 9.7 | 9.9 | 12.4 | 1147 | - |
| AL - 2 | 60.0 | 49.8 | 4.9 | 26.0 | 9.5 | 15.0 | 11.8 | 1130 | - |
| RTP - 5 | 57.3 | 49.8 | 5.9 | 35.1 | 10.2 | 16.1 | 12.6 | 1130 | - |

| | | | | | | | | | |
|-----------|------|------|------|------|------|------|------|------|---|
| RTP - 2 | 59.0 | 56.6 | 5.5 | 33.7 | 9.7 | 15.5 | 11.4 | 1093 | - |
| NS - 5 | 59.7 | 48.9 | 5.7 | 39.0 | 9.6 | 15.7 | 10.7 | 1090 | - |
| RMt - 143 | 55.0 | 54.9 | 5.0 | 31.3 | 8.9 | 15.5 | 13.1 | 1053 | - |
| NS - 4 | 60.7 | 46.7 | 4.9 | 36.2 | 10.0 | 14.6 | 9.7 | 977 | - |
| AL - 83 | 60.0 | 45.9 | 5.1 | 29.8 | 9.7 | 15.8 | 12.3 | 923 | - |
| AL - 103 | 60.3 | 57.7 | 4.4 | 36.9 | 10.2 | 15.0 | 13.9 | 850 | - |
| RTP - 10 | 59.3 | 50.5 | 5.8 | 34.7 | 9.6 | 15.9 | 12.2 | 833 | - |
| NS-3 | 45.0 | 87.0 | 1.3 | 20.4 | 12.2 | 17.8 | 15.8 | 787 | - |
| Local | 79.3 | 53.8 | 6.9 | 21.8 | 10.0 | 15.9 | 9.2 | 740 | - |
| NS-2 | 45.0 | 75.2 | 2.1 | 22.7 | 11.3 | 18.1 | 14.8 | 467 | - |
| CD (5%) | 1.84 | 3.91 | 0.56 | 4.21 | 0.48 | 0.83 | 0.64 | 165 | - |
| CV% | 1.94 | 4.60 | 6.79 | 7.82 | 2.92 | 3.24 | 3.13 | 8.25 | - |

The mean performance of the entries evaluated during 2000-2001 and 2001-2002 indicated that RTP - 4 recorded maximum seed yield of 1340 kg ha⁻¹ followed by RMt - 303 (1340 kg ha⁻¹), RTP - 9 (1314 kg ha⁻¹) AL - 1 (1279 kg ha⁻¹), RTP - 8 (1216 kg ha⁻¹), AL - 48 (1208 kg ha⁻¹), UM - 305 (1199 kg ha⁻¹), AL - 18 (1182 kg ha⁻¹) and AL - 51 (1166 kg ha⁻¹). The lowest mean seed yield of 534 kg ha⁻¹ was recorded in NS - 2 (Table 228).

Table 228. Performance of fenugreek entries under IET (pooled data) - Jobner

| Entry | Yield (kg ha ⁻¹) | | | | | | | | |
|-----------|------------------------------|-----------|------|-----------|------|------|------|--|--|
| | 2000-2001 | 2001-2002 | Mean | | | | | | |
| RTP - 4 | 1010 | 1670 | 1340 | AL - 31 | 770 | 1500 | 1135 | | |
| RMt - 303 | 1050 | 1630 | 1340 | RTP - 1 | 854 | 1407 | 1130 | | |
| RTP - 9 | 1442 | 1187 | 1314 | NS - 7 | 868 | 1297 | 1082 | | |
| AL - 1 | 1169 | 1390 | 1279 | AL - 45 | 616 | 1440 | 1028 | | |
| RTP - 8 | 1100 | 1333 | 1216 | AL - 47 | 616 | 1440 | 1028 | | |
| AL - 48 | 750 | 1667 | 1208 | AL - 8 | 842 | 1147 | 994 | | |
| UM - 305 | 952 | 1447 | 1199 | RMt - 1 | 602 | 1153 | 977 | | |
| AL - 18 | 1218 | 1147 | 1182 | RMt - 143 | 864 | 1053 | 958 | | |
| AL - 51 | 462 | 1870 | 1166 | RTP - 5 | 756 | 1130 | 943 | | |
| AL - 21 | 742 | 1550 | 1146 | AL - 106 | 588 | 1297 | 942 | | |
| AL - 49 | 896 | 1390 | 1143 | RTP - 11 | 434 | 1443 | 938 | | |
| | | | | RTP - 6 | 672 | 1163 | 917 | | |
| | | | | AL - 2 | 629 | 1130 | 879 | | |
| | | | | RTP - 2 | 644 | 1093 | 868 | | |
| | | | | NS - 1 | 413 | 1297 | 855 | | |
| | | | | RTP - 7 | 476 | 1187 | 831 | | |
| | | | | AL - 83 | 728 | 923 | 825 | | |
| | | | | AL - 103 | 750 | 850 | 800 | | |
| | | | | NS - 5 | 462 | 1090 | 776 | | |
| | | | | NS - 6 | 378 | 1147 | 762 | | |
| | | | | NS - 4 | 434 | 977 | 705 | | |
| | | | | NS - 3 | 616 | 787 | 701 | | |
| | | | | RTP - 10 | 448 | 833 | 665 | | |
| | | | | Local | 560 | 740 | 650 | | |
| | | | | NS-2 | 602 | 467 | 534 | | |
| | | | | CD (5%) | 131 | 165 | | | |
| | | | | CV% | 11.0 | 8.25 | | | |

Jagudan

The trial was started during 2002-03 with 10 centers. Non significant differences

were observed among the entries. J.Fenu - 239 gave more yield (2370 kg ha⁻¹) which is 12.75% increase over check (Table 229)

Table 229. Yield and growth parameters of fenugreek accessions - Jagudan

| Entry | Days 50 flowering | Days maturity | Plant ht. (cm) | No. of branches plant ⁻¹ | No. of pods plant ⁻¹ | Length of pod (cm) | No. of grains pod ⁻¹ | 1000 seeds wt. (g) | Yield (kg ha ⁻¹) | Increase over control (%) |
|----------------|-------------------------|------------------|----------------------|---|---------------------------------------|--------------------------|---------------------------------------|-----------------------------|---------------------------------|------------------------------------|
| J.Fenu - 182 | 50 | 111 | 96.4 | 3.2 | 52.8 | 9.2 | 16.0 | 16.0 | 1898 | - |
| J.Fenu - 193 | 50 | 113 | 101.1 | 3.7 | 56.4 | 8.9 | 16.5 | 15.5 | 2213 | 5.28 |
| J.Fenu - 228 | 47 | 111 | 94.5 | 4.0 | 57.0 | 8.6 | 15.6 | 15.2 | 2192 | 4.28 |
| J.Fenu - 232 | 48 | 108 | 93.4 | 3.1 | 50.3 | 11.8 | 17.2 | 16.2 | 1988 | - |
| J.Fenu - 236 | 49 | 109 | 86.0 | 3.2 | 47.3 | 10.0 | 16.0 | 15.6 | 2071 | - |
| J.Fenu - 239 | 48 | 109 | 98.2 | 4.0 | 57.4 | 9.7 | 16.3 | 17.6 | 2370 | 12.75 |
| J.Fenu - 258 | 52 | 113 | 102.2 | 4.6 | 50.0 | 9.6 | 15.2 | 14.4 | 2071 | - |
| J.Fenu - 272 | 54 | 115 | 98.7 | 3.7 | 53.4 | 9.9 | 16.3 | 14.0 | 2154 | 2.47 |
| J.Fenu - 273 | 54 | 118 | 98.4 | 3.6 | 50.0 | 9.5 | 17.2 | 14.7 | 2228 | 5.99 |
| GM - 1 (check) | 54 | 112 | 93.4 | 3.9 | 48.2 | 9.8 | 16.0 | 14.8 | 2102 | - |
| CD (5%) | | | | | | | | | NS | |
| CV% | | | | | | | | | 7.60 | |

FGK/CI/5 Quality Evaluation Trial

FGK/CI/5.1 Quality evaluation in fenugreek

(Coimbatore, Guntur, Jobner, Jagudan, Hisar, Dholi and Kumarganj)

Coimbatore, Guntur, Jobner, Jagudan, Hisar, Dholi, Kumarganj

Reports not received.

FGK/CM/2 Nutrient Management Trial

FGK/CM/2.2 Efficacy of biofertilizers using *Azospirillum/Rhizobium* on fenugreek

(Jobner, Guntur, Coimbatore, Kumarganj, Jagudan)

Jobner

The experiment was initiated during

rabi 2000-01 with 9 treatments. During 2001-02 the data revealed that significantly more number of branches and pods plant⁻¹ and biological yield ha⁻¹ over control were recorded with the application of 100, 75 and 50% of recommended dose of N + *Rhizobium* + FYM 5 t ha⁻¹ and FYM 10 t ha⁻¹. Seed yield in all the treatments except *Rhizobium* inoculation alone was significantly high over control (Table 230). Application of N 100% + *Rhizobium* + FYM 5 t ha⁻¹ recorded maximum seed yield of 1451 kg ha⁻¹ which as at par with 75% and 50% N + *Rhizobium* + FYM 5 t ha⁻¹, *Rhizobium* + FYM 10 t ha⁻¹ and 100% inorganic N alone (Table 230).

Table 230. Effect of biofertilizer, *Rhizobium* on seed yield of fenugreek – Jobner

| Treatment | Seed yield (kg ha ⁻¹) | | |
|---|-----------------------------------|-----------|------|
| | 2000-2001 | 2001-2002 | Mean |
| Inorganic N 100% + <i>Rhizobium</i> + FYM 5 t ha | 801 | 1451 | 1126 |
| Inorganic N 75% + <i>Rhizobium</i> + FYM 5 t ha ⁻¹ | 796 | 1346 | 1071 |
| Inorganic N 50% + <i>Rhizobium</i> + FYM 5 t ha ⁻¹ | 870 | 1420 | 1145 |
| <i>Rhizobium</i> + FYM 5 t ha ⁻¹ | 685 | 1315 | 1000 |
| FYM 5 t ha ⁻¹ alone | 633 | 1296 | 965 |
| <i>Rhizobium</i> + FYM 10 t ha ⁻¹ | 833 | 1435 | 1134 |
| FYM 10 t ha ⁻¹ | 679 | 1324 | 1002 |
| Inorganic N 100% alone | 801 | 1358 | 1080 |
| <i>Rhizobium</i> 1.5 kg ha ⁻¹ alone | 648 | 1250 | 949 |
| Control | 555 | 1147 | 851 |
| CD (5%) | 102 | 126 | 106 |

Guntur

The experiment was started with 10 treatments during 2000-2001. During 2002-03 rabi season, T1 (N 100% + *Rhizobium* + FYM 5 t ha⁻¹) recorded significantly higher plant height, more number of branches, more number of pods and number of seeds per pod

(42.7 cm, 7.13, 23.5 and 14.2, respectively) than control (32.2 cm, 5.1, 13.2 and 9.0, respectively). With regards to seed yield T1 (620 kg ha⁻¹) recorded maximum yield and was on par with T2 (601 kg ha⁻¹) and T3 (587 kg ha⁻¹) and significantly superior to control (412 kg ha⁻¹) (Table 231).

Table 231. Effect of *Rhizobium* on the yield of fenugreek - Guntur

| Treatment | Plant height (cm) | No. of branches | No. of days to 50% flowering | No. of days to maturity | No. pods plant ⁻¹ | No. of seeds pod ⁻¹ | Pod length (cm) | Yield plot ⁻¹ (g) | Yield (kg ha ⁻¹) |
|---|-------------------|-----------------|------------------------------|-------------------------|------------------------------|--------------------------------|-----------------|------------------------------|------------------------------|
| T1 - N 100% + <i>Rhizobium</i> FYM + 5 t ha ⁻¹ | 42.7 | 7.1 | 40.7 | 81.3 | 23.5 | 14.2 | 11.5 | 747.3 | 620.0 |
| T2 - N 75% + <i>Rhizobium</i> + FYM 5 t ha ⁻¹ | 44.2 | 7.1 | 40.7 | 80.7 | 22.0 | 13.8 | 11.2 | 724.3 | 601.0 |
| T3 - N 50% + <i>Rhizobium</i> FYM + 5 t ha ⁻¹ | 40.1 | 6.9 | 40.0 | 79.7 | 20.9 | 13.1 | 10.8 | 707.3 | 587.0 |
| T4 - <i>Rhizobium</i> + FYM 5 t ha ⁻¹ | 36.0 | 5.7 | 40.3 | 79.3 | 16.5 | 10.8 | 10.1 | 624.0 | 518.0 |

| | | | | | | | | | |
|---------------------------------------|------|------|------|------|------|------|------|-------|-------|
| T5 - FYM 5 tha ⁻¹ Alone | 35.9 | 5.4 | 41.0 | 82.7 | 14.1 | 10.1 | 10.2 | 570.0 | 473.0 |
| T6 - <i>Rhizobium</i> + FYM 10 kg | 38.2 | 6.5 | 40.3 | 79.3 | 19.0 | 12.2 | 10.8 | 654.7 | 543.0 |
| T7 - FYM 10 kg alone | 34.8 | 5.7 | 40.7 | 80.3 | 15.3 | 9.3 | 10.2 | 591.3 | 490.0 |
| T8 - N 100% | 37.2 | 6.1 | 40.0 | 78.7 | 17.1 | 12.0 | 10.8 | 612.0 | 508.0 |
| T9 - <i>Rhizobium</i> only | 33.2 | 5.3 | 40.7 | 79.3 | 14.8 | 9.2 | 10.0 | 520.0 | 432.0 |
| T10 - Absolute control | 32.2 | 5.1 | 42.0 | 80.0 | 13.2 | 9.0 | 9.8 | 496.0 | 412.0 |
| CD (5%) | 6.8 | 0.95 | NS | NS | 3.06 | 1.32 | NS | 103.2 | 85.9 |
| CV% | 10.6 | 9.1 | | | 10.1 | 6.8 | | 9.6 | 9.7 |

Coimbatore

The experiment is in third year of progress with 10 treatments in RBD. Application of inorganic N100% + *Azospirillum* 1.5 kg ha⁻¹ (seed treatment) + FYM 5 t ha⁻¹ (T1) gave the highest yield of 732 kg ha⁻¹ as against 425 kg ha⁻¹ in the control. This was on par with application of inorganic N 75% + *Azospirillum* 1.5 kg ha⁻¹ as seed treatment + FYM 5 t ha⁻¹ (T2) and application of inorganic N 50% + *Azospirillum* 1.5 kg ha⁻¹ as seed treatment + FYM 5 t ha⁻¹ (T3)

which recorded a yield of 719 and 714 kg ha⁻¹, respectively. Seed treatment with *Azospirillum* 1.5 kg ha⁻¹ (T8) alone registered the lowest yield of only 112 kg ha⁻¹.

Kumarganj

The experiment was started during 2001 with 7 treatments. During 2002-03, maximum seed yield of 21.52 q ha⁻¹ was obtained in T6 treatment (FYM 10 kg + *Azospirillum* 50 g (Table 232). However, analysis of pooled data revealed that T - 6 recorded maximum seed yield of 18.76 q ha⁻¹.

Table 232. Effect of biofertilizer, *Azospirillum* on the performance of fenugreek – Coimbatore

| Treatment | Days to 50% flowering | Plant height (cm) | No. of branch splant ⁻¹ | No. of pods plant ⁻¹ | Length of pod (cm) | No. of grains pod ⁻¹ | Days to maturity | Yield (q ha ⁻¹) |
|---|-----------------------------|-------------------------|--|---------------------------------------|--------------------------|---------------------------------------|---------------------|--------------------------------|
| T1 Inorganic N 100% + <i>Azospirillum</i> + FYM 5 t ha ⁻¹ | 86.30 | 80.67 | 4.30 | 224.73 | 11.07 | 23.10 | 135.67 | 15.27 |
| T2 Inorganic N 75% + <i>Azospirillum</i> + FYM 5 t ha ⁻¹ | 85.00 | 68.57 | 3.83 | 221.63 | 9.73 | 23.17 | 135.00 | 19.44 |
| T3 Inorganic N 50% + <i>Azospirillum</i> + FYM 5 t ha ⁻¹ | 87.00 | 75.30 | 4.30 | 205.27 | 10.40 | 24.07 | 137.0 | 15.27 |

| | | | | | | | | |
|---|-------|-------|------|--------|-------|-------|--------|-------|
| T4 FYM 5 t ha ⁻¹ + <i>Azospirillum</i> | 87.00 | 72.07 | 3.63 | 193.60 | 10.50 | 22.30 | 135.67 | 15.96 |
| T5 FYM 5 t ha ⁻¹ alone | 85.67 | 71.07 | 4.07 | 206.63 | 10.40 | 22.63 | 138.67 | 16.31 |
| T6 FYM 10 t ha ⁻¹ + <i>Azospirillum</i> | 86.33 | 66.20 | 4.00 | 199.73 | 9.97 | 23.30 | 136.67 | 21.52 |
| T7 FYM 10 t ha ⁻¹ alone | 86.00 | 72.30 | 4.07 | 199.50 | 10.20 | 21.60 | 135.0 | 19.09 |
| T8 Control | 86.33 | 69.10 | 4.30 | 209.67 | 10.20 | 22.97 | 136.33 | 19.78 |
| CD (5 %) | 2.82 | 3.11 | 0.61 | NS | 0.74 | 4.80 | 4.52 | 2.79 |
| CV % | 1.87 | 2.47 | 8.59 | 9.28 | 4.11 | 11.97 | 1.89 | 8.92 |

Jagudan

Report not received.

FGK/CP/1 Disease Management Trial
FGK/CP/1.1 Biocontrol of root rot in
fenugreek
(Coimbatore)
Coimbatore

The experiment was initiated during 2000 with 8 treatments. All the seven

treatments were effective in reducing the disease incidence by more than 50%. Among these, soil application of *Trichoderma viride* (5 kg ha⁻¹) + soil application of neem cake (150 kg ha⁻¹) (T6) recorded the lowest disease incidence (32.98%). However it was next only to seed treatment with carbendazim (2 g kg⁻¹) + soil drenching (0.1%) + soil application of neem cake 150 kg ha⁻¹ which reduced the disease incidence by 72.59 (Table 233).

Table 233. Effect of biocontrol agent and neem cake on the incidence of fenugreek root rot - Coimbatore

| Treatment | Root rot disease incidence (%) | Disease reduction (%) | Yield | |
|---|--------------------------------|-----------------------|----------------------|---------------------|
| | | | g plot ⁻¹ | kg ha ⁻¹ |
| T1 - S.T with carbendazim (2 g kg ⁻¹) + soil drenching (0.1%) | 27.72 (31.74) | 66.80 | 232.68 | 465.35 |
| T2 - S.T with <i>Trichoderma viride</i> (4 g kg ⁻¹) | 39.50 (38.93) | 52.70 | 225.25 | 450.50 |
| T3 - S.A. of <i>Trichoderma viride</i> 20 DBS. | 36.57 (37.16) | 56.20 | 226.75 | 453.50 |
| T4 - S.A. of neem cake (150 kg ha ⁻¹) | 41.33 (40.0) | 50.50 | 224.50 | 449.00 |
| T5 - S.T with <i>Trichoderma viride</i> + S.A. of neem cake | 35.37 (36.48) | 57.64 | 228.75 | 457.50 |
| T6 - S.A of <i>Trichoderma viride</i> + S.A. of neem cake | 32.98 (35.04) | 60.50 | 231.38 | 462.75 |
| T7 - S.T with carbendazim, soil drenching + S.A. of neem cake | 22.88 (28.56) | 72.59 | 236.63 | 473.25 |
| T8 - Control | 83.50 (66.04) | | 104.00 | 208.0 |
| CD (5%) | 2.15 | | | 37.8 |

GENETIC RESOURCES OF SPICES AT AICRPS CENTRES

(As on 31-03-2003)

| Crop/Center | Indigenous | | Exotic | Total |
|---------------------|------------|----------------------|-----------|------------|
| | Cultivated | Wild and related sp. | | |
| Black pepper | | | | |
| Panniyur | 147 | 28 | 4 | 179 |
| Sirsi | 201 | 19 | 1 | 221 |
| Chintapalli | 56 | — | — | 56 |
| Yercaud | 106 | — | — | 106 |
| Pundibari | 11 | — | — | 11 |
| Dapoli | 64 | 6 | — | 70 |
| Dholi | 7 | — | — | 7 |
| Total | 592 | 53 | 5 | 650 |
| Cardamom - | | | | |
| Pampadumpara | 104 | — | — | 104 |
| Mudigere | 263 | 2 | — | 265 |
| Total | 367 | 2 | - | 369 |
| Ginger | | | | |
| Pottangi | 167 | 2 | 3 | 172 |
| Solan | 269 | — | 2 | 271 |
| Dholi | 103 | — | — | 103 |
| Kumarganj | 29 | — | — | 29 |
| Pundibari | 25 | — | 6 | 31 |
| Raigarh | 35 | — | — | 35 |
| Dapoli | 3 | — | — | 3 |
| Total | 631 | 2 | 11 | 644 |
| Turmeric | | | | |
| Dapoli | — | — | — | — |
| Pottangi | 171 | 22 | — | 193 |
| Jagtial | 189 | — | — | 189 |

| | | | | |
|---------------------|-------------|-----------|-----------|-------------|
| Dholi | 74 | 2 | — | 76 |
| Bhavanisagar | — | — | — | — |
| Raigarh | 61 | — | — | 61 |
| Kumarganj | 102 | — | — | 102 |
| Pundibari | 100 | 17 | 25 | 142 |
| Solan | 171 | — | — | 171 |
| Coimbatore | 249 | — | — | 255 |
| Guntur | 124 | — | — | 124 |
| Total | 1241 | 41 | 25 | 1307 |
| Clove | | | | |
| Yercaud/Pechiparai | 19 | 3 | — | 22 |
| Thadiyankudisai | 1 | — | — | 1 |
| Pechiparai | 19 | 3 | — | 22 |
| Dapoli | 3 | — | — | 3 |
| Total | 42 | 6 | - | 48 |
| Nutmeg | | | | |
| Yercaud /Pechiparai | 11 | 9 | — | 20 |
| Thadiyankudisai | 1 | — | — | —1 |
| Pechiparai | 11 | 9 | — | 20 |
| Dapoli | 87 | — | — | 87 |
| Total | 110 | 18 | - | 128 |
| Cinnamon | | | | |
| Yercaud/Pechiparai | 12 | — | — | 12 |
| Thadiyankudisai | 6 | — | — | 6 |
| Pechiparai | 12 | — | — | 12 |
| Dapoli | 11 | — | — | 11 |
| Total | 41 | - | - | 41 |
| Cassia | | | | |
| Pechiparai | 5 | - | - | 5 |
| Dapoli | 6 | | | 6 |
| Total | 11 | - | - | 11 |

| | | | | |
|--------------------|-------------|----------|------------|-------------|
| Coriander | | | | |
| Jobner | 683 | — | 112 | 795 |
| Jagudan | 71 | — | 20 | 91 |
| Coimbatore | 224 | — | — | 224 |
| Guntur | 264 | — | 5 | 269 |
| Hisar | 179 | — | — | 179 |
| Dholi | 85 | — | — | 85 |
| Raigarh | 20 | — | — | 20 |
| Kumarganj | 65 | — | — | 65 |
| Total | 1591 | - | 137 | 1728 |
| Cumin | | | | |
| Jobner | 366 | — | 10 | 376 |
| Jagudan | 176 | — | 7 | 183 |
| Kumarganj | 19 | — | — | 19 |
| Total | 561 | | 17 | 578 |
| Fennel | | | | |
| Jobner | 191 | — | 12 | 203 |
| Jagudan | 182 | — | 20 | 202 |
| Hisar | 74 | — | — | 74 |
| Dholi | 44 | — | — | 44 |
| Kumarganj | 27 | — | — | 27 |
| Total | 518 | | 32 | 550 |
| Fenugreek | | | | |
| Jobner | 357 | — | 8 | 365 |
| Jagudan | 43 | — | — | 43 |
| Coimbatore | 255 | — | — | 255 |
| Guntur | 125 | 1 | — | 126 |
| Hisar | 86 | — | — | 86 |
| Dholi | 97 | — | — | 97 |
| Raigarh | 13 | — | — | 13 |
| Kumarganj | 60 | — | — | 60 |
| Total | 1036 | 1 | 8 | 1045 |
| Grand Total | | | | 7099 |

ICAR – ADHOC PROJECTS

I.1. Project title: Identification and evaluation of bioactive peptide - A biotechnological approach towards controlling the fungal pathogen of the quick wilt disease of black pepper.

2. Investigator (s) : George Thomas

Manoj Kurian Jacob

3. Name of the Institution/University and Address: Plant Molecular Biology Group
RajivGandhi Centre for Biotechnology,
Thiruvananthapuram – 695 014, Kerala

4. Objectives

- (a) To screen synthetic peptides for the identification of bioactive lead peptides against *Phytophthora capsici*
- (b) To compare the anti-fungal properties of selected bioactive peptides with other synthetic chemical fungicides
- (c) *In vitro*/field studies and evaluation of crop protection efficiency of the selected peptides

5. Progress of work

A set of peptides was designed on the basis of the properties and characteristics of synthetic and naturally occurring antimicrobial peptides published in the literature. These peptides were synthesized and purified, following the protocol standardized, and their antimicrobial activities

against *Phytophthora capsici* were tested. The naturally occurring antimicrobial peptide histatin-5, a synthetic hexapeptide with known antibacterial activity against *Pythium* and the synthetic chemical fungicide amphotericin-B were used as control. Initially bio-assay using hyphal fragments was standardized. However, the hyphal length between two experiments varied greatly, which resulted in greater variation in the antibacterial activity of the peptides. Therefore, a bio-assay using zoospores was standardized. Different zoospore concentrations were tried and the concentration between 7×10^4 to 7×10^5 zoospores/ml yielded standard growth curve and this concentration was used for bio-assay. A preliminary screening was carried out using seven 1:1 serial dilutions of each peptide starting from an initial concentration of 250 mM. Minimum Inhibitory Concentration (MIC) was determined using the dilutions differing by 20 mM starting from the lowest concentration that was found to be effective in the preliminary screening. The MIC of the two designed peptides was less than 10 mM, whereas that of amphotericin-B and histatin-5 was less than 16 mM and 40 mM, respectively. Results indicated that the two designed peptides have stronger antimicrobial activity against *P. capsici* than the other known antifungal compounds tested in the present study. Experiments to determine the site of action of these peptides on *Phytophthora* and to evaluate their in vivo antimicrobial activity are in progress.

II. 1. Project Title: Characterization of nutmeg germplasm for quality

2. Investigator(s) : B. Krishnamoorthy

T. John Zachariah

3. Name of the Institute/ University and Address :
Indian Institute of Spices Research,
Calicut - 673 012

4. Objectives

- (a) Characterizing nutmeg germplasm based on quality evaluation.
- (b) Identification of quality nutmeg accessions from germplasm conservatory

5. Progress of work (Final Report)

Essential oil of nutmeg and mace from 95 accessions were extracted by Cleavenger method and its yield (%v/w) calculated. In nutmeg, the essential oil content ranged from 3.9% (A9/116) to 16.5% (A9/18) and in mace, it ranged from 6% (A9/107) to 26.1% (A9/18). Thus among the accessions screened, A9/18 has the highest essential oil content in both nutmeg and mace.

The essential oils of nutmeg and mace of 65 accessions were analyzed by Gas Liquid Chromatography (GLC). The percentages of myristicin, elemicin, safrole, α -pinene, and sabinene fractions in nutmeg and mace were calculated. Accessions have been classified based on these parameters. Accessions A9/71 and A9/95 have low myristicin, low elemicin and low safrole coupled with high sabinene in both nutmeg and mace oils. Myristicin, elemicin and safrole have

hallucinogenic properties and sabinene imparts a sweet taste. Thus these two accessions are suitable for confectionery.

The butter content ranged from 21.5% in A9/107 to 44% in A11/12. The oleoresin content obtained from defatted nutmegs with acetone ranged from 1.4% (A9/63) to 5.3% (A9/30). However, with ethanol, the yield of oleoresin increased from 6.7% (A9/1) to 23.0% (A9/116). The range of mace oleoresin (with acetone) was from 13.8% (A9/1) to 32.2% (A4/22).

In leaf, the essential oil (v/w) ranged from 0.98% (A9/26) to 2.5% (A11/70). The range of myristicin was from 0.3% to 11.9% and that of elemicin, 0.3% to 7.98%. There is no correlation between the essential oil profile of leaf and the sex of the plant.

Amino acids of leaves of male, female and bisexual plants were analyzed to see if the profile could be used for identification of the sex of the plant. It was seen that there was no difference in the amino acid profile in relation to the sex of the plant.

Total free amino acids in leaf samples were also estimated (Yapinlee & Tunekazu, 1966). No significant difference was obtained in the total free amino acid content in these samples. Among the different species of *Myristica*, *M. fatua* var *magnifica* had the lowest content (127.65 μ g/100 mg) of total free amino acids while the highest amino acid content was obtained in *M. prainii* (315.21 μ g/100 mg).

The non volatile ether extract of nutmeg and mace was estimated by AOAC method and found to be 33.77 and 18.65%, respectively. This is in accordance with the reported value of 33.6% and 21.98% in nutmeg and mace, respectively.

Lycopene is the pigment responsible for the attractive red colour of mace. Lycopene is a potent antioxidant. It participates in a host of chemical reactions that are believed to prevent carcinogenesis and atherosclerosis

Thus lycopene is a phytochemical with potent nutraceutical properties. None of the storage systems tried could prevent the degradation of lycopene and only

25% of the lycopene content was retained after 28 days of storage. Since mace is used in confectionery and pharmaceutical products, the change in configuration is a very critical factor in the value-addition of mace.

The dry mace powder was stored in airtight amber-colored bottles for extraction of essential oil. Oil was extracted & its GC profile was followed for 28 days. There was a decrease of only 15% in essential oil after 28 days. Among the five major components of the oil, α -pinene and sabinene had an increase in its relative concentration and the other three components (safrole, myristicin and elemicin) had a decrease in its concentration. Hence we suggest that mace should not be stored in the powdered form.

III. 1. Project Title : Organization of ginger and turmeric germplasm based on molecular characterization.

2. Investigator(s) : B. Sasikumar

T. John Zachariah

3. Name of the institution/University and Address : Indian Institute of Spices Research, Calicut - 673 012

3. Objectives

- (a) Characterization of ginger and turmeric germplasm using molecular markers.
- (b) Build up a core collection of ginger and turmeric germplasm based on molecular and morphological features.
- (c) DNA Profiling of improved varieties of ginger and turmeric as their cultivars.

5. Progress of work

A protocol for the isolation and amplification of DNA from rhizomes (recalcitrant tissue) of turmeric and ginger is perfected. The yield of isolated DNA ranged from 10.83 to 14.44 μ g per gram of fresh mature rhizome tissue of turmeric and 10.13 to 13.38 μ g per gram of fresh mature rhizome tissue for ginger. The average molecular weight of the DNA was 200 - 220 kb. The isolated DNA was digested with Eco R I & Hind III restriction enzymes in addition to PCR amplification.

For characterization of ginger and turmeric germplasm using RAPD, DNA was isolated and purified from 200 turmeric and

81 ginger accessions. Sixty random decamer primers screened for getting polymorphism 28 primers gave good clear banding pattern with both ginger and turmeric. Amplification of DNA from 50 accessions of turmeric with seven random decamer primers revealed, good polymorphism, however amplified products of 25 ginger accessions with four random decamer primers yield low to moderate polymorphism.

An efficient protocol for the isolation and amplification of DNA from mature rhizomes of turmeric and ginger is perfected. This will help in the identification and elimination of spurious market samples/seed materials and thereby restricting unscrupulous seed trade practice in these crops. This has more relevance in crops like ginger and turmeric which are not easily discernable based on rhizome morphology.

IV. 1. Project Title : Micropropagation and development of Seedless Malabar Tamarind through in vitro techniques.

2. Investigator (s) : P.C. Rajendran

A. Augustin

3. Name of the Institution/ University and Address: Centre for Plant Biotechnology and Molecular Biology College of Horticulture, Kerala Agricultural University Vellanikkara, Trichur, Kerala

4. Objectives :

- (a) To standardised the culture conditions for large scale multiplication through *in vitro* techniques.
- (b) Standardisation of protocol for

developing triploid plantlets through *in vitro* endosperm culture.

- (c) To develop haploids through anther culture from male trees of *Garcinia gummi-gutta*.
- (d) To compare the Hydroxy Citric Acid (HCA) content in callus cultures and fleshy fruit rind (fresh and dry) of Malabar tamarind fruit through Gas chromatography.
- (e) Isozyme studies, protein patterns and ribosomal DNA banding patterns in haploid, diploid and triploid plantlets.
- (f) Induction of somatic embryogenesis from triploid calli cultures and development of synthetic seeds.
- (g) To isolate and purify the protoplasts from haploids and diploid females.
- (h) To fuse the protoplasts of haploid and diploid females for the development of triploid plantlets.

5. Progress of work

Standardisation of micro-propagation in this dioecious allogamous tree spices (*Garcinia gummigutta* var. *gammigutta*) is the primary mandate of the project. In general, the explants collected from field grown plants lead to more contamination in inoculated cultures. Hence the grafted plants are also maintained under glass house for excising explants from vegetative part. A slight modification in pretreatment of explants by dipping the explants in 70% ethanol for one minute and further treatment with mercury chloride for 3-4 minutes with the addition of

0.1% bavistin directly in the media. It was observed that there is no marked change in the contamination rate. This is due to the inherent latent contamination from the active endogenous fungus in the system of perennial tree spices.

Direct organogenesis for microp-ropagation has been continued for getting multiple shoots from shoot tips and nodal segments. Regeneration from shoot tip cultures was observed in $\frac{1}{2}$ MS + 0.5 mg⁻¹ BA + 5.0 mg⁻¹ IBA with addition of 15% coconut water as compared to nodal segments followed by the media $\frac{1}{2}$ MS + 0.5mg⁻¹ BA + 5.0 mg⁻¹ IBA with the addition of 15% coconut water and 0.1% bavistin. Indirect organogenesis were also continued during the second year of investigation. However, the overall rate of contamination was 64.2% with the survival rate of 18.8%. In order to overcome the inherent difficulty of fungal contamination, *in vitro* production of explants from immature garcinia seed is being tried.

Standardisation of protoplast isolation by direct method from the leaf explants of female trees was initiated. Different combinations of osmoticum and enzymes with different duration were tried, of which 0.84% cellulose and 0.1% pectinase with 0.5M Sorbitol at 15 h of incubation was observed to give abundant viable protoplast.

In vitro germination of mature dried seeds as well as immature seeds were attempted to break the inherent dormancy as a prelude to produce aseptic explants from *in vitro* seed germinated cultures. It is interesting to note that the immature seeds scooped out from fresh fruit harvested at 75% maturity

stage exhibited the quick germination.

Somatic embryogenesis was also observed directly from fresh immature seeds inoculated on $\frac{1}{2}$ MS media fortified with the hormonal combination of 2.0 mg/l 2,4-D and 1.0mg/l kinetin, *in vitro* germination and somatic embryogenesis will be continued in the coming fruiting season also.

A clear-cut difference in banding pattern of male and female plants has been observed for Isozyme analysis of esterase using PAGE. This finding is advantageous to know the sex at seedling stage.

- V. 1. Project title : Improvement of Productivity and Quality of Birds-Eye Chillies Grown in North Eastern Region of India
2. Investigator (s) : S. J. N. Baruah
3. Name of the Institution/University and Address : Department of Horticulture, Assam Agricultural University, Jorhat-785 013, Assam
4. Objectives :
 - (a) Local germplasm of bird's eye chillies collection, evaluation and preservation.
 - (b) Development of inbreds from the collected germplasm.
 - (c) Study of genetic architecture of disease resistance vis- a- vis economic characters to identify suitable parental genotypes and breeding approaches to exploit the material acquired.

- (d) To assess the possibilities of heterosis breeding by making use of cytoplasmic and genetic male sterility, if available.

5. Progress of work :

Irrespective of stages of observation, BEC 4 attained the highest plant height (61.00 cm at 90 DAT) followed by BEC 7 (58.65 cm at 90 DAT) which were significantly superior to other test lines. Number of secondary branches was found to vary significantly among the test lines at 60 and 90 DAT, which was found to be maximum in BEC 7 (24.42) followed by BEC 4 (23.28). There was no significant difference in flowering, and maturity of fruits. In all test lines first flowers appeared within 61.10 to 68.05 days from sowing, while days to maturity in different test lines ranged from 81.62 to 97.50 days.

The difference in leaf area index was significant. The maximum and minimum LAI of 3.03 and 1.94 were recorded in BEC 7 and BEC 29, respectively. Differences in the number of flowers per plant among the cultivars were highly significant. BEC 2 recorded the highest number of flowers (307.93) which was statistically at par with BEC lines 1, 4, 6, 7, 8, 9, 10, 12, 20 and 27, while the lowest was recorded in BEC 42 (255.47).

Maximum number of fruits per plant was produced by BEC 7 (139.17), followed by BECs 4 (135.07) and 9 (135.09), BEC 2 (132.88); while, the lowest (97.16) was recorded in BEC 42. But, the fruiting was found to be non-significant. Fruit length was

significant amongst different BEC lines. The highest fruit length of 3.02 cm was recorded in BEC 3 and the lowest in BEC 6 (0.97 cm). BEC lines also differed significantly in respect of fruit diameter. BEC 1 registered the highest fruit diameter of 0.95 cm, followed by BEC 8 (0.93 cm); while it was lowest (0.43 cm) in BEC 6. BEC 3 produced fruits with the highest weight (1.01g), while the lowest weight of 0.60 g was recorded in BEC 6 and 21. Seeds per fruit were also statistically significant amongst the test lines with the maximum number (50.33) in BEC 7 and minimum (20.55) in BEC 21.

The BEC lines differed significantly for yield per plant (dry fruit yield per plant and yield per hectare). BEC 7 produced the highest fruit yield per plant (123.86 g) and also yield per hectare (49.54 q), followed by BEC 4, 8 and 9. For both the characters (fruit yield per plant and per hectare) BEC 21 recorded the lowest (63.20 g plant⁻¹ and 25.30 q ha⁻¹). The dry fruit yield per plant was also found to be superior in BEC 7 (58.97g plant⁻¹), followed by BEC 4 (55.35 g plant⁻¹).

VI. 1. Project Title : Management of seedborne pathogens and wilt disease of coriander by using biotechnological approaches

2. Investigator(s) : R. Rabindran

Sabitha Doraiswamy

3. Name of the Institute/University and Address : Department of Plant Pathology, Centre for Plant Protection Studies, Tamil Nadu Agricultural University, Coimbatore - 641 003

4. Objectives :

- (a) Assessment of seedborne diseases and wilt disease incidence in coriander crop and the pathogens associated with the disease in different agroclimatic zones in Tamil Nadu.
- (b) Detection, identification and establishing Koch's postulates.
- (c) Management of seedborne pathogens by using biocontrol agents and plant products.

5. Progress of work (Final report)

A field survey was conducted in major coriander growing areas (27 farmers fields) in Coimbatore District. In surveyed areas wilt incidence was 0-1%. Powdery mildew incidence was maximum in Thudiyalur (60%). Seed samples were collected from all the localities to study presence of seed borne pathogens.

In the survey of five districts thirty seven villages were covered 117 farmers were contacted. Due to unusual rains during the cropping period almost in all the districts 50% of the crop was damaged. In the field the major problem encountered during 96-97 was powdery mildew disease alone and wilt was observed in Coimbatore District. *Rhizoctonia solani* was found to be associated with the wilted plants.

From the survey it could be inferred that coriander is cultivated on a large scale in South Arcot, Virudhunagar and Thoothukudi districts. The crop in these districts is free

from wilt caused by *Fusarium*. Four pathogens were associated with the seed samples tested.

Survey was conducted for during 1996-97 and 1997-98 in the major coriander growing areas of Tamil Nadu, covering 33 villages in five districts. Thirty four farmers were contacted and seed samples were collected and analyzed to detect the seed borne pathogens. In all the areas surveyed, powdery mildew was found to be a major problem. Its incidence was recorded to the tune of 60 per cent alos. Wilt was noticed in South Arcot District to the tune of 10%.

Seven fungi viz., *Alternaria*, *Aspergillus*, *Curvularia*, *Fusarium*, *Trichothecium*, *Penicillium* and *Rhizopus* were found to be associated with coriander seeds collected from the 5 districts of Tamil Nadu. Among these, *Fusarium semitectum* (78%) and *A. alternata* (85) frequently associated with the seeds.

Seven plant extracts were tried against *F. semitectum* and *A. alternata* and among them, *Prosopis juliflora* extract (10%) was found affective.

VII. 1. Project title: Elucidation of Biosynthetic Pathways of Curcumin in Turmeric.

2. Investigator (s) : B. Chempakam
K. Vasu
N.K. Leela

3. Name of the Institute/University and Address : Indian Institute of Spices Research, Calicut

4. Objectives :

- (a) To study the nature of precursors, intermediates and degradation products of curcumin so as to evolve a suitable biosynthetic pathway.
- (b) To assay and localize the key enzymes involved in the biogenesis, based on the established pathway.
- (c) Exploring the possibilities of utilizing the data generated from the scheme for establishing the pathways of biosynthesis of the active principles in other spices viz; pepper and ginger.

5. Progress of work (Final report)

PAL the major enzyme, which initiates the series of reactions leading to curcumin synthesis, was studied during the early germination phase. The activity was maximum in leaves as compared to roots, rhizomes and pseudostem, indicating that the conversion of phenylalanine to cinnamic acid mostly takes place in the leaves.

Studies on the localisation of PAL activity in various cell fractions showed maximum activity in microsomal fraction

GC-MS studies of the essential oil from

rhizome, root and leaf indicated the major compounds as α -turmerone and α -curcumene in rhizome and root and α -phellandrene and terpenolene as the major ones in leaf oil.

Effect on light studies on PAL is a good indication on the levels of the enzyme under different environmental conditions. Exposure to three forms of light White, Red & Blue to turmeric leaves results in varied response of PAL activity, either through de novo synthesis or by a derepression factor.

Majority of the phenolic acids identified in the leaf are coumaric, caffeic and ferulic acids. These phenolic acids are intermediate precursors in the proposed pathway of curcumin biosynthesis.

Studies using labeled CO_2 , labeled ^{14}C -phenylalanine and ^{14}C -Malonyl CoA to see the incorporation of the intermediary precursors have been completed. Maximum incorporation of ^{14}C -phenyl alanine in both phenolic acids and curcumin was seen in the early period (1 month) in the leaf (Table 6.). Simultaneous incorporation in both components indicates a direct role for phenyl alanine as initial precursor. Translocation and incorporation of ^{14}C malonyl CoA is poor and erratic and hence initial precursor as acetate can be ruled out.

STAFF

PROJECT COORDINATOR'S CELL

Indian Institute of Spices Research

Calicut – 673 012, Kerala

| | | |
|-------------------------------|---|---|
| Project Coordinator | : | Dr P N Ravindran (upto 30-04-2002) Dr K V Ramana (w.e.f. 01-05-2002) |
| Scientist (Hort.) | : | Dr K N Shiva |
| Technical Information Officer | : | Dr Johny A Kallapurackal |
| Personal Assistant | : | Ms P V Sali |
| Peon | : | Mr K Chandran |

COORDINATING CENTRES

1 Cardamom Research Station, KAU, Pampadumpara

| | | |
|-------------------------------------|---|--|
| 1. Breeder (Posted at Ambalavayal) | : | Ms Susamma P George |
| 2. Asst. Professor (Agron. /Hort.) | : | Dr K Vasantha Kumar |
| 3. Asst. Professor (Ag. Entomology) | : | Dr A Joseph Rajkumar (upto 10-02-2003) (on study leave) |
| 4. Farm Assistant Sel. Gr. | : | Mr C G Pradeep |
| 5. Lab Assistant Grade II | : | Mr C S Manoj |
| 6. Peon | : | Mr Paulose Mathew |

2 Regional Research Station, UAS (Bangalore), Mudigere

| | | |
|------------------------|---|----------------------|
| 1. Breeder | : | Mr M Narayanaswamy |
| 2. Agronomist (Hort.) | : | Dr M Dinesh Kumar |
| 3. Pathologist | : | Mr L Arasumallaiah |
| 4. Jr. Entomologist | : | Mr D Jemla Naik |
| 5. Technical Assistant | : | Mr Narayana |
| 6. Technical Assistant | : | Mr V Mallikarjunappa |
| 7. Messenger | : | Ms Savithri |

3 Horticultural Research Station, TNAU, Yercaud/Pechiparai

| | | |
|------------------------|---|---------------------------|
| 1. Agronomist (Hort.) | : | Dr V Lakshmanan/Yercaud |
| 2. Jr. Breeder (Hort.) | : | Dr Prem Jousha/Pechiparai |
| 3. Lab Assistant | : | Mr P Pappu/Yercaud |

4 Pepper Research Station, KAU, Panniyur

- | | | |
|-------------------------------------|---|---|
| 1. Assoc. Professor (Pl. Pathology) | : | Mr P K Unnikrishnan Nair (upto 15-04-2002) Dr K P Mammootty (w.e.f. 12-09-2002) |
| 2. Asst. Professor (Pl. Pathology) | : | Dr G Sivakumar |
| 3. Asst. Professor (Pl. Breeding) | : | Dr V P Neema |
| 4. Asst. Professor (Agro) | : | Vacant |
| 5. Farm Supervisor Gr. II | : | Mr A Sasidharan (w.e.f. 30-05-2002) Mr K A Kurien (w.e.f. 01-06-2002) |
| 6. Farm Assistant Sel. Gr. | : | Mr K Lakshmanan |
| 7. Lab Assistant | : | Ms Nirmala Chellath |
| 8. Peon | : | K Rajeevan |

5. Regional Agricultural Research Station, APAU, Chintapalle

- | | | |
|------------------------|---|-----------------------|
| 1. Horticulturist | : | Mr M M Naidu |
| 2. Junior Pathologist | : | Smt V Prasanna Kumari |
| 3. Technical Assistant | : | Vacant |

6. Agricultural Research Station, UAS (Dharwad), Sirsi

- | | | |
|--------------------------------------|---|-------------------|
| 1. Jr. Pathologist (Assoc. Prof.) | : | Dr M S Lokesh |
| 2. Jr. Horticulturist (Asst. Prof.) | : | Dr H G Hegde |
| 3. Technical Assistant (Field Asst.) | : | Mr G V Hiregowder |

7. Department of Vegetable Crops, Dr YSPUHF, Solan

- | | | |
|-----------------------------|---|----------------------|
| 1. Breeder (Olericulturist) | : | Dr B N Korla |
| 2. Jr. Plant Pathologist | : | Dr N P Dohroo |
| 3. Jr. Biochemist | : | Dr (Mrs) Nirja Singh |
| 4. Jr. Technical Assistant | : | Mr Rajeshwar Chauhan |

8. High Altitude Research Station, OUAT, Pottangi

- | | | |
|----------------------------|---|-----------------|
| 1 Breeder (Olericulturist) | : | Dr A K Pattnaik |
| 2 Jr. Breeder | : | Dr D K Dash |
| 3 Jr. Technical Assistant | : | Mr R C Dash |
| 4 Jr. Technical Assistant | : | Mr B N Sahoo |

9. Department of Plant Breeding, SKN College of Agriculture, RAJAU, Jobner

- | | | | |
|---|-------------------------|---|--|
| 1 | Sr. Breeder (Prof.) | : | Dr D L Singhanian |
| 2 | Breeder | : | Dr Dharendra Singh |
| 3 | Agronomist (Hort.) | : | Dr G R Chaudharay (upto 14-02-2003) Dr N L Jat (w.e.f 14-02-2003) |
| 4 | Jr. Plant Pathologist | : | Mr M P Jain |
| 5 | Jr. Biochemist | : | Dr S Agrawal |
| 6 | Sr. Technical Assistant | : | Mr S S Rajput |
| 7 | Jr. Technical Assistant | : | Mr S R Kumawat |

10. Regional Agricultural Research Station, APAU, Guntur

- | | | | |
|---|---------------------|---|--|
| 1 | Horticulturist | : | Smt C Sarada |
| 2 | Jr. Breeder (Hort.) | : | Sri K Giridhar |
| 3 | Sub Assistant | : | Mr K Sivakumar (upto 10-02-2003) Mr V Veerabhadra Rao (w.e.f. 11-02-2003) |

11. Spices Research Station, GAU, Jagudan

- | | | | |
|---|-----------------------|---|------------------|
| 1 | Sr. Plant Pathologist | : | Dr K D Patel |
| 2 | Jr. Breeder | : | Mr G M Patel |
| 3 | Technical Assistant | : | Mr S R Chaudhari |

12. Department of Spices & Plantation Crops, TNAU, Coimbatore

- | | | | |
|---|--------------------------|---|---|
| 1 | Breeder (Horticulturist) | : | Ms G Jansi Rani (upto 31-12-2002) Dr S Subramanian (w.e.f. 01-01-2003) |
| 2 | Jr. Pathologist | : | Dr P Muthulakshmi (upto 30-05-2002) Dr E Rajeswari (w.e.f. 11-09-2002) |
| 3 | Agricultural Assistant | : | Mr R Swaminathan |

13. Regional Agricultural Research Station, ANGRAU, Jagtial

- | | | | |
|---|---------------------------|---|------------------------|
| 1 | Jr. Pathologist | : | Mr C L Narasimha Chary |
| 2 | Jr. Horticulturist | : | Mr R Manohar Rao |
| 3 | Technical Asst./Sub Asst. | : | Vacant |

14. Department of Vegetable Crops, CCS HAU, Hisar

- | | | | |
|---|-------------------------------|---|----------------|
| 1 | Olericulturist/Horticulturist | : | Dr K K Thakral |
| 2 | Assistant Scientist (VC) | : | Dr S K Tehlan |

15. Tirhut College of Agriculture, RAU, Dholi

- | | | |
|-----------------------|---|---------------|
| 1 Horticulturist | : | Dr S P Singh |
| 2 Jr. Pathologist | : | Dr Bimala Rai |
| 3 Technical Assistant | : | Dr N B Dwedi |

16. Konkan Krishi Vidya Peeth, Dapoli

- | | | |
|------------------------|---|---|
| 1 Horticulturist | : | Mr A G Desai (upto 15-07-2002) Mr R N Nawale (16-07-2002 to 31-12-2002) Dr P M Haldankar (w.e.f. 01-01-2003) |
| 2 Jr. Pathologist | : | Dr V S Pande |
| 3 Junior Spice Breeder | : | Prof R G Khandekar (w.e.f. 01-02-2003) |
| 4 Technical Assistant | : | Mr S D Tambe |
| 5 Technical Assistant | : | Mr A B Jadhav |

17. Najendra Dev University of Agriculture and Technology, Kumarganj

- | | | |
|-----------------------|---|---------------|
| 1 Horticulturist | : | Dr J Dixit |
| 2 Jr. Breeder | : | Dr V P Pandey |
| 3 Jr. Pathologist | : | Dr R P Saxena |
| 4 Technical Assistant | : | Mr V K Singh |
| 5 Technical Assistant | : | Mr R K Gupta |

18. Indira Gandhi Krishi Vishwa Vidhyalaya, Raigarh

- | | | |
|-----------------------|---|----------------|
| 1 Horticulturist | : | Dr C R Gupta |
| 2 Jr. Breeder | : | Dr N S Tomar |
| 3 Jr. Pathologist | : | Dr A K Singh |
| 4 Technical Assistant | : | Mr G P Kashyap |
| 5 Technical Assistant | : | Mr D S Kshatri |

19. Uttar Banga Krishi Viswa Vidhyalaya, Pundibari

- | | | |
|------------------------|---|---|
| 1 Horticulturist | : | Dr J C Jana |
| 2 Jr. Breeder | : | Dr S K Dash (w.e.f. 03-05-2002) |
| 3 Jr. Pathologist | : | Dr P M Bhattacharya (upto 20-03-2003) Mr S Bandhopadhyay (w.e.f. 21-03-2003) |
| 4 Technical Assistant | : | Mr B Mazumdar |
| 5. Technical Assistant | : | Vacant |

RELEASE OF GRANTS DURING 2002-2003 (Rs. in lakhs)

| Centre | Allocation 2002-03 | Amount released | | | Additional fund released | Grand total released |
|--------------------|-----------------------|-----------------|---------------|----------------|--------------------------------|----------------------------|
| | | I half | II half | Total | | |
| Pampadumpara (KAU) | 7.580 | 3.790 | 3.790 | 7.580 | | 7.580 |
| Panniyur (KAU) | 8.750 | 3.875 | 4.875 | 8.750 | 0.500 | 9.250 |
| Mudigere (UAS-B) | 10.140 | 5.065 | 5.075 | 10.140 | 1.300 | 11.440 |
| Sirsi (UAS-D) | 5.450 | 2.725 | 2.725 | 5.450 | 9.600 | 15.050 |
| Yercaud (TNAU) | 4.250 | 2.125 | 2.125 | 4.250 | 0.700 | 4.950 |
| Coimbatore (TNAU) | 3.000 | 2.200 | 0.800 | 3.000 | 0.250 | 3.250 |
| Chintapalli (APAU) | 3.000 | 0.000 | 3.000 | 3.000 | 0.900 | 3.900 |
| Jagtial (APAU) | 6.000 | 3.000 | 3.000 | 6.000 | | 6.000 |
| Guntur (APAU) | 1.500 | 0.000 | 1.500 | 1.500 | 3.900 | 5.400 |
| Solan (YSPUHF) | 6.800 | 2.925 | 3.875 | 6.800 | 2.190 | 8.990 |
| Pottangi (OUAT) | 1.000 | 0.000 | 1.000 | 1.000 | | 1.000 |
| Jobner(RAJAU) | 14.600 | 5.325 | 9.275 | 14.600 | 6.760 | 21.360 |
| Jagudan (GAU) | 4.400 | 2.200 | 2.200 | 4.400 | 2.900 | 7.300 |
| Hisar (HAU) | 5.360 | 2.680 | 2.680 | 5.360 | | 5.360 |
| Dholi (RAU) | 4.400 | 2.200 | 2.200 | 4.400 | 1.600 | 6.000 |
| Kumarganj (NDUAT) | 10.600 | 4.195 | 6.405 | 10.600 | | 10.600 |
| Pundibari (BCKVV) | 6.390 | 3.195 | 3.195 | 6.390 | | 6.390 |
| Dapoli (KKV) | 10.390 | 5.195 | 5.195 | 10.390 | | 10.390 |
| Raigarh (IGKVV) | 6.390 | 3.195 | 3.195 | 6.390 | 6.400 | 12.790 |
| Total | 120.000 | 53.890 | 66.110 | 120.000 | 37.000 | 157.000 |

Note : Additional fund of Rs. 37.00 lakhs was received from ICAR under pay and allowances and the amount was released to 12 centers. Accordingly necessary changes made in the X plan EFC Memo of 11512 based of the approved RE letter No. 15-54/2002 1A (V) dated 25-03-2003

BUDGET PROVISION - 2002-2003

| Center | Sanctioned provision for pay and allowances | | | | (Rs. in lakhs) | |
|--------------------|--|--------------|---------------|----------------|----------------|----------------|
| | Estt. | TA | RC | Grand Total | ICAR share | State share |
| Pampadumpara (KAU) | 8.607 | 0.300 | 1.200 | 10.107 | 7.580 | 2.527 |
| Panniyur (KAU) | 10.333 | 0.400 | 1.600 | 12.333 | 9.250 | 3.083 |
| Mudigere (UAS-B) | 13.253 | 0.400 | 1.600 | 15.253 | 11.440 | 3.813 |
| Sirsi (UAS-D) | 19.067 | 0.200 | 0.800 | 20.067 | 15.050 | 5.017 |
| Yercaud (TNAU) | 5.600 | 0.200 | 0.800 | 6.600 | 4.950 | 1.650 |
| Coimbatore (TNAU) | 3.333 | 0.200 | 0.800 | 4.333 | 3.250 | 1.083 |
| Chintapalli (APAU) | 4.200 | 0.200 | 0.800 | 5.200 | 3.900 | 1.300 |
| Jagtial (APAU) | 7.000 | 0.200 | 0.800 | 8.000 | 6.000 | 2.000 |
| Guntur (APAU) | 6.200 | 0.200 | 0.800 | 7.200 | 5.400 | 1.800 |
| Solan (YSPUHF) | 10.487 | 0.300 | 1.200 | 11.987 | 8.990 | 2.997 |
| Pottangi (OUAT) | 1.330 | 0.000 | 0.000 | 1.330 | 1.000 | 0.330 |
| Jobner (RAJAU) | 25.980 | 0.500 | 2.000 | 28.480 | 21.360 | 7.120 |
| Jagudan (GAU) | 8.733 | 0.200 | 0.800 | 9.733 | 7.300 | 2.433 |
| Hisar (HAU) | 6.147 | 0.200 | 0.800 | 7.147 | 5.360 | 1.787 |
| Dholi (RAU) | 7.000 | 0.200 | 0.800 | 8.000 | 6.000 | 2.000 |
| Kumarganj (NDUAT) | 12.633 | 0.300 | 1.200 | 14.133 | 10.600 | 3.533 |
| Pundibari (BCKVV) | 7.020 | 0.300 | 1.200 | 8.520 | 6.390 | 2.130 |
| Dapoli (KKV) | 12.353 | 0.300 | 1.200 | 13.853 | 10.390 | 3.463 |
| Raigarh (IGKVV) | 15.553 | 0.300 | 1.200 | 17.053 | 12.790 | 4.263 |
| Grand Total | 184.829 | 4.900 | 19.600 | 209.329 | 157.000 | 52.329 |
| ICAR share | 138.622 | 3.675 | 14.700 | | | |
| State share | 46.207 | 1.225 | 4.900 | | | |

Note: * Includes committed expenditure under pay and allowances to clear the past arrears (IX Plan) to all the centres except Chintapalle, Guntur, Pottangi and Pundibari centers.

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METEOROLOGICAL DATA 2002

Pampadumpara

Latitude : 9°45 N
Altitude : 1100m MSL

Longitude : 77°10E
Soil type : Clay loam

| Month | Rainfall (mm) | No. of rainy days | Temperature (°C) | | Relative humidity (%) |
|-----------|------------------|----------------------|---------------------|------|-----------------------------|
| | | | Min. | Max. | |
| January | 9.4 | 3.0 | 16.6 | 22.3 | 7.26 |
| February | 15.2 | 3.0 | 16.9 | 25.9 | 9.16 |
| March | 38.4 | 4.0 | 17.7 | 29.9 | 8.57 |
| April | 245.0 | 15.0 | 19.6 | 28.1 | 6.63 |
| May | 70.6 | 11.0 | 18.4 | 27.0 | 6.60 |
| June | 382.6 | 25.0 | 18.8 | 22.3 | 4.05 |
| July | 385.9 | 26.0 | 17.0 | 22.3 | 4.85 |
| August | 233.8 | 25.0 | 17.8 | 22.6 | 4.05 |
| September | 125.0 | 15.0 | 17.7 | 25.5 | 5.30 |
| October | 291.3 | 26.0 | 17.8 | 23.7 | 5.25 |
| November | 272.8 | 14.0 | 17.4 | 25.0 | 5.50 |
| December | 27.1 | 7.0 | 15.4 | 22.2 | 5.45 |

Panniyur

Latitude : 12.5° N
Altitude : 95m MSL

Longitude : 74.55 E
Soil type : Laterite

| Month | Rainfall (mm) | No. of rainy days | Temperature (°C) | | Relative humidity (%) |
|-----------|------------------|----------------------|---------------------|------|-----------------------------|
| | | | Min. | Max. | |
| January | - | - | 33.2 | 19.9 | 87.6 |
| February | 15.2 | 1 | 34.8 | 22.5 | 86.0 |
| March | - | - | 37.7 | 22.6 | 84.1 |
| April | 50.2 | 6 | 37.5 | - | 82.8 |
| May | 153.3 | 14 | 33.7 | - | 86.6 |
| June | 784.5 | 25 | 29.6 | - | 92.5 |
| July | 468.8 | 25 | 30.1 | 25.3 | 93.9 |
| August | 680.2 | 24 | 28.9 | 24.5 | 95.0 |
| September | 232.2 | 8 | 31.8 | 24.3 | 90.5 |
| October | 740.7 | 19 | 31.3 | 24.8 | 93.2 |
| November | 139.8 | 8 | 33.1 | 24.9 | 91.5 |
| December | 62.8 | 1 | 33.9 | 21.3 | 82.8 |

Mudigere

Latitude : 13°50 N Longitude : 75°39 E
 Altitude : 1175m MSL Soil type : Black clay loam

| Month | Rainfall (mm) | No. of rainy days | Temperature (°C) | | Relative humidity (%) | |
|-----------|------------------|----------------------|---------------------|-------|--------------------------|-------|
| | | | Min. | AM | PM | Max. |
| January | - | - | 14.20 | 68.83 | 31.61 | 28.38 |
| February | - | - | 15.80 | 76.50 | 35.46 | 31.04 |
| March | - | - | 18.04 | 72.84 | 50.03 | 31.79 |
| April | 131.30 | 7 | 19.40 | 83.40 | 58.16 | 31.00 |
| May | 73.30 | 10 | 19.20 | 83.03 | 62.52 | 28.25 |
| June | 522.00 | 22 | 17.90 | 88.83 | 77.76 | 23.02 |
| July | 429.20 | 26 | 17.80 | 90.06 | 83.38 | 22.00 |
| August | 346.30 | 28 | 17.70 | 92.70 | 87.58 | 21.00 |
| September | 194.10 | 14 | 17.80 | 90.53 | 74.50 | 24.12 |
| October | 86.80 | 6 | 18.70 | 88.38 | 78.54 | 24.88 |
| November | 89.90 | 3 | 17.60 | 78.60 | 60.63 | 26.25 |
| December | 2.40 | 1 | 15.80 | 70.96 | 56.71 | 25.98 |

Sirsi

Latitude : 14°36 N Longitude : 74°50 E
 Altitude : 619m MSL Soil type : Laterite

| Month | Rainfall (mm) | No. of rainy days | Temperature (°C) | | Relative humidity (%) | |
|-----------|------------------|----------------------|---------------------|-------|--------------------------|-------|
| | | | Max | Min | Max. | Min. |
| January | 0.00 | 0 | 34.04 | 14.19 | 77.87 | 71.48 |
| February | 16.40 | 1 | 34.04 | 15.82 | 76.93 | 66.04 |
| March | 0.00 | 0 | 35.94 | 16.26 | 80.82 | 49.45 |
| April | 126.40 | 7 | 36.13 | 21.06 | 76.43 | 59.60 |
| May | 32.70 | 7 | 33.81 | 21.42 | 81.58 | 63.39 |
| June | 527.70 | 25 | 28.53 | 21.07 | 86.20 | 83.20 |
| July | 450.00 | 30 | 27.23 | 21.13 | 86.74 | 86.77 |
| August | 304.00 | 29 | 27.48 | 21.13 | 88.19 | 86.54 |
| September | 68.00 | 4 | 30.33 | 20.33 | 88.53 | 86.73 |
| October | 56.90 | 10 | 30.17 | 20.87 | 87.93 | 85.43 |
| November | 2.20 | 1 | 31.43 | 18.10 | 83.57 | 74.33 |
| December | 0.00 | 0 | 31.03 | 14.06 | 80.51 | 74.06 |

Yercaud

Latitude : 11.4' N
 Altitude : 1450m MSL

Longitude : 78.5' E
 Soil type : Clay loam

| Month | Rainfall (mm) | No. of rainy days | Max temperature (°C) | Min temperature (°C) | Relative humidity (%) |
|------------|------------------|----------------------|----------------------------|----------------------------|-----------------------------|
| January'02 | - | - | Data is not available | Data is not available | Data is not available |
| February | 10.3 | 1 | | | |
| March | 34.0 | 1 | | | |
| April | 18.4 | 3 | | | |
| May | 197.9 | 9 | | | |
| June | 79.0 | 5 | | | |
| July | 59.9 | 4 | | | |
| August | 262.5 | 8 | | | |
| September | 82.4 | 6 | | | |
| October | 224.1 | 9 | | | |
| November | 13.2 | 1 | | | |
| December | - | - | | | |

Coimbatore

Latitude : 11°N
 Altitude : 426.72m MSL

Longitude : 77 E
 Soil type : Clay loam

| Month | Rainfall (mm) | No. of rainy days | Temperature (°C) | | Relative humidity (%) | |
|-----------|------------------|----------------------|---------------------|------|--------------------------|---------|
| | | | Max | Min | M 07.22 | E 14.22 |
| January | - | 5 | 30.3 | 19.7 | 87 | 44 |
| February | - | - | 33.5 | 20.0 | 87 | 37 |
| March | - | - | 35.3 | 22.1 | 80 | 35 |
| April | 96.0 | 5 | 34.7 | 23.6 | 87 | 42 |
| May | 6.5 | 1 | 35.0 | 23.5 | 82 | 44 |
| June | 52.6 | 5 | 31.2 | 22.1 | 78 | 52 |
| July | 19.9 | 3 | 31.2 | 22.7 | 80 | 54 |
| August | 22.8 | 4 | 31.4 | 22.1 | 85 | 53 |
| September | 96.6 | 4 | 32.7 | 22.3 | 89 | 50 |
| October | 286.7 | 6 | 31.0 | 22.1 | 90 | 61 |
| November | 136.6 | 10 | 29.5 | 21.6 | 92 | 63 |
| December | 16.1 | 2 | 28.2 | 18.7 | 90 | 55 |

Chintapalle

| Month | Rainfall (mm) | No. of rainy days | Temperature (°C) | | Relative humidity (%) | |
|-----------|------------------|----------------------|---------------------|------|--------------------------|------|
| | | | Max. | Min. | Max. | Min. |
| January | | | | | | |
| February | | | | | | |
| March | | | | | | |
| April | 58.0 | 6 | 18.5 | 33.0 | 49.0 | 77.0 |
| May | 33.6 | 4 | 22.0 | 34.8 | 46.5 | 66.6 |
| June | 68.0 | 8 | 21.4 | 30.8 | 64.8 | 79.5 |
| July | 36.6 | 5 | 21.8 | 29.5 | 74.5 | 84.5 |
| August | 99.6 | 12 | 20.6 | 25.9 | 89.7 | 92.0 |
| September | 89.6 | 6 | 19.3 | 28.8 | 86.9 | 90.4 |
| October | 134.0 | 7 | 17.5 | 28.3 | 87.0 | 90.7 |
| November | — | — | 10.8 | 27.8 | 67.2 | 87.8 |
| December | — | — | 9.0 | 28.4 | 37.5 | 77.8 |

Jagtial

| Month | Rainfall (mm) | No. of rainy days | Temperature (°C) | |
|-----------|------------------|----------------------|---------------------|------|
| | | | Max. | Min. |
| January | 40.8 | | 28.6 | 14.6 |
| February | 2.2 | | 31.5 | 18.5 |
| March | 1.0 | | 35.9 | - |
| April | 3.0 | | 39.9 | - |
| May | 23.4 | | 41.8 | - |
| June | 8.0 | | 35.8 | - |
| July | 7.3 | | 33.7 | - |
| August | 3.8 | | 29.7 | 24.2 |
| September | 4.6 | | 32.3 | 23.9 |
| October | 4.2 | | 33.1 | 21.7 |
| November | 4.2 | | 31.4 | 15.9 |
| December | 3.7 | | 31.2 | 14.4 |

Guntur

Latitude : 16.18 N Longitude : 80.29 E
 Altitude : 32m MSL Soil type : Black Clay

| Month | Rainfall (mm) | No. of rainy days | Temperature (°C) | | Relative humidity (%) | |
|-----------|------------------|----------------------|---------------------|-------|--------------------------|-------|
| | | | Max. | Min. | AM | PM |
| January | 0.00 | - | 30.80 | 15.36 | 90.26 | 56.94 |
| February | 0.00 | - | 34.24 | 18.43 | 87.60 | 49.44 |
| March | 0.00 | - | 36.26 | 24.41 | 85.45 | 66.03 |
| April | 30.20 | 1 | 36.40 | 25.61 | 88.10 | 66.93 |
| May | 0.00 | - | 42.66 | 29.10 | 78.12 | 60.64 |
| June | 131.00 | 5 | 37.51 | 26.46 | 74.23 | 62.86 |
| July | 155.00 | 6 | 34.24 | 24.90 | 80.58 | 64.03 |
| August | 278.80 | 12 | 33.32 | 24.08 | 89.58 | 83.61 |
| September | 104.00 | 7 | 34.57 | 24.61 | 90.26 | 82.90 |
| October | 153.90 | 8 | 32.50 | 23.98 | 92.48 | 80.61 |
| November | 64.70 | 3 | 31.73 | 21.52 | 89.56 | 78.93 |
| December | 1.40 | - | 30.14 | 16.96 | 89.83 | 80.48 |

Solan

Latitude : 16.18 N Longitude : 80.29 E
 Altitude : 32m MSL Soil type : Black Clay

| Month | Rainfall (mm) | No. of rainy days | Temperature (°C) | | Relative humidity (%) |
|-----------|------------------|----------------------|---------------------|------|--------------------------|
| | | | Max. | Min. | |
| January | 25.8 | 2 | 19.8 | 50.0 | 1.8 |
| February | 5.0 | 1 | 22.5 | 41.0 | 4.3 |
| March | 56.5 | 3 | 24.5 | 45.0 | 7.4 |
| April | 59.4 | 5 | 28.8 | 47.7 | 12.7 |
| May | 100.8 | 5 | 31.7 | 55.7 | 17.2 |
| June | 306.6 | 12 | - | 75.3 | 18.5 |
| July | 144.6 | 13 | 28.4 | 85.3 | 20.7 |
| August | 191.0 | 7 | 28.7 | 79.2 | 20.1 |
| September | - | - | 29.7 | 79.5 | 15.2 |
| October | - | - | 28.2 | 54.5 | 11.8 |
| November | - | - | 24.5 | 57.5 | 6.5 |
| December | - | - | 20.2 | 66.4 | 4.3 |

Pottangi

Latitude : 18° 34' N
 Altitude : 917 m MSL

Longitude : 82° 52'
 Soil type : Sandy Loam

| Month | Rainfall (mm) | No. of rainy days | Temperature (°C) | | Relative humidity (%) |
|-----------|------------------|----------------------|---------------------|------|--------------------------|
| | | | Max. | Min. | |
| January | 31.0 | 2 | 20 | 11 | 67 |
| February | 5.0 | 1 | 34 | 15 | 69 |
| March | 15.0 | 2 | 35 | 16 | 64 |
| April | 84.0 | 7 | 35 | 18 | 69 |
| May | 13.0 | 2 | 40 | 27 | 64 |
| June | 178.0 | 11 | 40 | 18 | 67 |
| July | 174.0 | 12 | 32 | 18 | 92 |
| August | 297.5 | 27 | 30 | 18 | 88 |
| September | 142.5 | 14 | 32 | 17 | 81 |
| October | 204.0 | 9 | 37 | 27 | 73 |
| November | - | - | 27 | 7 | 65 |
| December | - | - | 28 | 7 | 63 |

Jobner

Longitude : 23.52 N
 Altitude : 90.6m MSL

Longitude : 72.43 E
 Soil type : Sandy Loam

| Month | Rainfall (mm) | No. of rainy days | Temperature (°C) | | Relative humidity (%) |
|-----------|------------------|----------------------|---------------------|------|--------------------------|
| | | | Max. | Min. | |
| January | 2.0 | 1.0 | 22.04 | 4.3 | 62.6 |
| February | 15.8 | 2.0 | 25.0 | 7.2 | 56.0 |
| March | - | - | 32.8 | 12.3 | 37.0 |
| April | 8.0 | 1 | 38.5 | 18.9 | 29.8 |
| May | - | - | 42.9 | 26.3 | 27.5 |
| June | 8.6 | 2 | 40.0 | 26.5 | 45.0 |
| July | 13.2 | 1 | 37.6 | 27.4 | 52.2 |
| August | 17.0 | 2 | 36.3 | 26.0 | 63.0 |
| September | 8.5 | 2 | 36.8 | 22.6 | 52.2 |
| October | - | - | 36.2 | 17.0 | 45.5 |
| November | - | - | 31.1 | 11.2 | 43.6 |
| December | 9.1 | 1 | 26.9 | 7.5 | 52.8 |

Jagudan

Latitude : 16.18 N Longitude : 80.29 E
 Altitude : 32m MSL Soil type : Black Clay

| Month | Rainfall (mm) | No. of rainy days | Temperature (°C) | |
|-----------|------------------|----------------------|---------------------|------|
| | | | Max. | Min. |
| January | - | - | 27.3 | 11.2 |
| February | - | - | 31.4 | 11.3 |
| March | - | - | 34.7 | 17.2 |
| April | - | - | 36.4 | 24.3 |
| May | 16 | 1 | 39.6 | 25.2 |
| June | 178 | 3 | 36.8 | 26.2 |
| July | 306 | 18 | 29.8 | 26.1 |
| August | 228 | 5 | 31.1 | 26.4 |
| September | - | - | 33.4 | 25.3 |
| October | 11 | 1 | 36.3 | 22.3 |
| November | - | - | 33.7 | 16.0 |
| December | - | - | 28.7 | 12.4 |

Hisar

| Month | Rainfall (mm) | No. of rainy days | Temperature (°C) | | Relative humidity (%) | |
|-----------|------------------|----------------------|---------------------|------|--------------------------|----|
| | | | Max. | Min. | AM | PM |
| January | | | | | | |
| February | | | | | | |
| March | | | | | | |
| April | 0.0 | 0 | 38.2 | 18.3 | 60 | 19 |
| May | 87.0 | 2 | 42.0 | 26.8 | 47 | 23 |
| June | 20.3 | 4 | 40.0 | 27.6 | 65 | 37 |
| July | 12.9 | 3 | 33.8 | 28.5 | 61 | 37 |
| August | 22.6 | 5 | 37.0 | 27.1 | 78 | 48 |
| September | 35.9 | 4 | 34.4 | 21.6 | 89 | 47 |
| October | 0.0 | 0 | 33.9 | 16.9 | 85 | 31 |
| November | 00 | 0 | 28.7 | 9.8 | 92 | 31 |
| December | 10.0 | 1 | 23.8 | 6.4 | 92 | 41 |

Dholi

| Month | Rainfall (mm) | No. of rainy days | Temperature (°C) | |
|-----------|------------------|----------------------|---------------------|------|
| | | | Max. | Min. |
| January | 0 | 0 | 22.6 | 14.1 |
| February | 5 | 1 | 25.4 | 12 |
| March | 6.5 | 2 | 29.9 | 15.4 |
| April | 13.0 | 1 | 29.9 | 15.4 |
| May | 12.5 | 7 | 33 | 23.4 |
| June | 14 | 5 | 34.9 | 24.4 |
| July | 32.4 | 17 | 33.7 | 25.9 |
| August | 87 | 12 | 34.3 | 27.1 |
| September | 27.9 | 10 | 32.2 | 27.3 |
| October | 5.5 | 3 | 32.9 | 24.2 |
| November | 0 | 0 | 30.3 | 18.1 |
| December | 0 | 0 | 26.4 | 10.6 |

Kumarganj

| Month | Rainfall (mm) | No. of rainy days | Temperature (°C) | | Relative humidity (%) | |
|-----------|------------------|----------------------|---------------------|------|--------------------------|------|
| | | | Max. | Min. | AM | PM |
| January | 24.8 | 4 | 8.7 | 21.8 | 63.7 | 91.0 |
| February | 0 | 0 | 10.3 | 25 | 52.3 | 88.1 |
| March | 0 | 0 | 14.9 | 32.1 | 34.9 | 68.8 |
| April | 0 | 0 | 20.8 | 37.2 | 34.5 | 62.0 |
| May | 30.6 | 3 | 25.5 | 37.8 | 46.2 | 74.4 |
| June | 66.4 | 6 | 25.4 | 37.2 | 52.3 | 78.1 |
| July | 72.4 | 8 | 27.8 | 36.3 | - | 64.9 |
| August | 231.7 | 13 | 26.3 | 33.6 | 89.0 | 71.3 |
| September | 393.6 | 15 | 24.1 | 31.1 | - | 82.9 |
| October | 4.2 | 1 | 18.6 | 31.6 | 61.2 | 89.1 |
| November | 0 | 0 | 13.2 | 28.0 | 55.6 | 88.9 |
| December | 2.0 | 1 | 7.8 | 26.1 | 88.2 | 45.7 |

Pundibari

| Month | Rainfall (mm) | No. of rainy days | Temperature (°C) | | Relative humidity (%) | |
|-----------|------------------|----------------------|---------------------|------|--------------------------|------|
| | | | Max. | Min. | Max. | Min |
| January | 16.5 | 2 | 22.6 | 9.6 | 96.2 | 54.3 |
| February | 20.7 | 3 | 25.2 | 10.4 | 92.4 | 48.9 |
| March | 15.5 | 2 | 29.5 | 15.4 | 86.1 | 47.6 |
| April | 193.4 | 7 | 32.2 | 18.6 | 88.2 | 55.1 |
| May | 715.2 | 17 | 31.6 | 22.4 | 92.2 | 80.6 |
| June | 574.5 | 19 | 30.6 | 23.2 | 92.6 | 62.2 |
| July | 919.9 | 20 | 30.5 | 23.3 | 95.3 | 79.4 |
| August | 545.2 | 15 | 29.7 | 23.4 | 95.5 | 75.5 |
| September | 362.5 | 10 | 31.5 | 22.1 | 95.2 | 73.6 |
| October | 42.2 | 4 | 31.2 | 18.1 | 94.0 | 63.0 |
| November | Nil | 0 | 29.6 | 13.1 | 95.0 | 54.0 |
| December | Nil | 0 | 25.4 | 8.3 | 92.0 | 48.0 |

Dapoli

| Month | Rainfall (mm) | Temperature (°C) | | Relative humidity (%) | |
|-----------|------------------|---------------------|------|--------------------------|------|
| | | Max. | Min. | Dry. | Wet. |
| January | 0 | 29.5 | 11.7 | 93.0 | 40.5 |
| February | 0 | 32.1 | 14.5 | 92.8 | 43.0 |
| March | 0 | 32.5 | 16.4 | 90.6 | 49.5 |
| April | 0 | 33.3 | 19.9 | 85.8 | 68.6 |
| May | 0 | 33.3 | 25.1 | 86.0 | 70.0 |
| June | 686.2 | 30.2 | 24.1 | 92.5 | 83.8 |
| July | 470.1 | 29.5 | 24.2 | 94.0 | 88.7 |
| August | 533.0 | 27.2 | 25.1 | 97.0 | 92.2 |
| September | 176.2 | 28.5 | 21.6 | 96.1 | 88.2 |
| October | 73.0 | 32.2 | 21.2 | 95.7 | 76.2 |
| November | 0 | 33.0 | 17.0 | 92.0 | 72.7 |
| December | 4.0 | 31.8 | 14.0 | 96.0 | 63.0 |

Raigarh

Latitude : 16.18 N
Altitude : 32m MSL

Longitude : 80.29 E
Soil type : Black Clay

| Month | Rainfall (mm) | Temperature (°C) | | Relative humidity (%) | |
|-----------|------------------|---------------------|-------|--------------------------|-------|
| | | Max. | Min. | Max. | Min. |
| January | 0.762 | 28.77 | 9.54 | 78.03 | 39.61 |
| February | Nil | 32.82 | 10.28 | 74.57 | 29.21 |
| March | 4.064 | 35.67 | 20.19 | 80.77 | 36.51 |
| April | 1.27 | 40.1 | 24.2 | 72.46 | 27.76 |
| May | 2.032 | 42.42 | 28.12 | 70.48 | 28.51 |
| June | 43.973 | 33.03 | 26.13 | 82.4 | 68.03 |
| July | 54.86 | 31.06 | 25.12 | 87.51 | 33.19 |
| August | 22.85 | 31.64 | 25.67 | 86.54 | 75.74 |
| September | 7.62 | 33.46 | 25.73 | 85.43 | 66.87 |
| October | 6.096 | 32.66 | 21.80 | 83.12 | 64.64 |
| November | Nil | 29.77 | 19.36 | 82.3 | 63.9 |
| December | Nil | 29.48 | 17.29 | 79.09 | 64.03 |

Ambalavayal

Latitude : 16.18 N
Altitude : 32m MSL

Longitude : 80.29 E
Soil type : Black Clay

| Month | Rainfall (mm) | No. of rainy days | Temperature (°C) | | Relative humidity (%) | |
|-----------|------------------|----------------------|---------------------|------|--------------------------|------|
| | | | Max. | Min. | AM | PM |
| January | 0 | Nil | 27.6 | 89 | 47 | 16.0 |
| February | 47.2 | 3 | 29.4 | 94 | 51 | 18.2 |
| March | 12.0 | 2 | 30.7 | 90 | 49 | 18.7 |
| April | 206.2 | 8 | 29.9 | 93 | 62 | 19.1 |
| May | 101.6 | 9 | 28.6 | 94 | 69 | 19.5 |
| June | 232.0 | 21 | 24.9 | 94 | 80 | 18.6 |
| July | 312.4 | 19 | 24.5 | 94 | 83 | 18.3 |
| August | 194.1 | 19 | 24.3 | 97 | 85 | 18.7 |
| September | 140.8 | 9 | 26.8 | 93 | 73 | 18.4 |
| October | 100.2 | 11 | 26.3 | 95 | 74 | 18.7 |
| November | 88.8 | 9 | 26.8 | 94 | 66 | 17.8 |
| December | Nil | Nil | 26.6 | 86 | 50 | 16.0 |

Pechiparai

| Month | Rainfall (mm) | No. of rainy days | Temperature (°C) | | Relative humidity (%) |
|-----------|------------------|----------------------|---------------------|------|--------------------------|
| | | | Max. | Min. | |
| January | 25 | 2 | 34.2 | 27.2 | 72.2 |
| February | 332 | 14 | 33.8 | 26.4 | 70.3 |
| March | 40 | 5 | 35.3 | 27.0 | 68.6 |
| April | 68 | 7 | 35.5 | 27.3 | 69.4 |
| May | 67.5 | 9 | 34.8 | 26.4 | 72.1 |
| June | 288 | 21 | 32.5 | 24.8 | 77.8 |
| July | 54 | 9 | 31.3 | 23.8 | 77.7 |
| August | 578 | 20 | 32.6 | 23.6 | 76.7 |
| September | 355 | 12 | 34.6 | 27.1 | 71.5 |
| October | 197 | 16 | 30.8 | 22.6 | 84.8 |
| November | 130 | 10 | 30.4 | 22.0 | 84.8 |
| December | 159 | 5 | 31.8 | 22.3 | 78.3 |

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