

The ICAR-AICRPS through its network across the country has developed several varieties and technologies which have been demonstrated in farmers' plots and have become popular among the farmers. There are several success stories throughout the country. Some of those success stories are presented below.

1. Varietal deployment/ spread- for harnessing high yield

- Black pepper:-** The first hybrid variety of black pepper, Panniyur 1 developed and popularized through Panniyur center of AICRPS is still the dominant cultivar not only in India but also worldwide. The popularity of Panniyur 1 is visible even in the non-traditional areas of black pepper cultivation like tribal regions of Visakhapatnam district in Andhra Pradesh.
- Turmeric:-** The BSR 1 & 2 varieties of turmeric from Erode Local developed by TNAU, Coimbatore are the most sought after varieties in Tamil Nadu. Narendra Haldi 1 developed at NDUAT, Faizabad under AICRPS has positive impact on the productivity and production of spices crops in Uttar Pradesh and is also the preferred variety of many NGO's, State Govt, KVK and KGK's of University. NDH 98, the saline tolerant variety of turmeric is the climate resilient variety and gives stable yield across the country. Roma, the high curcumin turmeric variety from Pottangi center occupies 2000 ha of tribal belt in Odisha. Megha Turmeric-1, a high yielding and high curcumin selection of turmeric from Lakadong Local is the most preferred variety in the North East and is highly suitable for curcumin and pharma industry. The turmeric variety Suranjana (TCP-2) from Pundibari centre of ICAR-AICRPS in West Bengal is the most sought variety for cultivation in that area.



IISR PRAGATI
Serves Niche for Indian Turmeric Growers

The ICAR-Indian Institute of Spices Research, Kozhikode through its systematic breeding programme has developed a high yielding, short duration turmeric variety for the benefit of farmers. The variety, IISR PRAGATI, is a clonal selection from the vast repository of turmeric germplasm maintained at the institute. This variety was field tested as Acc. 48, for over three years in different turmeric growing regions of the country and under various climatic conditions.

Rhizome characters of IISR Pragati



The characteristic features

- Short duration variety and takes only 180 days to harvest
- Suitable for turmeric growing areas with serious irrigation problems.
- High yielding variety with average yield of 38 t/ha (fresh rhizomes); 7.6 t/ha (dry) The yield can go up to 52 t/ha under favourable conditions. It has 30 % and 34% yield increase over national and local turmeric varieties.
- Stable and high curcumin variety (5.02%) across locations.
- Moderately resistant to root knot nematode infestation.
- The variety is suitable for cultivation in Kerala, Tamil Nadu, Andhra Pradesh, Telangana, Karnataka and Chhattisgarh states.

This variety was identified for release during the XXVII All India Coordinated Research Project on Spices (AICRPS) Group Meeting held at NRC Seed Spices (Ajmer, Rajasthan) in 2016.

Quality Attributes	Percentage
Curcumin	5.02%
Oleoresin	12.14%
Essential oil	3.40%
Morphological Characters	
Plant height (cm)	94.75
Leaf length/breadth (cm)	43.8/15.0
No. of tillers per clump	2.5
No. of leaves per clump	13.8
Dry recovery (%)	20.04

Field view of IISR Pragati



Developed by A. Subhakar, ICAR-IISR, Kozhikode

*Turmeric variety
IISR Pragati
developed by ICAR-
IISR through multi-
location trials of
ICAR-AICRPS*

- Ginger:-** Ginger variety Suprabha from Pottangi center is the most sought after variety of ginger in Odisha. In north east, ginger cultivar Nadia bold rhizome selection from West Bengal is the most preferred genotype which is highly suitable for vegetable gingers and ginger based confectionary product development.
- Coriander:-** Andhra Pradesh is an important state for the production of seed spices in the country. Due to the collaborative efforts of AICRP on Spices and Department of Horticulture, A.P. Government, the state of Andhra Pradesh surpassed the national average productivity in coriander from 609 kg/ha to the peak of 1200 kg/ha which is completely from rain fed production systems. The high yielding coriander varieties with higher productivity have greatly helped farmers of dry land cultivation in Andhra Pradesh. Survey reports indicated that the entire area in Koppolu village of Prakasam district is occupied by high yielding variety *Sudha* (LCC-128) replacing earlier varieties only because of its productivity. The AICRPS coriander varieties from Guntur center viz., *Sudha*, *Sadhana*, *Sindhu* and *Swathi* have replaced local varieties and occupied about 70% of the total coriander area in Andhra Pradesh.
 The coriander variety *Hisar Bhumith* is a highly flavored variety developed through mass selection at Hisar centre of AICRPS. Besides its high green leaf yield potential (180 –200 q/ha) and seed yield (11.5 q/ha). It is resistant to stem gall disease which severely affects the coriander crop and is suitable for cultivation throughout the country. Its small round shaped seeds are rich in volatile oil content (0.66%) and is suitable for growing during off season.
- Cumin:-** The wilt disease of cumin caused by *Fusarium oxysporum* f.sp *cumini* damages the crop to the extent of 70% and almost all the varieties are susceptible to this disease. The development of high yielding (>1250 kg/ha), cumin wilt tolerant variety Gujarat Cumin 4 by AICRP Spices Jagudan Center could rescue the farmers from crop losses and generated an additional revenue of Rs. 904 crores per year from cumin cultivation. Gujarat Cumin 4 has occupied around 70% of the area in the main cumin growing areas of Gujarat and Rajasthan.



Field view of Gujarat Cumin 4



Field view of Hisar Bhumith

- **Nutmeg**



Nutmeg: IISR Keralashree- farmer participatory bred nutmeg- for minting money

The first nutmeg variety developed through farmer's participatory breeding programme and this accession was found superior for mace and nutmeg yield over the existing variety, IISR Vishwashree. The tree is a pure female which flowers profusely and bears oblong shaped yellow fruits. The aril which is thick and dark red in colour covers the entire seed. The nut is bold and brownish black in colour. The mace and nut of IISR Keralashree are rich in sabinene.

2 Improved technologies – for enhancement of livelihood security

- i. **Transplanting technology using single bud rhizome: to enhance income in turmeric and ginger-** Traditionally turmeric and ginger are propagated through seed rhizome and seed rate of 2000 to 2500 kg's is required per ha. To reduce the seed rate and main field duration, a novel protrait based transplanting technique was developed using single bud sprouts (5 g) raised in soil-less nursery mixture.

This protrait technology is adopted in at least 20% of turmeric and ginger cultivated areas, and about 55 and 42 thousand tonnes of seed rhizome requirement of turmeric and ginger could be saved (amounting to Rs. 75.8 crores).

Need for single bud rhizome method

Characters	Direct planting method	Transplanting method
Propagation through	Whole rhizome	Rhizome single bud
Seed rate	2500 kg/ha	750 kg/ha
Cost of planting material	Rs. 30,000	Rs. 9,000
Crop establishment	75 - 80%	95 -100 %
Rhizome development	Starts from 5 MAP	Starts from 2 MAP
Productivity	30-32 tonnes/ha	40-42 tonnes/ha



Protrait raised plants

Cost of production of turmeric plants from single bud rhizome

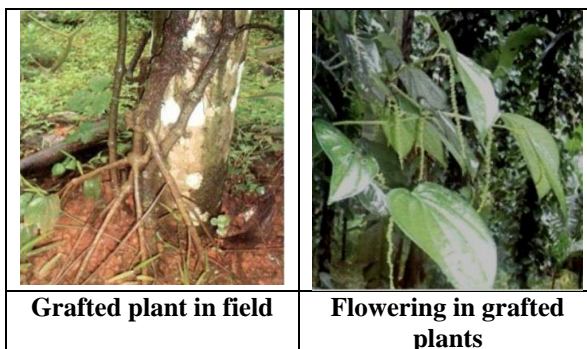
A) Cost of seedling production (1500 portrays/ha)	Cost (Rs.) per ha
1. Protrait (Rs.4/1No.)	6,000.00
2. Cost of growing media	2,500.00
3. Cost of rhizome (750 kg @ Rs.10/kg)	7,500.00
4. Labour charge	2,500.00
Total	18,500.00
B) Cost of seed rhizome (2500 kg/ha)	25,000.00
Benefit from transplant production	6,500.00



This method requires 1/4th of planting material as compared to conventional method and saves 60% of production cost.

This technology is popularised among the farmers of Andhra Pradesh, Telangana, Maharashtra, Tamil Nadu, Odisha, Kerala, Karnataka, North Eastern states and Madhya Pradesh.

- ii. **Grafting in black pepper: an ecofriendly way to manage *Phytophthora* foot rot-** The technology of grafting black pepper (*Piper nigrum*) with *Phytophthora* resistant root stock, *Piper colubrinum* was developed which is an eco friendly way to manage *Phytophthora* foot rot in water logged arecanut gardens reducing excessive use of fungicides. The growth and performance of grafts were better in Panniyur-I than Karimunda. The black pepper grafts are also blessed with nil incidence of virus disease. Integrated nutrient management practices ensures regular bearing nature and good growth in grafts. This technique reduces the chemical application for control of foot rot disease; cost of production of black pepper is also considerably reduced.



Foot rot disease can be easily controlled as the rootstock is resistant to disease

Replanting with new rooted cuttings is very low or nil as there is no death of vines due to foot rot disease

- iii. **Management of Stem gall of coriander- a relief for the farmers**

Stem gall is a serious and common disease of coriander caused by fungus, *Protomyces macrosporus* which causes 7.52 to 24.4 % damage with yield reduction of 9.6-33.81% and deteriorates quality of the seed. ICAR- AICRPS has developed stem gall resistant varieties like Pant Haritima, RCr 20, RCr 446, RCr 684, Hisar Sugandh, Hisar Bhumith and ACR-1.

Technology for stem gall management –

- Seed treatment with PGPR, IISR *Pseudomonas* talc formulation @ 0.40% followed by its foliar sprays @ 0.40% at 40, 60 & 75 days after sowing.
- Under limitation of IISR *Pseudomonas* talc formulation availability, coriander seed treatment with Hexaconazole @ 0.20% followed by its foliar spray @ 0.20 at 40, 60 & 75 days after sowing control the disease.
- In addition to this by adopting clean and healthy seeds, proper field sanitation, removal and destruction of the diseased plants, crop rotation and treatment of soil and seeds with calixin, the disease can be controlled.

These varieties are of high yielding types (10-14 q/ha) and occupy 60% of the coriander growing region of the country.

iv. PGPR technology in seed spices- *for enhanced growth and yield*

An eco-friendly, seed coating technology in coriander, cumin, fennel and fenugreek using PGPR (FK 14- rhizosphere colonizer of fenugreek, *Pseudomonas putida* – NCBI(FN257488) and FL 18- root endophyte from fennel, *Microbacterium paraoxydans* – NCBI (FN257489) isolates was developed for increased yield (10-30%), enhanced seed germination, reduced storage pest incidence and is suitable for mechanical sowing. The farmers who adopted this technique are very much satisfied as they obtain net monetary returns from the crop.

Seed coating with Rhizobacteria in seed spices			
			
Coriander	Cumin	Fennel	Fenugreek

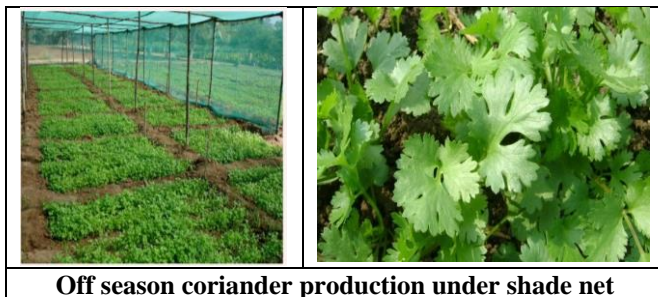
It is a low cost technology which enhances seed quality and viability during storage.

- v. **Off season leafy coriander- a way for profit generation-** Off season production of coriander under shade net is a boon for farmers as it generates additional income and overcomes the problem of low germination percentage under field conditions during March

80% germination success under shade net condition during offseason production






Technology has benefitted the farmers in Tamil Nadu, Odisha and Andhra Pradesh

- April. Application of NPK @ 30:40:20 kg per ha along with spraying of GA @ 15 ppm at 20 DAS produces maximum leaf yield of coriander (4824 kg/ha) with yield increase of 25% over control. The crop can be harvested 45th day after sowing and a B:C ratio of 5.80 can be realised.



Off season coriander production under shade net

- vi. **Mechanization in turmeric- *for mitigating labour shortage***- Introduction of mechanization in planting, harvesting and post harvest operations minimizes labour shortage and ensures high quality produce.

		
Broad bed former	Turmeric harvester	New steam boiler
		
Boiled dried turmeric	Tractor drawn polisher	Polished turmeric