



# TURMERIC

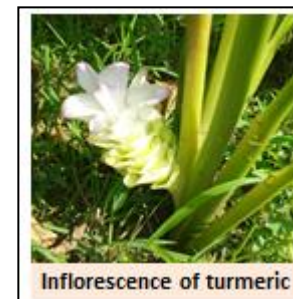
## Package of Practices for Turmeric Cultivation in Arunachal Pradesh



Department of Vegetable Science  
All India Co-ordinated Research Project on Spices  
College of Horticulture & Forestry  
Central Agricultural University  
Pasighat-791 102, Arunachal Pradesh  
2020

## Package of practices for turmeric cultivation in Arunachal Pradesh

Turmeric (*Curcuma longa* or *domestica*) belongs to the family Zingiberaceae is one of the major spice crops of North Eastern Hill region of India. It is originated from South East Asia. The economic part is underground rhizome which is used as spice, dye, cosmetic, medicine and in religious ceremony. The importance and its popularity are due to the presence of curcumin which is yellow to orange in colour. In the NE region particularly in Manipur, raw rhizome is used in the preparation of chutney after baking or boiling, besides the inflorescence is also used in making “*Pakora*” and chutney. Special dish from gram or pea flour with spices called “*Paknam*” is prepared by wrapping with turmeric leaves and baked or steamed. Likewise another dish called “*Nganam*” is prepared from raw small fish mixed with various spices and condiment. Wrap it with the leaves of turmeric and bake on a thick pan or underneath hot ash till cooked (In the state of Manipur). This is treated as a special dish and relished by all. The chopped leaves are also used as condiment in the preparation of fish. The benefit of turmeric are well known from the ancient time and to this present day as it is very essential in preparation of dishes, medicine, ritual ceremony, dyeing, colourant, etc. It can be used as anti-



inflammatory, anti-cancer, anti-oxidant, anti-depression, anti-bacterial and digestive aid. It can be used to reduce joint pain, for healing wounds, to control blood pressure, for liver detoxification, for balancing cholesterol level, to fight allergies, enhance skin glow, for boosting immunity, etc. Nowadays, curcumin is available in the form of capsule as bio-curcumin for various body ailments. Other quality products like essential oil and oleoresin are widely used. These are also good source of income as high value but low volume commodity. The region has great potential for higher production as well as demand in the spice industry. The State-wise area, production and productivity in the NE region are highlighted below:

| <b>State-wise Area, production &amp; Productivity under NER</b> |                           |                                  |                                |
|---|---------------------------|----------------------------------|--------------------------------|
| <b>State-wise</b>   | <b>Area<br/>(‘000 Ha)</b> | <b>Production<br/>(‘000 Ton)</b> | <b>Productivity<br/>(t/ha)</b> |
| Arunachal Pradesh   | 0.80                      | 3.84                             | 4.80                           |
| Assam   | 17.11                     | 19.17                            | 1.12                           |
| Manipur   | 1.40                      | 15.40                            | <b>11.00</b>                   |
| Meghalaya   | 2.65                      | 16.50                            | <b>6.23</b>                    |
| Mizoram   | 7.74                      | 29.82                            | 3.85                           |
| Nagaland  | 0.71                      | 10.19                            | <b>14.43</b>                   |
| Sikkim  | 1.95                      | 5.68                             | 2.91                           |
| Tripura   | 1.66                      | 10.08                            | 6.08                           |
| <b>(Source: Hort. Stats Div., DAC, 2017-18)</b>                 |                           |                                  |                                |

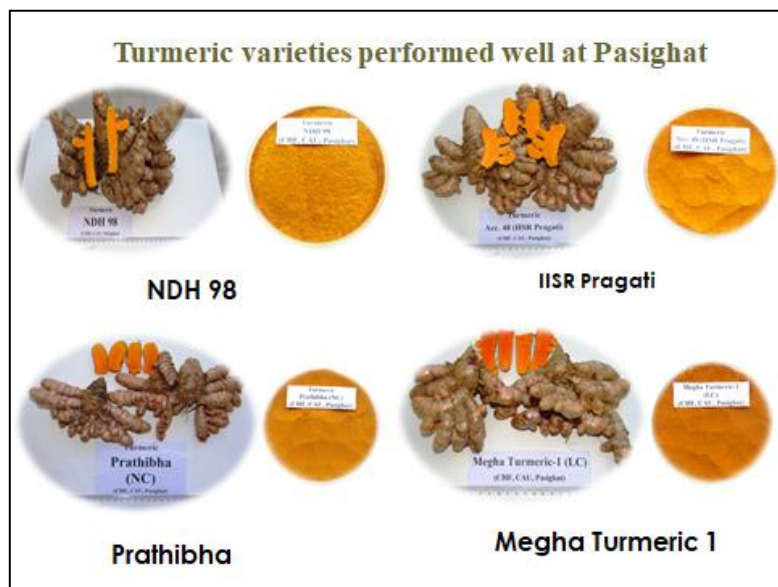
### **Climate and Soil:**

Turmeric grows well in warm and humid climate, mostly cultivated as rainfed with well distributed rainfall and dry spell before harvest. Preferable temperature varies from 20 to 30°C for growth and development. It thrives best in well drained, friable, rich sandy or clay loam soils.

### **Varieties:**

Turmeric has different varieties with various characteristic such as high yielding, high dry matter recovery, high curcumin content, high oleoresin content, high essential oil and different maturation period such as long duration types (9 months, e.g. Duggirala, Tekurpeta), medium duration types (8 months, e.g. Krishna, NDH-98) and short duration types (6-7 months, e.g. Suguna, Sudarshan, IISR Pragati). Some of the varieties which are suitable in the region are Megha Turmeric-1 (6.8% curcumin, Av. yield 30-32 t/ha), Lakadong (7.4% curcumin, Av. yield 19.7 t/ha), NDH-98 (6.2% curcumin, Av. yield 30-35 t/ha), Rajendra Sonia (>5% curcumin, potential yield 42 t/ha).

There are improved varieties of turmeric which can be selected for higher yield, e.g. Suguna, Sudarsana, Prabha,, Krishna, Roma, Suroma, Rajendra Sonia, Alleppey, Supreme, Kedaram. IISR Prathibha, NDH-98, IISR Pragati, Megha Turmeric-1, etc. Varieties tolerant to pest and diseases and high curcumin content may be selected for organic farming as there is a demand of organic produce.



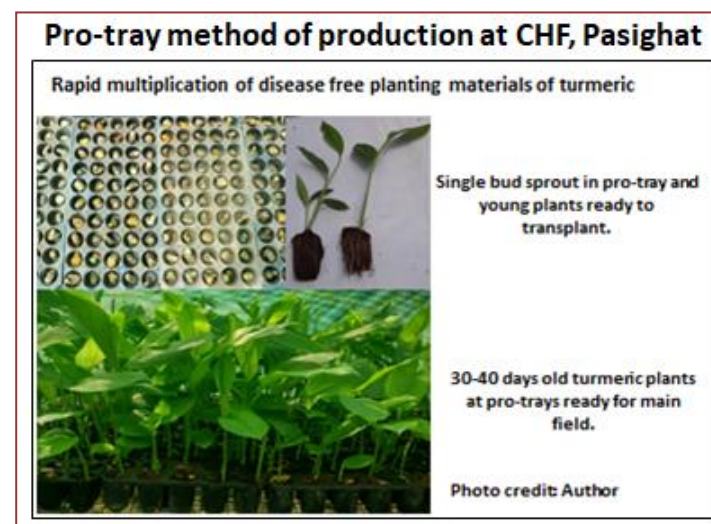
### Propagation:

Turmeric is propagated by vegetative means that is rhizome. Select healthy finger rhizome of 7-8cm length with 2-3 sprouting buds or mother rhizome weighing about 20-35g for planting. If the mother or finger rhizome is bigger in size, it can be cut into two to reduce the seed rate.

### Planting material required: (seed rate)

- Mother rhizomes: 2000 to 2500 kg/ha
- Primary fingers: 1500 to 2000 kg/ha
- Advance method: 500 to 700 kg/ha (5 g/plug)

### Advance Technology of propagation by pro-tray method:



The seed rate of turmeric is very high as well as often attack by diseases causing serious problem to growers. Advance Technology of propagation by pro-tray method is recently developed in order to reduce cost of seed rate and rapid multiplication of disease free planting materials of turmeric. The following is the flow chart of raising pro-tray method of turmeric nursery:

- Select healthy turmeric rhizomes for seed purpose.
- Treat the selected rhizomes with Mancozeb (0.3% or 3g/litre of water) and Quinalphos (0.075% or 0.75g/litre of water) for 30 minutes to protect from diseases and pests and store in well-ventilated area.
- About 30-40 days prior to planting, the seed rhizomes are cut into single bud with small piece of rhizome weighing about 4-6 g.
- Treat the single bud sprout (Mancozeb 0.3%) for 30 min before planting.

- Fill the pro-trays (98 cell or bigger size hole) with nursery medium containing partially decomposed coir pith and vermicompost (3:1) enriched with PGPR/Trichoderma 10g/kg of mixture or sandy soil with well rotten FYM (2:1)
- Plant the turmeric bud sprout in the hole of pro-tray and keep the pro-tray under shade net house.
- Apply irrigation with rose can or by using suitable sprinklers or mist as and when required.
- Seedlings will be ready within 30-40 days for transplanting in the main field.

### **Preparation of land:**

Give 4-5 deep ploughings to get fine tilth up to 20-25 cm depth. Ploughing should be done before monsoon begins. The crop can be grown in flat bed, raised bed, ridges and furrows method based on topography and rainfall. It can be grown under poly-house and even in container. Prepare beds of 1 m width and convenient length with a spacing of 40 to 50 cm between beds which is easy for mechanise farming.

### **Planting:**

The optimum period for planting turmeric is during April-May. It can go upto June before the monsoon begins.

### **Seed treatment:**

Before planting treat the rhizome with Plant Growth Promoting Rhizobacteria (PGPR) strain GRB-35 capsule + trichoderma capsule. Rhizomes are treated with Dithane M 45 0.3% (3g/litre water) or Bavistin 0.1% (1g/litre water) and quinalphos @ 0.075% solution for 30 minutes and shade dried before planting.

### **Spacing:**

For optimum production, turmeric can be planted at the spacing of 30cm x 20-25cm (row to row and plant to plant) however for mechanise farming the spacing may be wider so as to operate by turmeric planter.

### **Method of planting:**

Rhizomes are dibbled at 5-10 cm depth in bed or ridge. Treat the rhizome with Mancozeb @ 0.2% or 2g (fungicide) and Malathion @0.5% or 5g (insecticide) before planting. Germination starts in 10-20 days after planting and it will be over by 30-40 days.

### **Manuring:**

For good yield of rhizome, it is recommended to apply 20-25t/ha of well rotten Farm Yard Manure (FYM) and inorganic fertilizer @ 120:75:75 kg NPK/ha (i.e. Urea 260 kg, SSP 468 kg and MOP 125 kg per hectare) and micronutrient (Zn, B, Mn) @5g/litre. During land preparation FYM should be incorporate and full dose of phosphorus, potassium and half dose of nitrogen should be applied before planting the rhizomes. The remaining nitrogen i.e. 130kg should be applied after two months of planting the rhizomes. Micronutrient should be sprayed at 60 and 90 days after planting as foliar spray to obtain higher rhizome yield and quality.

Application of POP (120:75:75 kg NPK/ha) + bio-control agents such as Trichoderma capsule + PGPR strain called GRB35 capsule recorded significantly highest rhizome yield and reduced incidence of rhizome rot under Pasighat condition (Research result, 2020).

For organic cultivation apply FYM 20 tonne + Neem cake @ 2 tonne + 2 tonne vermicompost + Ash @0.5 tonne + turmeric booster

micronutrient @ 5g/litre for hectare of land increase yield and quality of rhizome under Pasighat condition (Research result, 2020).

### **Mode of application of bio-control agents**

#### **a) PGPR strain GRB-35 capsule**

For one acre of land, suspend 2 capsules in 2 litre sterilized water (boiled and cooled) for activation of organism. Keep overnight and dilute this suspension to 2000 litre with ordinary water. Soak the required quantity of turmeric in this suspension for 30 minutes before planting. Drench the remaining suspension on the beds. Repeat the application of 4 capsules GRB-35 at 90 days after planting by suspending in 4 litres cooled sterile water after boiling for activation. Dilute this suspension to 4000 litres with ordinary water and apply in the field. (5 litres per bed of 3 x 1 m<sup>2</sup>)

#### **b) *Trichoderma* capsule: same as GRB-35 capsule**

For one acre of land, suspend 2 capsules of *Trichoderma* in 2 litres sterilized water (boiled and cooled) for activation of organism. Keep overnight and dilute this suspension to 2000 litre with ordinary water. Soak the required quantity of turmeric in this suspension for 30 minutes before planting. Drench the remaining suspension on the beds. Repeat the application of 4 capsules *Trichoderma* at 90 days after planting by suspending in 4 litres cooled sterile water after boiling for activation. Dilute this suspension to 4000 litres with ordinary water and apply in the field. (5 litres per bed of 3 x 1 m<sup>2</sup>).

### **Irrigation:**

In the north east hill region of India, the crop is grown under rainfed condition where moisture is abundant during the growing period. However, during winter period, rainfall is scanty which affect yield.

Therefore, irrigation may be given during rhizome formation and maturation stage for higher production.

### **Mulching:**

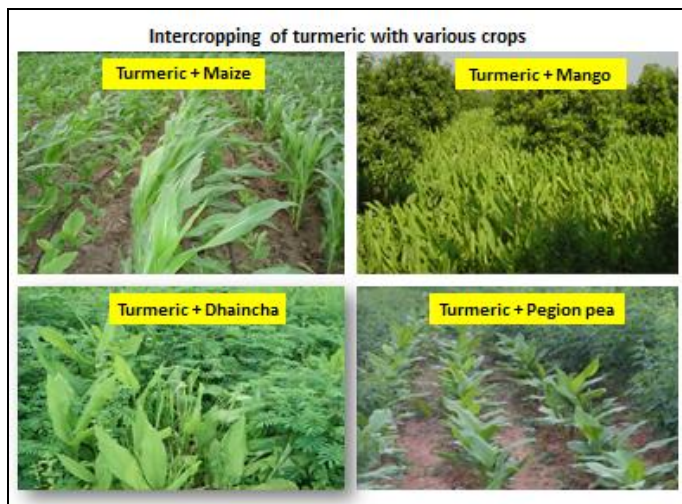
Mulching may be practiced to protect sprouts, conserve moisture, reduced weed growth and to enhance germination with leguminous green leaves, paddy straw, dry leaves such as oil palm leaves, dry grasses (before flowering), plastic mulch, etc. Mulches conserve moisture, increase soil fertility, suppress weeds, and prevent soil erosion due to incessant rain. It also protects the sprout from heavy rain and scorching sun.

### **Weeding:**

Two weeding are required for better growth and development. Weeding, hoeing, and earthing up is done simultaneously when the plants attained one month onwards and depending upon the intensity of weeds. Weeding is very much essential during the early crop growth but later weed is suppressed by the vegetation of turmeric. Weeding should be done just before the application of fertilizer and mulching.

### **Intercropping and crop rotation:**

Turmeric is a heavy feeder, hence depletes soil nutrients. Continuous cropping results in build up of diseases. Therefore, it may rotate and intercrop with legumes and vegetables. Turmeric is also successfully grown as intercrop in orchard and plantation which provide supplementary source of income particularly during the initial stage of orchard and plantation crops. Example of few intercrop are turmeric + mango, turmeric + pigeon pea, turmeric + Dhaincha, turmeric + maize. Turmeric can be rotated with rainfed crop like paddy, sugarcane, banana, betel vine, vegetables, etc.



### Harvesting:

Depending upon the varieties, the crop is ready to harvest within 7-8 months after planting. Main season of harvesting falls in January-February. Maturity indication of crop is complete yellowing and drying up of plants. Field may be irrigated one or two days prior to harvesting for easy digging of the crop and to reduce rhizome damage. Dry plants above ground parts are cut close to the ground level for easy operation or dig as such and remove while cleaning the rhizome. Crop can be harvested by ploughing or digging with spade and rhizomes are cleaned. Mother rhizomes are separated from the fingers before they are cured

### Yield:

Average yield ranges from is 20- 25 t/ha but improves variety e.g. NDH-98 yield about 35-40 t/ha

### Plant protection:

**Leaf blotch** (*Taphrina maculans*): Disease appears as small, oval, rectangular or irregular brown spots on either side of the leaves which

soon become dirty yellow or dark brown during Oct-Nov. Leaves turn yellow. In heavy condition rhizome yield is reduced.

- **Control:** Spray Mancozeb 0.2% or Carbendazim 0.1% at monthly interval. Adopt crop rotation and burn the infected leaves.



**Leaf spot** (*Collectotricum capsici*): It appears as brown spots of various size & white or grey in the centre on the upper surface of the young leaves & eventually covers the whole leaf and dry up. Rhizomes do not develop well.



- **Control:** Spray Carbendazim (0.5 kg/ha) or mancozeb (0.2%) or Copper oxychloride (0.2%) at 15 days interval twice with the appearance of symptom.

**Rhizome rot** (*Pythium sp.*): It is a serious soil borne disease, showing yellowing of leaves, drying up of shoot & decaying of rhizomes and stems with foul smell.

- **Control:** Treat the rhizome with mancozeb 0.3% or thiram 0.25% for 30 minutes before storage and planting as well spray or drench with Bordeaux mixture 1% at 30 days interval at standing crop. Application of bioagents e.g. GRB-35 capsule and *Trichoderma* capsule reduced the incidence of rhizome rot of turmeric. Bordeaux mixture and bio-agents can be used in organic cultivation of turmeric to control rhizome rot.



**Shoot borer** (*Conogethes punctiferalis*): It is a serious pest where larvae bore into the pseudostem and feed on internal tissues. Frass is extruded on the bore hole of stem resulting in withered central shoot.



- **Control:** Spray malathion (0.1%) at 21 days intervals during July to October with the appearance of symptom on the inner most leaf. Neem oil or neem gold @5ml/litre of water as foliar spray at monthly interval during July to October controls the pest organically.

**Rhizome scale** (*Aspidiella hartii*): It infest in field as well as in storage. They feed on sap which becomes shrivelled affecting germination.

- **Control:** It can be controlled by timely harvest and treat the rhizome with quinalphos (0.075%) for 20-30 minutes before storage and sowing.

#### **Preservation of turmeric seed rhizomes:**

Mature, healthy rhizomes are heaped over a layer of sand (about 5-10 cm thickness) under shed or room and covered with dry healthy turmeric leaves or jute bag. Rhizomes are treated with Dithane M 45 0.3% (3g/litre water) or Bavistin 0.1% (1g/litre water) solution for 30 minutes and shade dried before heaping. Heaps are plastered with earth mixed with cow dung and water.

**Authors: (Based on research findings)**

**Dr. Ps. Mariam Anal**, PI/Assistant Professor  
AICRP on Spices under Pasighat Co-opted Centre  
Contact: [psmariamlui@gmail.com](mailto:psmariamlui@gmail.com)

**Dr. B.N. Hazarika**  
College of Horticulture and Forestry  
Central Agricultural University  
Pasighat-791 102, Arunachal Pradesh (India)

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