

TURMERIC

Turmeric (*Curcuma longa*) (Family: Zingiberaceae) is used as condiment, dye, drug and cosmetic in addition to its use in religious ceremonies. The tuberous rhizomes or underground stems of turmeric are used from antiquity as condiments, a dye and as an aromatic stimulant in several medicines. Presently it is cultivated in China, Taiwan, Indonesia, Sri Lanka, Australia Africa, Peru and West Indies. India is a leading producer and exporter of turmeric in the world. In India, Turmeric is mainly grown in Andhra Pradesh, Tamil Nadu, Orissa, Karnataka, West Bengal, Gujarat, Meghalaya, Maharashtra, Assam and other NE states like Nagaland, Manipur, Mizoram and Sikkim. Andhra Pradesh alone occupies 35.0% of area and 47.0% of production. Turmeric has been used in Indian systems of medicine for a long time. Recently, the demand for organic turmeric is growing rapidly in the global pharmaceutical market due to its anti-cancer properties. The turmeric of northeast are known for its high Curcumin content and other quality parameters.



Photo – Turmeric field

Climate and soil

Turmeric can be grown in diverse tropical conditions from sea level to 1500 m above sea level, at a temperature range of 20-35°C with an annual rainfall of 1500 mm or more, under rain fed or irrigated conditions. Though it can be grown on different types of soils, it thrives best in well- drained sandy or clay loam soils with a pH range of 4.5-7.5 with good organic carbon status. The crop cannot withstand water logging and alkalinity. Like other crops, turmeric also requires deep tilth and heavy manuring for high yields.

Varieties

A number of local cultivars are available in the country and recommended for North eastern states. Lakadang variety of turmeric originated from Meghalaya is popular for high curcumin content of 6 to >7%. Dzongu local, Allepey, Sudharshana, Suroma, Roma and Megha Turmeric 1 are also grown in the region.

Site selection

For organic turmeric production, a buffer zone of 25-50 feet is to be left all around from the conventional farm, depending upon the location of the farm. The produce from this zone shall not be treated as organic. Turmeric being an annual crop, the conversion period required will be 2-3 years, turmeric can be cultivated organically as an intercrop or mixed crop with other crops provided all the other crops are grown following organic methods. The site selected should have good drainage facilities.

Preparation of land

The land is prepared with the receipt of early monsoon showers. The soil is brought to a medium tilth by giving about three deep ploughing. In NEH region, farmers starts land preparation little early (February-March). Immediately with the receipt of pre-monsoon showers, beds of 1.0 m width, 15 cm height and of convenient length are prepared with spacing of 50 cm between beds. Solarization of such beds is beneficial in checking the multiplication of pest and disease causing organisms. To ameliorate soil acidity, hydrated lime @ 400 kg/hectare or Dolomite @ 2t/ha should be applied and mixed with soil. In valley region or high rainfall area, proper drainage channel should be provided in the inter-rows to drain-off stagnant water.

Seed material and Treatment

Whole or split mother and finger rhizomes are used for planting and well developed healthy and disease free rhizomes are to be selected. The source of seed should be selected carefully. In the beginning seed material from high yielding local varieties may be used in the absence of organically produced seeds. But afterwards only carefully preserved healthy seed rhizomes which were collected from organically cultivated farms should be used for planting. A seed rate of 1.5-2.5 tons of rhizomes is required for planting one hectare of turmeric. Micro-rhizome produced through tissue culture can

also be used for planting. Rhizome treatment and drenching with bioorganic RCHE 22 @ 30 ml/l has been found effective in increasing turmeric productivity by 15%.

To control the rot disease, slurry of *Trichoderma viridae* @ 5 g/kg of seed is prepared and used for treating the seed materials. Accacia gum may be applied in to the slurry as sticker material. Before planting, the rhizome bits are then soaked in the slurry for 30 minutes and then dried in airy place under shade. Rhizome bits should be stirred 3-4 times to ensure uniform soaking. Along with *Trichoderma*, rhizome can be treated with biofertilizers (*Azospirillum*, *Azotobactor*, PSB etc.). For controlling of soil born disease. Turmeric crop should be rotated with cereals/legumes after every 2-3 years. It is beneficial, if legume crop such as groundnut and French bean are rotated.

Planting

The planting season for turmeric is from March-April in hills and April-May in valley. Small pits are made with a hand hoe on the beds with a spacing of 30 cm x 25 cm. Pits are filled with well decomposed cattle manure or compost mixed with *Trichoderma*. The optimum spacing in furrows and ridges is 45-60 cm between the rows and 25 cm between the plants. At the time of planting apply 25 g neem cake per sqm mixed well with soil in each pit. A light irrigation is beneficial after planting followed by mulching.

Manuring and fertilizer application

Farmyard manure @ 15-20 t/ha along with 250 kg neem cake and 150 kg/ha rockphosphate or vermicompost @ 10 t/ha along with, 250 kg neem cake and 150 kg/ha rockphosphate is useful for optimum turmeric yield. Integrated application of FYM 10t /ha and vermicompost 5t/ha along with 250 kg neem cake and 150 kg/ha rockphosphate is the best option for sustainable turmeric production. It is more beneficial if biofertilizers such as *Azospirillum* (Nitrogen fixer) and *Bacillus* (Phosphate Solublizing Bacteria) is applied along with FYM or vermicompost.

Mulching

Mulching of turmeric with paddy straw or green leaves (*Alnus nepalensis*, *Schima wallichii*) or available weed biomass (*Ambrosia spp.*, *Artemisia vulgaris*, *Eupatorium odoratum*) is an essential operation to enhance germination of rhizomes and to prevent soil erosion during heavy rains. This also help to add organic matter to the soil and conserve moisture during later part of the cropping season. First mulching is to be done immediately after planting with green leaves @ 10 t/ha. Mulching may be repeated @ 5 t/ha at 45 and 90 days after planting, immediately after weeding and earthing up. Cow dung slurry may be poured on the bed after each mulching to enhance microbial activity and nutrient availability. In Sikkim leaves of *Chilaune* (*Schima wallichii*) is preferred among the farmers as mulching material.

Water Management

Turmeric is generally grown as rainfed crop. However, irrigation has to be given when soil becomes totally dry. To loosen the soil, a light irrigation has to be given when soil becomes totally dry. A light irrigation may also be given 2-3 days before digging up the rhizomes. In water scarcity areas (like hilly terrain), suitable water conservation techniques (rain water harvesting) has to be adopted for providing life-saving irrigation.

Weed management

Weeding has to be done thrice at 60, 90 and 120 days after planting depending upon weed intensity. Mulching reduces the weed problem.

Mixed cropping

Turmeric can be grown as an inter crop with chillies, colocasia, onion, brinjal and cereals like maize, ragi, etc. Turmeric can also be successfully grown as intercrop in plantations.

Plant protection

Insects

1. Shoot borer (*Conogethes punctiferalis*)

Symptoms - It is the most important and serious pest of turmeric. The larvae bore into pseudostems and feed on the growing shoot resulting in yellowing and drying of infested shoots. The larvae bore into the rhizome also. Larva pupates inside the affected pseudostem in a thin silk cocoon. The presence of bore holes in the pseudostem through which frass is extruded and the withered central shoots (dead hearts) are characteristics symptoms of pest infestation. The shoot borer is highly polyphagous.

Management

Cultural - Removal and destruction of alternate hosts like castor, cardamom in the immediate vicinity. Roguing and pruning of infested pseudostem during July-August at fortnightly intervals

Biological - Promote predators like *Bracon* sp, *Apanteles taragamae* and parasitoids like *Eriborus* sp., *Friona* Sp, *Agrypone* sp.

Control measures - Apply entomopathogenic nematode *Steinernema carpocapsae* @ 100 IJ/larva or *Hexamermis* sp or Apply *Bacillus thuringiensis* (0.3%) at monthly

intervals during July – August or Spraying neem oil or neemgold @ 0.5% during July – October at 21 days interval. Two sprays of Nimbicidine or Neemazal @ 3ml/l at 15 days interval has also been found to be effective against shoot borer.

2. Leaf roller (*Udaspes folus*)

It is a specific and serious pest of turmeric. The butterfly is black and white; the larvae feed inside the leaf folds and pupate inside a thick mass of waxy stuff.

Management

Cultural - Collection and destruction of larvae and pupae of leaf roller mechanically can reduce infestation.

Control measures – Two sprays of Nimbicidine or Neemazal @ 3ml/l at 15 days interval has also been found to be effective against leaf roller. 2-3 foliar spray of garlic-chilly extract with 2.5% neem oil with soft soap starting from the appearance of pest at an interval of 10-15 days is quite effective.

Diseases

3. Rhizome rot (*Pythium aphanidermatum*, *P. graminicolum*)

Symptoms - The symptoms are visible both on above ground and below ground parts of turmeric plant. In above ground, the disease is characterized by drying of leaves starting from the margin of the lower leaves. The dried leaves show necrosis. Water soaked spots in collar region are produced by the fungus. In case of belowground parts, There is rotting of rhizomes as well as roots. The infected rhizomes emit obnoxious smell. Varying degrees of brown shade can also be noticed on the infected rhizome in contrast to the bright yellow colour of the healthy rhizome.

Management

Cultural - Selection of healthy seed. Provision of good drainage facility. Crop rotation. Removal and burning of the infected clumps from the field.

Control measures - Soil application of *Pseudomonas fluorescens* talc formulation @ 2.5 kg/ha. In severe infestation rhizome dip treatment in copper oxy chloride @ 0.3% for 30 minutes before planting is effective. Soil drenching with copper oxy chloride @ 0.25% or Bordeaux mixture @ 1 per cent in and around affected plants effectively manages the disease.

4. Leaf blight [*Rhizoctonia solani* (*Thanatephorus cucumeris*)]

Symptoms - The disease manifests as water soaked spots of varying sizes and shape on the lower leaves and blighting of leaves. In moist weather fungal growth appears on the under surface of the infected portion of the leaf. At the end, the infected plant dies.

Management

Cultural - Selection seed material from disease free areas. The infected and dried leaves should be collected and burnt in order to reduce the inoculum source in the field. Crop rotations should be followed whenever possible

Control measures - Hot water treatment of seed at 50°C for 10 minutes followed by treatment with *Trichoderma viride* in well-decomposed manure @ 1 kg *T. viride*/10kg manure. Spraying of copper oxychloride @ 3 g/l of water or Bordeaux mixture (1%) was found effective against leaf blight.



Photo Leaf Blight (left) and leaf spot (right)

5. Leaf spot (*Colletotrichum capsici*)

Symptoms - Brown, elliptic to oblong spots of various sizes with grey or whitish centre appear on the upper side of the leaf. The spots enlarge in size and extending to whole leaf area. There is characteristic black spot on the leaf which represents acervuli of the fungus in concentric rings on the leaf. The grey centers become thin and get torn. Severely affected leaves dry and wilt. They are surrounded by yellow halos. Indefinite number of spots may be found on a single leaf and as the disease advances; spots enlarge and cover a major portion of leaf blade.

Management

Cultural - Selection seed material from disease free areas. The variety Sugantham and Suguna was found to be highly resistant. The infected and dried leaves should be collected and burnt in order to reduce the inoculum source in the field. Crop rotations should be followed whenever possible

Control measures - Hot water treatment of seed at 50°C for 10 minutes followed by treatment with *Trichoderma viride* in well-decomposed manure @ 1 kg *T. viride*/10kg manure. Spraying of copper oxychloride @ 3 g/l of water or Bordeaux mixture (1%) was found effective against leaf spot.

6. Leaf blotch (*Taphrina maculans*)

Symptoms - Small, oval, rectangular or irregular brown spots appear on the both surfaces of the leaf and cover a larger portion of the leaf lamina. The spots coalesce forming reddish brown blotches leading to varying degrees of leaf blight.

Management

Cultural - Selection of seed from disease free area. Field sanitation should be practiced. The infected and dried leaves should be collected and burnt in order to reduce the inoculum source in the field. Crop rotation using non-host crop.

Control measures - Seed treatment with *Trichoderma viride* @ 8-10 gm/kg of rhizome followed by shade drying before planting. Spray copper oxychloride @ 0.3 per cent or Bordeaux mixture @ 0.1 per cent to avoid further spread of the disease.



Photo Leaf blotch in Turmeric

Harvesting

Depending upon the variety, the crop becomes ready for harvest in 7-9 months after planting during January-March. Early varieties mature in 7-8 months, medium varieties in 8-9 months and late varieties after 9 months. The land is ploughed and the rhizomes are gathered by hand picking or the clumps are carefully lifted with a spade. The harvested rhizomes are cleared of mud and other extraneous matter adhering to them. A good crop may be yield around 20-25 t/ha.

Processing

Curing

Fresh turmeric is cured for obtaining dry turmeric. The fingers are separated from mother rhizomes. Mother rhizomes are usually kept as seed material. Curing involves boiling of fresh rhizomes in water and drying in the sun. The cleaned rhizomes are boiled in water just enough to immerse them. Boiling is stopped when froth comes out and white fumes appear giving out a typical odour. The boiling should last for 45-60 minutes when the rhizomes turn soft. The stage at which boiling is stopped largely influences the colour and aroma of the final product. Over cooking spoils the colour of the final product while under-cooking renders the dried product brittle. In the improved scientific method of curing, the cleaned fingers (approximately 50 kg) are taken in a

perforated trough of 0.9 m x 0.5 m x 0.4 m size made of GI or MS sheet with extended parallel handle. The perforated trough containing the fingers is then immersed in a pan; 100 litres of water is poured into the trough so as to immerse the turmeric fingers. The whole mass is boiled till the fingers become soft. The cooked fingers are taken out of the pan by lifting the trough and draining the water into the pan. The water used for boiling turmeric rhizomes can be used for curing fresh samples. The processing of turmeric is to be done 2 or 3 days after harvesting. If there is delay in processing, the rhizomes should be stored under shade or covered with sawdust or coir dust.

Drying

The cooked fingers are dried in the sun by spreading them in 5-7 cm thick layers on bamboo mats or on drying floor. A thinner layer is not desirable, as the colour of the dried product may be adversely affected. During night time, the rhizomes should be heaped or covered with material which provides aeration. It may take 10-15 days for the rhizomes to become completely dry. Artificial drying, using cross-flow hot air at a maximum temperature of 60 degree centigrade also gives a satisfactory product. In the case of sliced turmeric, artificial drying has clear advantages in giving a brighter coloured product than sun drying which tends to undergo surface bleaching. The yield of the dry product varies from 10-30% of fresh produce depending upon the variety and the location where the crop is grown.

Preservation of seed rhizomes

Rhizomes for seed purpose are generally stored by heaping in well ventilated rooms and covered with turmeric leaves. The seed rhizomes can also be stored in pits with saw dust, sand along with leaves of *Strychnos nuxvomica* (kanjiram). The pits are to be covered with wooden planks with one or two openings for aeration. The rhizomes are to be dipped in litres of water to avoid storage losses due to fungi

Yield

A good crop of turmeric may yield about 20-25 t/ha under organic production.