

Organic cultivation of turmeric by Good Agricultural Practices (GAP) in Bundelkhand region

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The major aim of the turmeric cultivation is due to its properties such as antibiotic, antioxidant, anti-inflammatory, antimicrobial, antitumor, cepto-protective (to protect the liver), cardio-protective (to protect the heart) etc. which proves as very useful for curing various diseases. Turmeric powder is used as spices since a very long time. The essential component present in turmeric is known as curcumin which has many medicinal properties. It also has some amount of essential oils, which is volatile in nature. This crop is very useful and the beneficiary results can be brought by following the scientific methods of cultivation, such as good agricultural practices (GAP). This crop has been proven very useful for the farmers continuing their agriculture practices in a barren land. Also the farmer's can produce quite a good income by the cultivation of this crop.

Keywords: Field trial, Good agricultural practices, Post-harvest practices, Varietal study of turmeric

TURMERIC (*Curcuma longa* L.) is an important spice crop along with some medicinal benefits and many more points that benefits farmer's. The compound that is responsible for the medicinal purposes is curcuminoids. This crop generally originates from Tropical South Asia. Every house in India uses it as a major condiment in cooking. Its colour is obtained from quercetin, which used for colouring food stuff. The yellow dye obtained is also used for colouring other fabrics, papers, etc. GAP is a practice involving some codes, standards and regulations which are followed during cultivation techniques of crop. The goal of this practice is to provide good quality of products to the consumers and a good income to the farmers. The species of turmeric is found easily in Indian soil, hence India is a leading producer and exporter of turmeric among other countries in the world.

Cultivation practices

Soil properties: This crop can be cultivated on a sandy soil having a good drainage facility or loamy soil

having enough humus content. To obtain high yield of turmeric, the rhizome formation must be of high quality and can be achieved easily in a soil having pulverized tilth (Table 1).

Table 1. Required fertility status of organic research farm

Property	Result
pH	7.45
Electrical conductivity	0.246 ds/m
Organic carbon content (%)	1.35%
Organic matter content (%)	2.32%
Bulk density	1.13 gm/cm ³
Particle density	2.28 gm/cm ³
Porosity	48.8%
Available nitrogen (kg/ha)	190.6 kg/ha
Available phosphorus (kg/ha)	9.72 kg/ha
Available potassium (kg/ha)	259 kg/ha

Land preparation: The minimum tillage operation results good for this crop. In case of irrigated crop system, the ridges and furrows are prepared for the turmeric cultivation and crop is sown on the ridges with shallow pits and the proper spacing is provided. Soil solarization is also used.

Improved varieties

- **Rajendra Sonia:** This variety was released by Dr Rajendra Prasad at Central Agricultural University, Samastipur, Bihar. This variety has a duration of about 225 days. It yields about 42 tonnes/ha with 8.4% curcumin content and 5% essential oil content.
- **IISR-Pratibha:** This variety has a crop duration of 188 days. This crop gives a mean yield of about 39.1 tonnes/ha along with 6.5% curcumin content, 6.2% essential oil content and 16.2% oleoresin content. This variety has some special characteristics such as; reddish yellow colour of the core of rhizome, with plump and bold size of the rhizome.
- **Bundelkhand Moti Haldi:** This variety matures in about 260–270 days. It is generally grown in Bundelkhand region to maintain the economical aspects of farmer and known as cash crop of Bundelkhand region.
- **Megha Turmeric:** It generally takes 300–315 days for maturity with an average yield of



Land preparation



Mulching

27 tonnes/ha. This variety contributes around 6.8% curcumin content and 5.5% of essential oil content.

- **IISR-Pragati:** This is a short duration variety as it can be harvested in 180–200 days after sowing. This gives a yield of about 40–50 tonnes/ha with curcumin content of 5.02% and 2.4% of essential oil content. This variety is generally found resistant to root-knot disease.
- **Lakadong:** This variety is harvested after 240–300 days of life span. It gives a yield of about 5–7.5 tonnes/ha with 6–9% curcumin content and 5–6% essential oil content. This variety can be identified by the bright yellow colour of rhizome core which gives a characteristic colour to the spice.

Planting time: The suitable planting time for this crop is the pre-monsoon, i.e., during the months of June and July.

Planting material and plantation: The planting material used is termed as rhizome. The mother/finger rhizome is used for the purpose of sowing. Things that are considered during the selection of rhizomes are:

- The rhizome must be healthy and free from any kind of infection.
- The rhizome must be well developed.

The spacing is maintained about 15–20 cm x 30–45 cm. Sowing is done in beds prepared with a height of 15 cm and a width of around 1 m and the spacing between the beds is maintained at about 50 cm.

Manure and fertilizer: For nutrition supply, both of the ways, i.e. organic and inorganic can be

used. Initially, FYM (farm yard manure) is applied @30–40 tonnes/ha by the method of broadcasting. Ploughing is done to mix the FYM with the soil. Generally, the recommended dose of fertilizer states that 60 kg/ha N, 50 kg/ha P_2O_5 and 120 kg/ha K_2O should be applied to the field to ensure the availability of nutrients to the soil. The NPK is supplied in split doses such as, the FYM and P_2O_5 are applied as basal doses at the time of planting and nitrogen and potassium is supplied in split doses at an interval of 45 days each. The dose of potassium is required high because it helps in root growth.

Mulching: The process of covering the soil by some by-products obtained from agriculture or polythene sheets of certain thickness generates many profits such as:

- It provides protection to the soil moisture and nutrient loss from evaporation.
- It creates an atmosphere inside the mulch that reduces the growth of weeds.
- It helps in controlling some insect pests by creating the temperature that is not favorable for insects.

Irrigation: Generally, depending upon the weather and soil texture, about 15–25 times irrigation is

provided. In case of sandy soil, this irrigation practice raises to 35–40 times, during the whole crop duration.

Weed management: As stated in some studies, the weeding must be done thrice at 60, 90 and 120 DAS. Use of weedicides in this crop can reduce the quality of rhizome production, so for the good and healthy rhizome production the weedicide use is restricted.

Insect and pest management

Alike every crop, this crop also suffers the attack of insects, pests which reduces the growth and the quality of production. Some of the insects and their management is given as:

- **Termite:** This insect grows rapidly in moisture presence and attacks the plant root first and makes it hollow by entering inside, and make the plant wilt. The way to manage this insect is by destroying the bore of termite in the soil by turning the soil timely, and use of neem-cake is also useful.
- **Thrips:** The turmeric thrips (*Panchaetothrips indicus*) attacks the plant and make the leaves of plant rolls. The leaves gradually turn to pale yellow and the plant dries. This insect attacks mostly during the post monsoon season.
- **Nematode Pests:** This crop is majorly attacked by the nematode pests such as, Root knot nematode (*Meloidogyne* spp.) and the burrowing type nematodes (*Radopholus similis*). The best way to control the population multiplication of nematodes and to reduce the damage is by increasing the



IISR Pragati (60 DAS)



PUSA Rajendra sonia (60 DAS)



Megha (90 DAS)



Bundelkhand Moti Haldi



organic content in the soil by the application of FYM or VC (vermicompost).

Disease management

- **Leaf blotch:** This disease is caused by *Taphrina maculans*. In this disease the appearance of small oval, round, rectangular or irregular brown spots on either side of leaves occurs. Later the spots get yellow in colour and gradually turns brown resulting in the yield decrease.
- **Rhizome rot:** This disease is caused by *Pythium graminicolum*. In this disease the collar region of the pseudo stem is affected and becomes soft and water gets soaked which results in the plant lodging. This can be controlled by treating the seedling rhizome with suitable chemicals or treatments.

Harvesting

The method to harvest this crop is to dig out the rhizomes with the help of sickle (kudaa), or the land is lightly ploughed and then the rhizomes are hand-picked and washed properly. Generally the harvesting time is around the month of February–March. The harvesting varies according to varieties such as, early variety matures in 7–8 months, mid varieties matures in 8–9 months and late varieties matures after 9 months.

Post-harvest management of propagating material

The rhizomes obtained by mature harvesting include mother rhizome, seed rhizome and the economical yield. The seedling rhizome can be stored in a ventilated room by making heaps and covering the heap with turmeric leaves. Pits can also be used to store seedling rhizome with sawdust and sand. Later covered the pits with wooden plank and it should have some small holes in it to pass air and maintain proper ventilation. The Processing practices being followed for increasing the quality and shelf-life of production, such as:

Drying: In the day time the rhizomes are dried under the sun by spreading them over a 5–7 cm thick layer of bamboo mat. While in the night, the rhizomes are covered with an aerated heaping or covering material. It takes about 10–15 days for the rhizomes to be completely dry. Artificial drying is very helpful in the sliced turmeric, at a temperature of 60°C in the cross flow of hot air.

Polishing: The outer surface of rhizomes is covered with dust or root bits, these materials are removed by polishing the rhizomes with the help of abrasion by manual or mechanical rubbing.

Colouring: This process is generally adopted for the marketing

purpose, as the colour of the rhizomes affect the sale of products, so some amount of turmeric powder after mixing with little water is sprinkled over the rhizomes after polishing.

Yield: The average yield of turmeric is about 8–10 tonnes/ha. In some cases, if the climatic factors supports then the resulting yield becomes around 12 tonnes/ha (Table 2).

SUMMARY

Curcumin percentage is a very important factor from the point of view of the use of rhizome in spices and medicine. The cured turmeric has given medium curcumin yield after curing practices. This whole article is based on varietal experiments of the turmeric in the Bundelkhand region in the barren land for spreading the idea of turmeric as cash crop for doubling the farmer's income which was observed to be significantly enhanced in previous years by various factorial observations. The input used for cultivation was from the farm resources and the organic cultivation technique was followed. The output obtained by following the organic cultivation practice is quite promising.

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Table 2. Performance of growth and yield parameters of turmeric crop

Variety	Plant height (cm)	No. of leave	Leaf length (cm)	Leaf width (cm)	Tiller/plant	Primary rhizome	Secondary rhizome	Mother rhizome	Fresh rhizome yield (kg/ha)
Rajendra Sonia	144.47	12.22	88.66	17.40	4.67	6.28	14.77	3.42	320.57
Bundelkhand Motihaldi	145.93	13.88	89.96	17.86	4.87	8.42	15.91	3.27	321.07
IISR-Pragati	119.97	11.57	78.91	16.03	4.36	6.87	16.94	2.68	282.6
Megha	111.28	8.91	76.02	15.04	4.2	6.34	14.08	2.78	249.12
IISR-Pratibha	107.93	7.95	72.03	15.2	4.62	7.0	15.45	2.60	262.24