

Tomato



1. Introduction :

Tomato (*Lycopersicon esculentum*) belongs to the genus *Lycopersicon* under Solanaceae family. Tomato is a herbaceous sprawling plant growing to 1-3 m in height with weak woody stem. The flowers are yellow in colour and the fruits of cultivated varieties vary in size from cherry tomatoes, about 1–2 cm in size to beefsteak tomatoes, about 10 cm or more in diameter. Most cultivars produce red fruits when ripe. Tomato is a native to Peruvian and Mexican region. Though there are no definite records of when and how it came to India , the Portuguese perhaps introduced it to India.

Tomato is one of the most important "protective foods" because of its special nutritive value. It is one of the most versatile vegetable with wide usage in Indian culinary tradition. Tomatoes are used for soup, salad, pickles, ketchup, puree, sauces and in many other ways It is also used as a salad vegetable. Tomato has very few competitors in the value addition chain of processing.

2. International scenario :

Tomato is the world's largest vegetable crop after potato and sweet potato, but it tops the list of canned vegetables. The total global area under tomato is 46.16 lakh ha and the global production is to the tune of 1279.93 lakh tonnes. The major tomato producing countries, area, production, productivity and percentage share in the world production is given in Table 1.

Table 1. Area, production, productivity and percentage share of world production

Country	Area (000' ha)	Production (000't)	Productivity (t / ha)	% share of world production
Brazil	61	3453	56.61	2.70
China	1305	31626	24.23	24.71
Egypt	195	7600	38.97	5.94
India	535	9362	17.50	7.31
Iran	139	4781	34.40	3.74
Italy	139	7187	51.71	5.62
Mexico	119	2800	23.53	2.19
Spain	72	4810	66.81	3.76
Turkey	260	10050	38.65	7.85
USA	167	11043	66.13	8.62
Others	1624	35281	21.72	27.56
TOTAL	4616	127993	27.73	

Source : NHB Data base (2005-06)

The world trade in tomato consists of an export of 49.50 lakh tonnes valued at 50802.88 lakh US\$ and imports are to the tune of 47.30 lakh tonnes estimated at 50415.26 lakh US\$

3. National scenario :

The state wise area, production and productivity of tomato is given in Table 2.

Table 2. State wise scene Area, Production and Productivity of Tomato in India

STATE/UTs	Area (000' ha)	Production (000't)	Productivity (t/ha)
ANDHRA PRADESH	76.50	1453.50	19.00
BIHAR	46.00	727.20	15.81
CHHATTISGARH	29.20	365.80	12.53
GUJARAT	29.30	650.00	22.18
HARYANA	17.10	257.30	15.05
KARNATAKA	44.50	1188.10	26.70
ORISSA	100.40	1332.20	13.27
MADHYA PRADESH	20.40	306.70	15.03
MAHARASHTRA	35.00	987.00	28.20
TAMIL NADU	22.00	277.70	12.62
WEST BENGAL	50.00	857.20	17.14
OTHERS	64.10	959.10	14.96
TOTAL	534.50	9361.80	17.52

Source : NHB Data base (2005-06)

The major tomato growing tracts in India are given in Table 3.

Table 3. Major tomato growing tracts of the country

State	Major tomato growing districts
Uttar Pradesh	Varanasi, Mirzapur
Himachal Pradesh	Shimla, Kullu, Solan
Punjab	Amritsar, Ropar, Jalandhar, Hoshiarpur
Haryana	Rohtak, Sonapat, Jhajjarr, Faridabad, Karnal
Rajasthan	Jaipur, Dholpur, Alwar, Tonk, Bharatpur
Bihar	Vaishali, Sitamarhi, Bhagalpur, Patna, Aurangabad, Nalanda, Bhojpur, W&E Champaran
Jharkhand	Ranchi, Lohardaga , Hazaribagh, Godda
Maharashtra	Nashik, Ahmednagar, Pune, Nagpur
Gujarat	Surat, Valsad, Baroda, Ahmednagar, Gandhinagar, Kedha, Jamnagar
Madhya Pradesh	Satna, Sagar, Jabalpur,
Chhatisgarh	Raipur, Durg, Bastar, Bilaspur, Raigarh, Surguja
Orissa	Bolangir, Kendrapada, Dhenkanal, Ganjam, Mayurbhanj, Keonjhar
Andhra Pradesh	Rangareddy, Mehabubnagar, Prakasam, Vishakapattanam, Chittor
Karnataka	Kolar, Bangalore, Bellary, Dharwad, Belgaum
Tamil Nadu	Thiruvannamalai, Salem, Dharmapuri, Coimbatore, Erode,, Trichy, Madurai, Dindigul

Tomato is mainly grown as Rabi crop in the plains of India. However in the hilly region it can also be grown as a summer and rainy season crop.

4. Status of tomato in Jharkhand :

In Jharkhand, tomato is extensively cultivated in the vegetable belts covering districts like Ranchi, Lohardaga , Hazaribagh and Godda and covers approximately 13.9% of the area under vegetable cultivation. At present, the estimated area and production under tomato is 7290 ha and 131220 t respectively.

5. Organic farming :

Organic agriculture consists of a system of farm design and management to create an eco-system, which can achieve sustainable productivity without the use of artificial external inputs such as chemical fertilizers and pesticides. The major aims of organic agriculture are production of quality agriculture products which contain no chemical residues, the development of environment friendly production methods and the application of production techniques that

restore and maintain soil fertility. These are achieved by suitable crop selection and rotation, recycling of plant and animal residues, proper tillage and water management.

Organic farm products are, generally more expensive than inorganic crops. Yields drop sharply during the phase of conversion as it takes some time for the soil and plants to reach equilibrium. However, yields rise again, once management systems get established.

As the present level of farming is less intensive with lower levels of application of chemical fertilisers and pesticides transition to organic farming in the State will be comparatively easier.

The guidelines for organic farming are enclosed in **Annexure I**

6. Organic production :

6.1 Climate and soil

The crop is grown from almost MSL to an altitude of 1500 m in tropical and subtropical regions, with an annual rainfall of 60-150 cm. Very high rainfall during its growth is harmful. When grown under hot weather, it is cultivated as an irrigated crop. The winter crop is planted from August to September. For organic farming of tomato winter crop has been found to be ideal.

Well drained sandy loam soil with high level of organic contents is best suitable for tomato cultivation. Soils with high acidity are not suitable for tomato cultivation. Three to 4 q of suitable lime can be applied in the field in an interval of three years to reduce the level of acidity to tolerable limits. There is a need to go for soil testing at the beginning of the crop season.

6.2 Rotation

Crop rotation is a major component of organic farming, affecting both soil conditions and pest cycles. Tomato belongs to the Solanaceae family which includes tobacco, potato and bell pepper. Rotation with non-solanaceous crops like pulses/legumes are usually recommended to avoid pests and diseases affecting tomato and also to enrich the nitrogen status of the soil.

6.3 Buffer zone

In order to cultivate tomato organically a buffer zone of 7.5 to 15 m shall be maintained if the neighbouring farms are non-organic. The produce from this zone shall not be treated as organic.

6.4 Land preparation

The land may be ploughed and harrowed 3 or 4 times to obtain a fine tilth. About 10 tonnes of Farm Yard Manure (FYM) or vermi compost/compost @ 1-1.5 t per acre is applied at the last ploughing. Green manuring is recommended for areas with assured rainfall and also for irrigated crop. Beds are prepared against the slope and after levelling the bed, field channels of 50 cm breadth are prepared at intervals of 1 m.

6.5 Planting material

Tomato is propagated by seeds. Seed selection is an important aspect in organic tomato production. For raising nurseries, seeds of high yielding varieties with tolerance to pests and diseases may be used. They should be carefully selected from certified organic farms or from own seed plot which is raised organically. To start with, chemically untreated seeds from local high yielding varieties could also be used, in the absence of organically produced seeds.

6.6 Varieties

For organic farming of tomato, Open Pollinated Varieties (OPV) are preferred. The local varieties developed by Horticulture & Agro-Forestry Research Programme (HARP), Plandu, Ranchi viz., Swarna Lalima and Swarna Naveen are suitable for organic cultivation of Tomato. Lakshmi NP 5005 is also popular in the State as it is resistant to bacterial wilt and leaf mosaic virus.

6.7 Seed treatment

Seeds should not be treated with any chemical fungicides or pesticides. Prior to sowing, the seeds should be treated with Trichoderma at the rate of 1 g per 150 g of seeds.

6.8 Nursery development

In order to grow saplings in the nursery, beds of 1m X 3m are prepared with a height of 20 cm. Twelve to 15 beds are required for raising nursery for planting 1 acre of tomato. Soils are exposed to high temperatures, to prevent possible pest and diseases attack in the plants. After the beds are prepared 20 to 25 kg of farm yard manure along with 1.2 kg Kanranj/Neem cake is applied per bed. After necessary application of water the beds are covered with thin white plastic sheets for raising the temperature without loss of moisture. Such practice will further eradicate harmful bacteria and pests. For cultivation of tomato during Rabi season, seeds should be sown in the nursery during the month of August/September.

The requirement of seed /acre is approximately 150 g. Sowing of the seeds should be done in straight lines drawn at an interval of 5 cm with 2 cm spacing between successive seeds implanted. Seeds are to be planted at a depth of 0.5 cm to 1 cm. After sowing the seed, a thin layer of soil should be used as covering. Then beds should be covered by thin nylon nets keeping a gap of one foot from the bed and fully secured from all sides by placing adequate soil on the borders of the net. This practice will prevent pest infestation in the saplings.

6.9 Planting

20 to 25 days old seedlings are used for transplantation. They are transplanted in the main field in rows with a spacing of 60 cm between rows and 50 cm distance between two successive plants. Transplantation is done on one side of the channel keeping a distance of 30 cm. In the initial period, irrigation from the field channel is found to be adequate.

6.10 Irrigation

Irrigation should be provided once in 7-10 days depending on the soil and weather conditions

6.11 Cultural practices

Effective, non-chemical weed management begins with well planned, diverse crop rotations, especially those including competitive cover (smother) crops. Attention is to be given to careful site selection to avoid introduction of weed seeds and other propagules. Weeds are a big nuisance as they take up the nutrients in the soil and can also harbor insects and diseases that cause harm to tomatoes.

These weeds start growing four to five weeks after transplanting the tomato saplings. Hence focus has to be on extensive weed control during this period. Weeds should not be allowed to grow in numbers. Organic weed control can be achieved by using organic matter as mulches as these restrict weed growth. Crop rotation, mulching, sanitation, and shallow tilling also help in controlling the weeds. After transplantation, regular weeding is required to be done to remove harmful weeds from the field. The plants can be provided support with the help of small bamboo sticks to increase the production.

6.12 Manuring

In order to maintain a fertile soil, organic matter should be added to it regularly. If organic farming is being performed on own land since many years, the soil will have a good nutrient content. Compost / Farmyard manures can also be added to further enrich the soil. Application of organic manure is very important for tomato cultivation. Farm yard manure of 10 t or 1-1.5 t of vermicompost per acre is generally applied. To prevent contamination, FYM can be treated with trichoderma at the rate of 500 g per a tractor load of manure. After mixing the required amount of trichoderma the manure should be allowed to remain in a heap covered with wet gunny bag for proper culturing.

6.13 Plant protection

It is a long-drawn observation that insect pests and diseases first strike the well nourished plants. Therefore the objective of organic methods, is to grow crops which naturally resist the onslaught of pests and diseases. Management of soil tilth, moisture and nutrient status is the first step in effective pest and disease management.

6.13.1 Pests

Crop rotations, which assist in breaking life cycles of insects and pests, is a traditional means of pest control. Control of tomato pests require careful monitoring and integration of cultural practices and biological control. A wide range of biological pesticides are available to keep pests below the threshold level. It has been observed that organic tomato plants have fewer pest and insect problems than the conventional chemically grown tomato plants. Moreover, practicing crop rotation aids in breaking the life cycle of insects and pests thus reducing the pest menace.

Trap crops are also effective in controlling pests. An example of a trap crop is sweet corn. Sweet corn attracts tomato fruit worm and thus protects the tomato crop when inter-planted with it. Fruit Borer is one of the major threats to tomato crop. In order to prevent damage to the crop from fruit borer, marigold should be raised in the adjoining plot to divert the attention of the fruit borer. In case eggs of the insect are found on the leaves of the plant trichocard can be applied. In case, the intensity of pest attack increases, 4% solution of neem seed extract can be sprayed on plants at 15 days interval to control the insect. Among the alternatives, biological control of pests is one of the important means for checking pest problems in tomato.

Biopesticides include living organisms which can destroy pests. Use of biopesticides is one of the most appropriate and promising methods of pest management. *Ha NPV (Nuclear Polyhedrosis Virus)* is used against the *Heliothis armigera* (fruit borer) in tomato. *Trichoderma* is the most widely used fungal biopesticide. It is useful against root fungi. They are ideal for seed treatment also. *Trichogramma* belongs to a large group of egg parasitoids and success has been achieved against the *lepidopteran* pests of commercial crops like tomato. Tricho cards are used against the fruit borers. Neem based pesticides like neem cake, neem seed kernel extract (NSKE), neem leaf extract, neem oil etc., act as a repellent and antifeedent and its oil is effective against fruit borer.

6.13.2 Diseases

Despite good management practices, diseases usually occur, presenting one of the greatest challenges to organic tomato growers. The degree of occurrence is regionally based and largely dependent on environmental conditions. Tomatoes are injured by pathogenic diseases caused by fungi, bacteria, as well as physiological disorders such as cat facing and blossom end rot, which are caused by environmental / abiotic stress.

Pathogenic diseases develop through soil borne and above ground infections, and, in some instances, are transmitted through insect feeding. Major tomato diseases include those that attack the root system (fusarium wilt, verticillium wilt, bacterial wilt, rhizoctonia), above-ground stems and foliage (early blight, leaf spot, bacterial canker, late blight), and fruit (bacterial spot, bacterial speck, anthracnose). Thus, the disease control programme is important at each stage of growth. Organic tomato disease control programs are based on a combination of organic soil management practices, IPM practices and natural remedies. In order to prevent bacteria borne diseases, the resistant varieties can be adopted and as a preventive measure regular crop rotation may be adopted with non solanaceous crop. Accordingly, tomato, potato, chilli and brinjal should not be cultivated successively along with tomato.

6.14 Harvesting

The crop will be ready for harvest in about 2- 3 months after planting. The harvesting of the tomatoes is done as per the requirement of the market and in a typical season 8 to 10 harvesting is done to feed the market as per its requirement.

6.15 Yield

The yield of irrigated tomato varies from 15 to 20 t /acre. In the present model, a conservative yield @ 10 t per acre has been assumed

7. Linkages :

- Government of Jharkhand has signed a MOU with NAFED, International Panacea Ltd. and Panacea Organic Foods Pvt. Ltd. New Delhi for harnessing agriculture through the application of organic farming principles and practices. While NAFED is involved in activities related to supply of seeds, planting material, procurement, storage, grading, processing, packing etc. International Panacea Ltd. and Panacea Organic Foods Pvt. Ltd. New Delhi, is involved in the manufacture and marketing of organic farm products.
- *Promotion of production and use of Organic and Bio fertilizers by Dept. of Horticulture*
Under this programme, it is envisaged to train about 500 farmers and develop infrastructure and demonstration plots (200 compost pits) with a total financial allocation of Rs.50.00 lakh.
- Networking of project on organic farming is being done by Birsa Agriculture University (BAU), Ranchi
- The Capital Investment Subsidy Scheme for Commercial Production Units of Organic Inputs under "National Project on Organic Farming" is under implementation in the state and subsidy is made available for setting up bio-fertilizers / vermi-compost / fruit & vegetable waste compost units.

8. Financial aspects :

8.1 Sale price

The farm gate price of tomato has been considered at Rs. 5.00 per kg .

8.2 Cost of cultivation

The cost of cultivation for 1.0 acre organic tomato cultivation is Rs. 24300/- per acre. The detailed cost of cultivation is given in **Annexure -II**.

8.3 Margin

The percentage of margin / down payment to cost of development prescribed is 5, 10 and 15%

for small, medium and large farmers respectively. The rest of the cost of development will be provided as bank loan. Margin considered in the present model is 10%.

8.4 Bank loan

Bank loan of 85 - 95 % shall be available from the financing institution. Bank loan considered in the model is 90%.

8.5 Rate of interest

The rate of interest to be charged to the ultimate borrower would be guided by RBI guidelines issued from time to time. However, the ultimate lending rate has been considered as 12 % for working out the bankability of the model scheme.

8.6 Security

Banks are guided by RBI guidelines issued from time to time in this regard.

9. Conclusion

The net income from organic cultivation of tomato is Rs. 23000/-. The activity is technically feasible, financially viable and bankable.