Packages and Practices of Orange (*Citrus sinensis*) Production in Jhalawar District of Rajasthan

R. S. Meena, R. L. Meena, R. S. Singh and S. S. Rao
Scientist, National Bureau of Soil Survey and Land Use Planning, Regional Centre, Udaipur
(Indian Council of Agricultural Research, New Delhi)
*Email of corresponding author: mramswaroop@gmail.com*

Jhalawar district is famous for the production and sweetness of the Orange. It is also known as “Nagpur of Rajasthan”, as it stands at second place in orange production in India after Nagpur (Maharashtra). The area around Bhawani mandi (Jhalawar) has distinction of being an important place on fruit map of citrus at national as well as international level exporting a good basket of orange to different foreign countries. The district has more than 30,000 hectares area under orange orchards with 2,00,000 mt of orange production in the year 2013-14.

Introduction

Jhalawar is known as “Nagpur of Rajasthan”, for the production of citrus (oranges) which stands at second place in orange production in India after Nagpur (Maharashtra). The area around Bhawani mandi has distinction of being an important place on the international and national citrus (Naarangi) fruit map. Jhalawar district is known for the highest rainfall in Rajasthan state. This rain is very helpful for the farmers of the region. Besides this satisfying rainfall, district has a lot of irrigation dams, ponds, and medium scale projects, that are serving according to the needs of farmers. Orange-laden orchards provide a tempting sight. Citrus produced in Jhalawar region are of export-quality, and exported to various foreign countries. Citrus-belt is spread mainly around the Bhawani mandi, Jhalarapatan and Pirwa sub-divisions of the district.

According to revenue records, the production of oranges in 1984-85 was merely 794 hectare. Earlier with the establishment of directorate of horticulture at state level in 1989-90, importance was given to increase the production of orange in Jhalawar. Subsequently, the national horticulture mission launched in the year 2004-05, in the state, again major initiatives were taken to increase area and production of orange in the district. As such more than 30000 hectare area is under orchards of orange with 9091 hectare is bearing crop which produced 200000 mt orange in the year 2013-14.

Mandarin orange (*citrus reticulata*) is most common among citrus fruits grown in India. It occupies nearly 40% of the total area under citrus cultivation in India. The most important commercial citrus species in India are the mandarin (*citrus reticulata*), sweet orange (*citrus sinensis*) and acid lime (*citrus aurantifolia*) sharing 41, 23 and 23 % respectively of all citrus
fruits produced in the country. Oranges are mostly grown in the states of Maharashtra, Madhya Pradesh, Tamil Nadu, Assam, Orissa, West Bengal, Rajasthan, Nagaland, Mizoram, and Arunachal Pradesh. Orange is rich in vitamin C, A, B and phosphorus. It is consumed fresh or in the form of juice, jam, squash and syrup. It is the main source of peel oil, citric acid and cosmetics which have international market value.

**Agro-climatic Requirements**
The climatic factors which influence the growth and development of orange are temperature, rainfall, relative humidity, wind and light intensity. A 15°C isotherm during the coldest months forms the geological limit for orange cultivation, which more or less prevails on the latitudes of 35° to 40° north to south. The optimum temperature for growth of orange is between 25° to 30°C. The maximum and minimum endurable temperatures are 38°C and 13°C respectively. An average well distributed annual rainfall of at least 875 mm is required if orange is grown without irrigation.

**Soil**
The main requirement of orange soils is that no water logging should occur. The best soil for orange is a medium textured soil of recent alluvial origin, uniform, reasonably deep and fertile, having good internal drainage and free from injurious salts. Orange requires well-aerated soils devoid of any hard pan layers of CaCO₃ in the root zone. The best pH for orange soils ranges from 5 to 6.

**Propagation**
Orange is propagated by seeds and also vegetative propagated by T-budding. Seedlings are mostly transplanted in the month of July-August after commencement of monsoon. Budding should preferably be done in last week of January or first week of February following the ‘T’ or shield budding method.

**Plantation**
Oranges are usually planted in pits of 50 cm x 50 cm x 50 cm size prepared at specified row x plant spacing. After filling up the pits with soil manure mixture, the seedlings are planted. The best time for planting is the beginning of rainy season. The planting density usually varies from 200 to 400 plants per hectare but high density planting may also be followed using modified agro-techniques. In square system, a spacing of 7 m x 7 m (204 plants/ha) is required.

**Fertilizers**
The recommended fertilizer dose in terms of N, P & K is given in the following table

<table>
<thead>
<tr>
<th>Age of the plant (Year)</th>
<th>Year-wise fertilizer applied (g/plant)</th>
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<tbody>
<tr>
<td></td>
<td>N</td>
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<tr>
<td>1</td>
<td>150</td>
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<tr>
<td>2</td>
<td>300</td>
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<td>3</td>
<td>450</td>
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<td>4 &amp; above</td>
<td>600</td>
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</table>

About one third of the recommended dose of nitrogen should be applied through organic manures like FYM, cakes, etc. In case of non-bearing trees, nitrogen should be applied in split doses during April, August and November; Phosphorus in August and November and Potassium in November. Nitrogen should be applied in three split doses in case of bearing trees during April, August and November along with 200 g. Phosphorus in two split doses in August and...
November and 100 g. Potassium in November for mandarin grown in black clay soil. Micro-nutrients viz. zinc, copper, manganese, iron, boron and molybdenum are required in ample quantities. Improper supply of nutrients may cause serious disorders which may lead to decline of the whole orchard. The micro-nutrients should be supplied through foliar spraying.

**Water Requirement and Irrigation**
Irrigation is provided at an interval of 10-15 days during winter months whereas during summer months it is provided at an interval of 5-7 days. Water requirement of citrus trees is generally higher than most of the other sub-tropical fruits due to recurrent growth and development. The water requirement varies from 900 to 1100 mm/per year depending upon the location. Water requirement of young (1-4 years old), middle (5-8 years old) and mature (9 and more) Nagpur mandarin trees varies from 5 to 15 liters/day, 35 to 105 liters/day and 60 to 170 liters/day, respectively. Drip irrigation leads to effective, efficient and economic use of irrigation water and is recommended specially in low rainfall regions of Maharashtra, Madhya Pradesh and Rajasthan.

**Training & Pruning**
Trees are trained to single stem with 4-6 well-spaced branches for making the basic framework. The lowermost branches are not allowed to grow below the height of 50 cm from the soil surface. Pruning is done during the initial years of planting. The bearing trees require little or no pruning. Main objective of pruning of bearing trees is to maintain the framework and to secure higher yields with better quality fruits. Pruning of bearing trees though differs with variety but chiefly consists of removal of dead, diseased, criss-crossed and weak branches. Removal of water sprouts and suckers of rootstocks is also highly essential. Pruning of non-bearing trees can be done at any time of the year, but for bearing trees the best time is after harvesting, during late winter or early spring when these are in somewhat dormant stage. Root pruning is also practiced in some parts of central and southern India to regulate flowering season.

**Intercultural Operations**
Pre-emergence herbicides (diuron @ 3 kg/ha or simazine @ 4 kg/ha) should be sprayed twice at an interval of 120 days from the last week of May for effective and economical control of dicot and monocot weeds in the orchard.

**Mulching:** Application of dry leaf mulch or paddy husk to a thickness of about 8 cm. In the basin keeps down the weed growth and decreases the number of irrigations and also improves fruit quality.

**Inter-cropping:** Intercrops viz. Pea, cowpea and gram can be taken in mandarin orchards.
**Growth regulators:** Fruit drop in mandarin orange can be controlled in early stages of fruit development by applying two sprays of growth regulators- 2, 4, D (15 ppm) or GA3 (15 ppm) along with benomyl (1000 ppm) and urea (1%) after fruit set at monthly interval in May and June. The same spray schedule may be followed in September and October in order to control the pre-harvest fruit drop.

**Crop regulation:** The winter season fruiting in orange is popularly known as AMBER BAHAR while the summer crop is known as MIRG BAHAR. In south and central India, mandarins bloom thrice a year. February flowering is known as ambe bahar; June flowering as mrig bahar and October flowering as hast bahar. In order to get fruitful yield in any of the three flowering seasons, resting or root exposure or bahar treatment is given in the Deccan region. In this method, roots of the plant are exposed to sun by removing up to 7-10 cm. soil around 40-60 cm. radius of tree trunk. The water is withheld for about a month before flowering. As a result of water stress, leaves show wilting and fall on the ground. At this stage the roots are again covered with a mixture of soil and farmland manure and irrigated immediately. Subsequent irrigations are given at suitable intervals. Consequently, plants give new vegetative growth, profuse flowering and fruiting. However, in light sandy and shallow soils, exposure of roots should not be practiced and mere withholding of water for 2-3 weeks is sufficient for wilting and defoliation of trees. It depends upon the choice of the grower as to which of the three bahars is to be taken to get maximum profit. As the availability of water is a problem in central India during April-May, the farmers prefer ‘mrig bahar’ so that the plants are forced to rest in April-May and no water is required during the period. Plants put forth new vegetative growth, followed by flowering (July-August) and fruiting during the coming season. Resting treatment is not feasible in north India, as mandarin plants normally rest in winter and flower once a year.

**Plant Protection Measures**

(a) **Insect pests:** Devitalization of plants due to poor fruit set, fruit drop both at bearing and maturity stage, stem tunneling, bark removal, girdling etc., on account of the attack of the different insect pests viz. Citrus black fly, citrus psylla, citrus leaf miner, bark eating caterpillar, mealy bugs, citrus aphids, citrus thrips, fruit fly, mites etc. Results in poor performance by the tree in terms of quality fruit production. Spraying with insecticides viz. Monocrotophos, phosalone, dimethoate, phosphamidon, quinalphos etc. Depending upon the type of pest infestation has been found to be effective in most cases.

(b) **Diseases:** The main diseases reported are twig blight, gummosis, damping off, root and collar rot. The affected plants should be sprayed with ridomil mz 72, bavistin, benomyl etc. Depending on the type of infection.

**Harvesting and Yield**

Fruits are harvested when they attain full size, develop attractive colour with optimum sugar and acid blend. Fruits should be harvested preferably with clipper, shears or secateurs. Mandarins should not be harvested in wet weather or during rains.
Mandarins start bearing from the fourth year but substantial yield can be expected only from sixth year onwards. Mandarin produces 500-800 fruits after about 9-10 years. However, its plants attain the level of full bearing at the age of 10-12 years. The net productive life span of mandarin orchards after deducting the first 5 pre-bearing years is only 15-20 years. Degreening of mandarins by applying ethrel (50 ppm) one week before the actual date of harvesting has become a commercial practice in most of the developed mandarin growing countries. Further, fruits dipped in 50 ppm Ethrel after harvesting develop golden yellow colour within 5 days of the treatment. Average yield is 4.8 tonnes/acre.

**Post Harvest Management**

(A) **Grading:** Fruits are graded on the basis of their size and colour. The fruits which are oblong, high collard, immature, puffy, blemished, deformed, deep green coloured, bruised and diseased are removed during the sorting operation.

(B) **Storage:** Green or fully ripe fruits can be stored in evaporative cool chamber at 8-10°C & 90-95% relative humidity for a period of three weeks after post-harvest treatment with bavistin (1000 ppm). Yellowish green fruits develop attractive yellowish orange in this chamber.

(C) **Packing:** The harvested fruits are usually washed with chlorine (1000 ppm) and after removing the surface water they are coated with stay fresh high shine wax (2.5%) containing bavistin (4000 ppm) and finally dried at 50°-55°C in the tunnel dryer. Fruits are usually packed in wooden boxes for distant markets, while for local marketing baskets of split bamboo and mulberry are used. Chopped straw and dry grass is mostly used for padding. The fruits should be cleaned and polished lightly with a piece of cloth, before wrapping them in tissue paper or newspaper. Use of ventilated corrugated fibre board cartons in place of wooden boxes is highly beneficial.

(D) **Transportation:** mandarins are generally transported by rail or road as ordinary cargos without refrigeration.

**Conclusion**

Jhalawar is known for the Orange production as well as for its unique test. Orange exports to the international market helps to earn foreign currency for the state as well as for the country. It is the main source of peel oil, citric acid and cosmetics which have international market value. Orange is also important for its nutritious value as this fruit is rich in vitamin c, a, b and phosphorus. It is consumed fresh or in the form of juice, jam, squash and syrup. So we should try to provide the information to the farmers about its cultivation methods with package and practices for the higher production of the Orange in the state as well as in the country.

**References**