

Research and Methods

Cultivation of litchi

Litchi sinensis Sonn.

Sapindaceae

Origin: southern China (Canton region)

Requirements of litchi

The good phytosanitary state of the trees involves a set of techniques that are all essential: sanitary selection of the plant material, choice of variety and choice of location.

Cultivation zones

Litchi requires a warm, humid climate. In order to flower, it needs a vegetative resting period induced by a cool, dry season. A slight fall in temperature can induce flowering in some humid zones subjected to harmattan winds. A good supply of moisture is essential from the appearance of the flower spikes until harvesting.

Wind-breaks

The position of the land must allow good lighting. Poorly drained low-lying land should be avoided, as should steep slopes that hinder the mechanisation of maintenance work. The land must be sheltered from the prevailing winds and from sea spray near the coast. If there is no natural protection (relief, vegetation), wind breaks are installed around the field and even inside it if it is large or very exposed. Wind breaks consist of fast-growing trees with good anchorage in the ground (filao, eucalyptus, shisham, acacia and others) planted in dense rows and require maintenance (fertilisation, irrigation and pruning). They must be allowed sufficient space.

As far as possible, wind breaks should be installed a year before the litchis are planted to give protection from planting onwards. A wind break provides protection for a distance equal to ten times its height. They should be planted closer together in sloping land. They sometimes do not have any effect in extreme cases.

Soils

Litchi adapts to numerous types of soil but prefers slightly acid soils (pH 5.5 – 6.5) that are rich in organic matter, deep and well drained.

Although it can stand having 'wet feet' temporarily near rivers, prolonged submersion can be harmful. Drainage is all the more important as litchi is grown in zones with high rainfall and often in low-lying areas protected from wind.

The creation of orchards

Soil preparation

Planting in recently cleared land in which stump and root debris enhance the development of root rots should be avoided. If necessary, surface drainage is ensured by levelling and subsoil drainage by a network of ditches. If cultivation can be mechanised, deep subsoiling is followed by ploughing, possibly after the application of manure and phosphate and potassium fertiliser (in the light of the results of soil analysis). If planting is performed in holes, blanket chemical weed control must precede this operation.

Plants

Propagation is usually by air layering using trees noted for the quality of their production. The layers obtained during the hot, humid season from branches 10 to 15 mm in diameter and 0.50 to 0.70 m long have a small necrotic root point at the cut that heals quickly. The root system is also better balanced with the aerial part. After separation, the marcots are cultivated in pots in a nursery for 3 or 4 months before being transplanted to the orchard.

Planting density

The litchi tree displays considerable growth. Today, planting distances are 10 x 10 m or 8 x 10 m, that is to say a density of 100 or 125 trees per hectare. Nevertheless, plantation at 8 x 6 m (208 trees per ha) or 8 x 5 m (250 trees per ha) can be envisaged in more intensive cultivation. Annual pruning is necessary in this case. The orchard can be thinned by gradually cutting back the trees when they begin to hinder each other and then, in the absence of an effective pruning method, by felling one tree in two along the row.

Varieties

A great number of varieties exist around the world. Only those seen on export markets are mentioned here.

Kwai Mi

The fruits are medium-sized (22 to 25 g) and bright red in clusters of 12 to 30. Fruit quality is good. This is the most widespread variety in the Indian Ocean. Production is steady with little alternate bearing. The trees are of medium vigour slender.

Shahi (Muzaffarpur)

The fruits are medium-sized (20 to 25 g), bright pink and in clusters. The pulp is sweet. This is the most common variety in Bihar State in India. It is of very good export quality but susceptible to cracking and sun-scorch. The trees are vigorous with steady production (80 to 100 kg per tree).

Rose scented

The fruits are medium-sized (16 g), globular and heart-shaped. The pulp is very sweet with an aroma of roses, whence its name. The variety is grown mainly in Uttaranchal in India.

Haak Yip (Black leaf)

The fruits are medium-sized (20 g), dark red and in clusters of 15 to 25. The peel is smooth and hard. The pits are medium to large. The flesh is good to excellent, sweet and aromatic and forms 70 percent of the fruit. The trees are of medium vigour, compact, straight and bear well.

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Planting

Planting must be performed with a strict layout and perfectly aligned in each direction. If cultivation is not mechanised, a 0.8 x 0.8 x 0.8 m (500 litres) hole must be dug at the position of each seedling. The soil removed is then mixed with about 2 kg potassium sulphate + 2 kg natural phosphate + 25 to 30 kg well-rotted manure. The hole is then refilled with this mixture. A slight mound is formed as a result of the manure application and the expansion of the soil. The plants are installed in the mound and staked.

When budded plants are used, the soil of the mound must in no case be higher than the collar of the stock. Marcots are planted inclined in the opposite direction to the wind and staked. They are thus less exposed to the wind and root better. The plants must always be watered abundantly after planting. In cool zones, they must be sheltered during the winter following planting.

Orchard maintenance

Training pruning

As for other fruit species, it is sought to train the tree on a single trunk with horizontally spaced, regularly distributed main branches. Care must be taken in the early years to prevent the forming of shoots on the trunk or the main branches that have a very closed angle, following the natural tendency of litchi. These shoots are extremely weak points during strong wind.

Soil maintenance

The soil must be bare along the rows or under the foliage in the early years. Spontaneous inter-row vegetation must be kept down. Short-cycle, small growth intercrops can possibly be grown during the first three years and managed in such a way as not hinder the trees.

Irrigation

Litchi is very susceptible to water stress throughout the fruit growth period and the vegetative growth period that follows the harvest. Irrigation is necessary in case of shortage of water. Stress during fruit setting causes substantial fruit drop. Different irrigation systems can be envisaged. Microjet irrigation is

satisfactory. At least 200 mm water per month must be applied (according to soil type, the age of the trees, etc.).

Maintenance pruning

The fruits are in clusters at the extremities of the branches. The latter are broken at harvesting. However, this practice does not enable control of the volumes of the trees. The removal of dead wood, of small inner branches and branches that prevent sunshine from entering the tree is recommended.

Litchi growth is fast and soon becomes exuberant. The trees must therefore be controlled. For this, annual pruning is performed just after the harvest. The trees are usually too dense. The aim is to aerate them by allowing as much light as possible on the foliage and to keep them at a suitable height to make harvesting easier. The final result of pruning should be dome-shaped trees.

Fertilisation

Fertilisation is an important factor. It promotes good vegetative growth after the harvest and makes up for the exporting of minerals in the fruits. After the active vegetative growth period of about four months, litchi needs a short period of stress (nutritional, water, heat or other) to allow flower induction. The following applications are recommended:

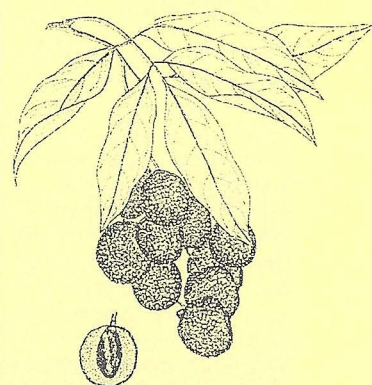
| Year | N | P | K | MgO |
|----------|-----|-----|-----|-----|
| 1 | 50 | 10 | 40 | 15 |
| 2 | 80 | 10 | 60 | 20 |
| 3 | 140 | 30 | 105 | 40 |
| 4 | 210 | 45 | 160 | 55 |
| 5 | 230 | 65 | 265 | 80 |
| 6 | 380 | 85 | 345 | 105 |
| 7 | 470 | 105 | 430 | 125 |
| 8 | 570 | 125 | 520 | 155 |
| 9 | 670 | 150 | 610 | 180 |
| 10 and + | 920 | 210 | 840 | 240 |

Grams per tree

Doses are modulated according to the date of application:

- after the harvest: 1/2 of the dose;
- at panicle emergence: 1/4 of the dose;
- after 'June drop': 1/4 of the dose.

Fertiliser is applied to the ground beneath and at the limit of the foliage. Trace elements are applied by leaf spraying at fruit setting.



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Harvesting

Traditional harvesting is performed manually with the clusters of fruits on branches stored in sacks containing 30 to 35 kg of fruit. The fruits at the bottom are therefore often crushed. These hand-made bags conserve good humidity around the fruits, preventing them from drying out. It is better to use slightly ventilated plastic crates to avoid crushing the fruits. The treatment and marketing of fruits are rapid to avoid the peel discoloration resulting from drying. The post-harvest biochemical characteristics of litchi do not display noteworthy evolution except for gradual deterioration. Fruit maturity is generally appraised on the basis of colour, peel texture and tasting. It is considered that a soluble dry matter/acidity ratio of 2.1 to 2.7 corresponds to optimum quality.

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Post-harvest treatment and packing

Litchi evolves very rapidly at ambient temperature. The shell turns brown, dries and becomes brittle in two or three days. The loss of colour results from the oxidation of anthocyanin pigments (an irreversible reaction). The fruits are then more subject to cracking and secondary contamination by fungi. Several treatments can be used to prolong conservation. Treatment with sulphur dioxide extends product life for several weeks. It is used above all for export since France gave provisional authorisation for sulphur treatment in 1987. Sulphur residues in fruit pulp must not exceed 10 mg/kg. Sulphur has fungicidal and antioxidant effects and conserves the flexibility of the shell.

The treatment can be applied to healthy, ripe fruits with no blemishes, insect damage or traces of moisture on the shells. It is suitable for both separate fruits and fruits in clusters. The dose used is 600 g powdered sulphur per tonne of fruits. The sulphur burns for 30 to 40 minutes in a closed chamber. After treatment, the fruits are entirely yellow. They are sorted again and packed in 500 g plastic punnets or 2 to 4 kg cardboard boxes for shipping by air. They conserve their yellow colour as long as they are kept cold and enclosed. They gradually recover their pink ochre or red colour when they are placed in warmer, more moist and ventilated conditions enabling the elimination of the sulphur.

Phytosanitary protection

Main fruit pests

- *Cryptophlebia peltastica* and fruitfly
Cryptophlebia lays eggs on immature fruits. The small caterpillars bore into the fruit to the seed for the nymph stage. The wound opens the way for other pests, especially fungi and fruitflies.

Treatment one month before harvesting: liquid Lebaycid (fenthion 550 g/l) 170 cc/hl or Sumicidin 10 (fenvalerate 100 g/l) 100 cc/hl.

Treatment 14 days before harvesting with one of the following products whose waiting period before harvest is less than 7 days:

- insecticides: Decis (deltamethrin 25 g/l) 80 cc/hl or Cymbush (cypermethrin 100 g/l) 30 cc/hl;
- fungicides to control any postharvest fungi: Sumisclex (procymidone 500 g/l) 150 g/hl, Rovral (iprodione 50 %) 400 g/hl or Euparen (dichlofluanide 50 %) 250 g/hl.

Main foliage pests

- Scales
Scales can infest fruits, leaves, stems, branches and the trunk. When numerous, they cause the withering of leaves and shoots. Leaves often display yellow spots where they have been pricked. Scale infestation is often accompanied by sooty mould.

Treatment: Itracide (medidathion 193 g/l) 300 cc/hl, Lannate (methomyl 200 g/l) 50 g/hl or petroleum oil (citrole 2 l/hl).

- Mites: *Aceria litchi* (Erinose mite)
This is a serious pest in India and China, attacking flowers and leaves. The leaves crinkle and the undersides acquire a brown coating.

| Plastic punnets (500 g) covered by food grade plastic film | Cold | Acceptability in days |
|--|------|-----------------------|
| Fresh litchis | 1°C | 14 |
| | 10°C | 7 |
| | 20°C | 4 |
| Litchis after sulphur treatment | 1°C | 45 |
| | 10°C | 25 |
| | 20°C | 15 |

Treatments with micronised sulphur are preferable to other treatments: Kelthane (dicofol 480 g/l) 100 cc/hl or Plictran (cyhexatin 25 %) 60 cc/hl. These are applied by leaf spraying.

Trunk and branch pests

- Bark-borer caterpillars (*Indarbela quadrinotata* and *I. tetroanis*)

Very common in India. Damage is caused by the larvae that bore into bark and trunk, reducing sap movement and affecting growth.

Treatment: remove the affected parts, coat holes with Thiodan (endosulfan). Cover the trunks with mud after application of the treatment.

- Bark borer: *Salagena* spp.

The larvae feed on the bark and wood of the tree. The tree does not die but the branches wither.

Treatment: these larvae can be controlled by stopping the holes with cotton wool soaked in systemic insecticide.

- Thrips

Dolicothrips indicus and *Magalurothrips usitatus* cause damage to flowers. *Selenothrips rubrocinctus*, *Heliothrips haemovoidalis* and *Franklinella cephalica* cause the withering of flowers and leaves.

Treatment: Rogor (dimethoate 500 g/l) 100 cc/hl, Decis (deltamethrin 25 g/l) 80 cc/hl or Klartan (fluvalinate 240 g/l) 60 cc/hl.

Diseases

- Root rot

This is caused by the fungus *Clitocybe tulescens*. Much damage is reported in Florida. *Botryodiplodia theobromae* can cause sudden death of the tree (Australia).

- Aerial system

Leaf necrosis caused by *Gloeosporium* spp. This is observed in certain poorly managed orchards.

NB. Treatments and products must be applied in conformity with the regulations in force.

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