Litchi

Cultivation

by Christian Didier

Requirements of litchi

Specific climatic conditions are required for litchi growing but the tree is not very fussy about soils. It also has low susceptibility to viral diseases.

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 and relative humidity may induce flowering in some humid zones. A good supply of moisture is essential from the appearance of the flower spikes until harvesting.

Windbreaks

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), windbreaks are installed around the field and even inside if it is large or very exposed. Wind breaks consist of fast-growing trees with good anchorage in the ground (filao, 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 on 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 to 6.5 and 8 or higher in some parts of India) 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.

Orchard creation

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 light of the results of soil analysis). When the trees are planted in holes, inputs are applied at this stage.

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.

Plantation 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, planting 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.

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.

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 formation 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 in 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, the climate, etc.).

Maintenance pruning

The fruits are clustered at the extremities of the branches. The latter are broken at harvesting. However, this practice does not control the tree volumes. 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 facilitate harvesting. 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 mineral loss to 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 induce flowering.

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 (boron, calcium).

Harvesting

Traditional harvesting is performed by hand with 'bunches' of fruits of the branch stored in bales or crates containing 10 to 15 kg only so that the fruits at the bottom are not crushed. These hand-made bales 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 fruits are rapidly treated and taken to market to avoid the peel discoloration resulting from drying. Litchi is not a climacteric fruit and its biochemical characteristics change little after harvesting, 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.

Litchi - Applications recommended
Grams per tree

Years	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 years and above	920	210	840	240

Pests and diseases

Warning: treatment must be applied in compliance with the regulations in force in the producer country and in the destination country.

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 fruit flies.

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.

- Mites: *Aceria litchi* (Erinose mite)

  A major pest in India and China, which attacks the flowers and leaves. The leaves wither, and their bottom side is covered with a brown film.

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.

- 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 rubrocinatus*, *Heliothrips haemovoidalis* and *Franklinella cephalica* cause the withering of flowers and leaves.

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.

C. pelastica

Fruitfly

Leaf-borer caterpillar

Bark borers

Anthracnose

Post-harvest and sulfur treatment

A feature of litchi is that it does not ripen after picking and so it is essential to harvest the fruit when it is fully ripe. However, it deteriorates very rapidly at ambient temperature. The shell browns, dries and becomes brittle in two or three days. Loss of colour results from the oxidation of anthocyanin pigments, an irreversible reaction. The fruit is then more subject to bursting and secondary contamination by fungi.

To prevent senescence before the fruit is sold, litchi can be fumigated with sulfur dioxide; this inhibits respiration and thus conserves texture and organoleptic qualities for several weeks. Sulfur has a fungicidal, anti-oxidant effect that keeps the shell flexible. This treatment can be applied to destemmed fruits or bunches that are sound, ripe, free from spotting, insect pricking and traces of damp on the shell. Sulfur is burned in a closed chamber containing the fruits. It causes the shells to turn yellow, whereas they are naturally pinkish red when the fruits are ripe. The fruits are then sorted again and packed. They remain yellow for as long as they are kept chilled. The colour gradually changes to pink ochre or purplish red when under warmer, moist, ventilated conditions to eliminate the sulfur.

Sulfur treatment is the cornerstone of litchi marketing insofar as it lengthens conservation time, providing access to sea transport and hence large-scale exports. The procedure is used for several other fruits such as table grapes and dried fruits and it is also used for wines. The main difference is that litchi shells are not edible. Sulfur treatment is permitted in Europe under certain conditions. Consumer health protection regulations stipulate that the residual sulfur content must not exceed 250 mg/kg in the shell and 10 mg/kg in the fruit pulp. Numerous experiments have been conducted to define treatment procedures so that these limits are respected. Both professionals and the European authorities pay close attention to the issue. Numerous control operations are performed throughout the life of the fruit in order to ensure that the regulations are respected. The gradual implementation of certification by operators should enhance product traceability and the mastery of treatment operations.

The continued use of sulfur is questioned from time to time. Indeed, with the regulations generally moving towards the protection of consumer health, there is a great risk of heading towards a reduction in residue levels at best and at the worst banning treatment. One of the roles of the sector is therefore to pay great attention to changes in the regulations concerning this point. A search for new conservation methods can also be an important approach. Unfortunately, litchi does not have sufficient economic weight to mobilise the resources required for such research, as is the case for other fruits.

Temperature during storage and transport is another key component in maintaining fruit quality over time. Indeed, chilling after harvesting, treatment and packing is performed by the transport facilities used. Here, it will be noted that litchi is one of the few tropical fruits that can withstand low temperatures (1°C ± 0.5°C). The combination of sulfur treatment and chilling allows good conservation of litchi. Fast chilling to the heart of the fruit is important for maintaining quality. Chilling must then be maintained to ensure as long a life as possible for the fruits. Any change in temperature may cause fruit deterioration and senescence.

Before sulfur treatment

After sulfur treatment

Photos © Christian Didier