



Litchi

PRODUCTION GUIDELINE



agriculture,
forestry & fisheries

Department:
Agriculture, Forestry and Fisheries
REPUBLIC OF SOUTH AFRICA



Litchi

PRODUCTION GUIDELINE

March 2013

Directorate: Plant Production

Department of Agriculture, Forestry and Fisheries

2013

Published by

Department of Agriculture, Forestry and Fisheries

Design and layout by

Directorate Communication Services

Private Bag X144, Pretoria 0001

Disclaimer

This document has been compiled by the Department of Agriculture, Forestry and Fisheries and every effort has been made to ensure the accuracy and thoroughness of the information contained herein and the department cannot be held responsible for any errors, omissions or inaccuracies in such information and data, whether inadvertent or otherwise. The Department of Agriculture, Forestry and Fisheries therefore accepts no liability that can be incurred resulting from the use of this information.

Contents

Part 1: General aspects

1. Classification	1
2. Origin and distribution	1
3. Production levels	1
4. Major production areas in South Africa	2
5. Cultivars	2
6. Description	3
7. Climatic requirements	4
8. Soil requirements	5

Part 2: Cultivation practices

1. Propagation	5
2. Soil preparation	5
3. Planting	5
4. Fertilisation	6
5. Irrigation	8
6. Weed control	8
7. Pest control	9
8. Disease control	10
9. Other cultivation practices	10
10. Harvesting	11

Part 3: Post-harvest handling

1. Sorting	11
2. Post-harvest handling	12
3. Grading	12
4. Packaging	13
5. Storage	14
6. Marketing	14

Part 4: Production schedule 15

Part 5: Utilisation 15

Part 6: References 15

PART I: GENERAL ASPECTS

1. Classification

Scientific name: *Litchi chinensis*

Family: *Sapindacea*

Common names: Litchi

2. Origin and distribution

The litchi is indigenous to a small subtropical area in the south of China. Literature reveals that litchi trees were imported into South Africa from Mauritius in 1876, but some trees had already been noticed in Natal (now KwaZulu-Natal) in 1875, which indicates earlier imports. Different cultivars were established in Natal and later in the former Transvaal (now Mpumalanga Province) Lowveld and other suitable frost-free areas of the country. These trees were brought to the Lowveld (Barberton area) by one Todd by ox-wagon more than 100 years ago and planted on the property Litchi Farm, where they continue to yield constant, satisfactory crops.

3. Production levels

3.1 South Africa

The litchi industry in South Africa is well established and exhibits a slow, yet rising trend with regard to new plantings and production. The present production in South Africa is approximately 18 000 tons per annum during a good season; most of this is being sold locally, as fresh fruit, on the Johannesburg market. The export potential for litchi is good. There is great demand for the fruit in England, while the European market is still not exploited. Depending on the local market prices and season, about 1 000 tons are exported annually.

3.2 Internationally

Most of the world litchi crop is produced in the East (China and India). Production in India is 92 000 tons, of which 2 000 are exported. Litchis from the East are exported to Western countries mainly in a preserved form, or as dried litchis (litchi nuts). Of the Western countries where litchis are produced, South Africa is the biggest and marketing possibilities are good, because the fruit is exported during Christmas and New Year when there is a great demand for exotic fruit.

4. Major production areas in South Africa

Province	Production areas
Mpumalanga	Mbombela
	Malelane
Limpopo	Trichardtsdal
	Tzaneen
	Louis Trichardt (Makhado)
	Levubu

5. Cultivars

The choice of cultivars is based on quality, adaptability and reliability, susceptibility to diseases and pests, plant growth and habit, the specific market and planting time.

Name of cultivar	Characteristics
Mauritius group	This group is the most frequently planted, both locally and abroad. The cultivars produce satisfactory yields and fruit of good quality. Cultivars include HLH Mauritius, Hazipur, Late Large Red, Muzaffarpur, Rose-Scented and Saharan.
Chinese group	Cultivars in this group do not produce as large yields as the Mauritius group, but the fruit is of excellent quality and has a high percentage of chicken-tongue seeds. Cultivars include Haak Yip, Kontand, Glutinous Rice, Shang Shou Hai, and Three Months Red.

Name of cultivar	Characteristics
Madras group	These trees bear very colourful red fruit, but the fruit quality is not as good as the fruit quality of the other two groups. The fruit flesh is soft and watery and the seed is large. The trees also tend to alternate bearing. Cultivars in this group are Bedana, Brewster, Durbhanga, Em-merson, Hazipur, Johnstone’s Favorite, Kafri, McLean’s Red, Madras 19, Ma-ries, Mooragusha and Shorts Seedless

6. Description

6.1 Mature plant

The litchi tree is attractive, dense, round-topped, slow-growing, 9 to 30 m high and equally broad.

6.1.1 *Roots*

Litchi has a strong taproot and some spreading in surface.

6.1.2 *Leave*

The leaves are evergreen, 12, 5 to 20 cm long, are pinnate, having 4 to 8 alternate, elliptic-oblong to lancelet, abruptly pointed leaflets, somewhat leathery, smooth, glossy, dark green on the upper surface and greyish-green beneath, and 5 to 7,5 cm long.

6.1.3 *Flowers*

The tiny petals, greenish-white to yellowish flowers are borne in terminal clusters to 75 cm long.

6.1.4 *Pollination*

Through faulty pollination, many fruit have shrunken, only partially developed seeds (called “chicken tongue”) and such fruit are prized because of the greater proportion of flesh. In a few days, the fruit naturally dehydrates, the skin turns brown and brittle and the flesh becomes dry, shrivelled, dark brown and raisin like, richer and somewhat musky in flavour. Because of the firmness of the shell of the dried fruits, they came to be nicknamed “litchi,

nuts” by the uninitiated, and this erroneous name has led to much misunderstanding of the nature of this highly desirable fruit. It is definitely not a “nut”, and the seed is inedible.

6.1.5 Seed

There is much variation in the size and form of the seed. Normally, it is oblong, up to 20 mm long, hard, with a shiny, dark-brown coat and is white internally.

6.2 Essential part

Fruits are in loose, pendent clusters of 2 to 30 are usually strawberry-red, sometimes rose, pinkish or amber, and some types tinged with green. Most are aromatic, oval, heart-shaped or nearly round, about 2,5 cm wide and 4 cm long; have a thin, leathery, rough or minutely warty skin, flexible and easily peeled when fresh. Immediately beneath the skin of some varieties is a small volume of clear, delicious juice. The glossy, succulent, thick, translucent-white to greyish or pinkish fleshy aril, which usually separates readily from the seed, suggests a large, luscious grape. The flavour of the flesh is sub-acid and distinctive.

7. Climatic requirements

7.1 Temperature

Litchis grow best in a subtropical climate with high summer temperatures, low and frost-free winter temperatures. Low winter temperatures are essential for bringing about the necessary physiological changes to stimulate flower initiation. Temperatures of below 0 °C can cause damage on flowers and young shoots. The frost-free areas of South Africa with a high summer rainfall and humidity (especially the Mpumalanga Lowveld, the Soutpansberg area and the KwaZulu-Natal coastal area) are therefore most suitable. For successful litchi production, the climate must comply with the following:

- The average monthly maximum temperature during summer must be below 32 °C, but above 26 °C
- The average monthly minimum temperature must be above 6 °C, but less than 14 °C for the 3 to 4 winter months
- The relative humidity from October to fruit maturing must be more than 50%.

7.2 Water

In litchi production, high summer rainfall promotes maximum fruit growth and yield. Adequate water must be available from flowering until the fruit can be harvested, that is from August to January. Sufficient soil moisture must be available during the flowering period and for 7 to 8 weeks after flowering because this is the most important period of fruit set and the start of cell division in the young fruitlet, especially in the skin and the young embryo (seed).

8. Soil requirements

Litchis grow well on sandy soils in the cooler subtropical areas of South Africa. A huge network of fine roots has been observed up to a depth of 4 m in such soils. However, the trees also grow and produce on clayey soils, but have a shallower root distribution. The crop is therefore well adapted to various soil types.

PART II: CULTIVATION PRACTICES

1. Propagation

Propagation is by means of air-layers that are made during August and which are cut off in January or February. Optimum root growth of the air-layer is obtained during the summer months.

2. Soil preparation

Soil testing is very important before planting in order to determine the soil pH and the availability of excess deficiency of macro and micro elements in the soil. Phosphorus is a serious problem in South African soil, so it is important to check if the levels of phosphorus and potassium are adequate. Normally, if there is a shortage in application of lime and fertilisers as recommended from the soil test result, it is advisable to cultivate phosphorus and lime in the soil because they move very slowly.

3. Planting

Grafted trees or trees developed from air-layers are ready for planting after the required breeding period in the lath-house or in the shade. Litchi trees can be planted at any time of the year, but the spring months or the onset of the rainy season would be the best time. It is advisable to dig the planting holes in advance and about twice as deep as the container in which the

trees were bought. The topsoil can be mixed with compost in the hole to create a favourable medium for good root development.

When the young tree is planted, the soil around the roots should be retained and root damage must be restricted to the absolute minimum. Immediately after planting, the soil around the tree must be thoroughly wetted and the basin around the tree must be about 1 m² with a high ridge to make thorough irrigation possible. The placing of mulch in the basin around the tree immediately after planting is strongly recommended. It is essential to irrigate the young trees regularly after planting. Under no circumstances must they suffer a water shortage.

4. Fertilisation

It is important to do a soil analysis before any fertiliser can be applied. Soil testing provides information that is useful in developing litchi fertilisation programmes. Soil pH should be monitored through soil testing, because pH influences the availability of most nutrients for the plants. However, direct measurements of the soil nutrient level are generally a crude indicator of orchard nutrient status.

It is important not to fertilise young, transplanted trees too soon. Fertiliser should be spread evenly about 0, 5 m outside the drip of the tree and it should not be incorporated because the litchi plant roots are sensitive to damage. Once the trees are established and start growing, fertilisation should be applied regularly according to the following quantities:

Age years	LAN 28 % N	Super-phosphate	Potassium chloride
1	200	250	50
2–3	500	250	100
4–5	1 000	250	200
6–7	1 500	500	300
8–9	2 000	500	400
10–11	2 500	750	500
12–13	3 000	750	750
14–15	3 500	1 000	1 000
15 and older	4 000	1 000	1 000

*Quantity of fertiliser per tree, per annum, according to age (g)

4.1 Nitrogen (N)

4.1.1 *First year*

Divide the nitrogen fertiliser into eight (8) equal monthly applications of 25 g each and apply during summer (September to April).

4.1.2 *Second to fifth year*

Divide the nitrogen fertiliser into five (5) equal applications and apply during summer (September to April).

4.1.3 *Sixth year and older*

Half of the nitrogen fertiliser is applied immediately before flowering and the remainder just after harvesting.

4.2 Phosphate (P)

All the phosphate is applied immediately after harvesting.

4.3 Potassium (K)

Half of the potassium fertiliser is applied just before flowering and the remainder after harvesting.

4.4 Zinc (Zn) and boron (B)

Zinc must be applied at least four (4) times a year. The following substances and concentrations are recommended per 100 ℓ of water:

- Zinc oxide at 200 g or
- Nitro-Zn at 150 ml or
- Agri-zinc at 50 ml.

Spray the trees from soon after planting with 100 g borax or 75 g Solu-bor/100 ℓ water every 2 years.

4.5 Organic fertiliser

Kraal or chicken manure can be used as additional fertiliser at 2 or 1kg, respectively per mature (10 years) tree, spread evenly in the drip area. However, if no other fertiliser is available, kraal manure can be applied as follows:

Tree age (years)	Kraal manure (kg/tree/year)	Time of application
1	5	± 1 kg every six (6) weeks from September to April
2—3 4—5	15 25	Give five (5) equal dressings between September and April
6—7 8—9 10—11 12—13 Maximum	40 55 70 80 100	Give half ($\frac{1}{2}$) the quantity before blossoming and the remainder after harvesting

5. Irrigation

It is advisable for the grower to irrigate the orchards using drippers or micro sprinklers because they are a prerequisite for the regular production of high quality fruit. The trees are irrigated from flowering onwards until the completion of the post-harvest flush. However, the growers normally irrigate the tree at 7 to 10 day intervals from panicle emergence to fruit harvest or until the post-harvest flush appears.

6. Weed control

Weeds compete with the trees for water and nutrients. Problems are avoided by maintaining a mown sward of mixed grasses and broadleaf species or cover crops between the rows. Weeds under the trees can be controlled by mulching, chipping and spot-spraying with herbicides.

Mulches used include wheat, barley or rice straw, hay, sorghum stubble and similar materials. Reduce costs by growing mulch material between the rows for later slashing. Renew the mulch as it breaks down. Keep it well away from the trunks as collar rots may develop. Mulches also increase soil organic matter, improve soil structure, increase water retention and help reduce fluctuations in root temperature.

Apply herbicides to the border of the mulched area and to individual weeds that grow through the mulch. Use glyphosate at 5 to 10 ml per litre or paraquat at 1 to 6 ml per litre plus a wetter at 1,25 ml per litre to control grasses and broadleaf weeds. Grasses can also be controlled with fluzafop-p (Fusilade 212) at 1,25 to 10 ml per litre. Do not allow the herbicides to contact any green part of the tree, including the trunk. Drift can be minimised by using a shielded, low-pressure fan or flood nozzle, or alternatively, use a rope wick applicator. Herbicides are very expensive in parts of Asia. With relatively low labour costs, chipping is more practical.

7. Pest control

7.1 Fruitflies

They cause severe damage to litchi fruit, especially during fruit formation. The small holes pierced through the skin by the fruitflies are invisible to the naked eye, but stung fruit will crack or be attacked by fungi, which will cause the fruit to rot on the tree or after harvesting.



7.3 Control

The use of bait must be applied correctly and regularly to ensure good results – 5 g trichlorfon 95% wsp + 25 ml protein hydrolysate (or 800 g sugar) + 10 litres of water. Apply to each tree by using a knapsack sprayer. Apply twice a week.

7.4 Litchi moth



This species also attacks macadamia nuts and is related to the false codling moth, *Cryptophlebia leucotreta* (Meyrick), although it has not been recorded on citrus yet, which is the main host of the latter pest. The abundance of false codling moth and litchi moth varies considerably from season to season.

The litchi moth lays her eggs on the skin of the fruit during the development stage. The newly hatched larva tunnels through the skin and into the seed where the insect develops into a red larva, which changes into a pupa. Infested fruit sometimes rot on the tree because of fungus attacks through the hole where the larvae penetrated. Alternatively, the damage is not noticeable at harvest time and decay only sets in during transit or marketing. Chemical control has so far not been very successful, but the use of litchi bags.

8. Disease control

Few diseases have been reported from any litchi-growing locally. The glossy leaves are very resistant to fungi. Leaf spots caused by *Botryodiplodia theobromae* and *Colletotrichum gloeosporioides*, begins at the tip of the leaflet. Lichens and algae frequently grow on the trunks and branches of litchi trees. The main post-harvest problem is spoilage by the yeast-like organism, which is quick to attack warm, moist fruits. It is important to keep the fruit dry and cool, with good circulation of air. When conditions favours rotting, dusting with fungicide will be necessary.

9. Other cultivation practices

The stage of maturity at which fruit is harvested is one of the most important factors that determine the ultimate quality at the point of sale. Litchis do not develop further after picking. The fruit must therefore remain on the tree until

quite ripe. Litchis harvested too early have an unattractive colour and have a sour taste. Ripe fruit has an average mass of between 21 and 25 g. Fruit with a mass of at least 21 g is therefore ready for harvesting during a normal season.

10. Harvesting

10.1 Harvest maturity

The stage of maturity at which fruit is harvested is one of the most important factors that determine the ultimate quality at the point of sale. Litchis do not develop further after picking. The fruit must therefore remain on the tree until quite ripe. Litchis harvested too early have an unattractive colour and have a sour taste. Ripe fruit has an average mass of between 21 and 25 g. Fruit with a mass of at least 21 g is therefore ready for harvesting during a normal season.

10.2 Harvesting methods

Litchis for fresh consumption are harvested by hand, leaving the pedicels intact. They are harvested at firm-mature stage to reduce bruising.

PART III: POST-HARVEST HANDLING

1. Sorting

Product quality is maintained by removing damaged and inferior fruit during sorting. Close attention to detail and good lighting are required at this stage. Sorting can be carried out on a table, or preferably as the fruit moves along a series of rollers. The entire surface of each fruit must be observed to ensure that damaged specimens are not packed. Damage extending to the aril rapidly leads to rots, which may spread to sound fruit within the package. For this reason, fruit with pulled stems, splits, cracks and insect damage should be rejected at this stage.

Fruit damaged by piercing moths the night before harvest show little damage initially, but will show signs of weeping and tissue darkening within 24 hours. For this reason, some growers store fruit overnight in high humidity cold-stores to ensure that all stung fruit is detected. If coldstores are not available or a quick turnaround is preferred, recently stung fruit can often be identified by leakage of aril juice when the fruit is squeezed. Immature fruit and fruit showing any signs of rot are also removed during sorting. Some markets have a low tolerance for cosmetic defects, such as scale infestation, small fruit, severe pepper spot (anthracnose) infection or superficial browning.

Fruit showing these defects is generally downgraded and not sent to the central markets, but can be processed or sold at roadside stalls.

2. Post-harvest handling

Once litchis are picked, they start to dry out and brown. The mechanisms of pericarp browning, colour retention and pulp quality maintenance have been the worldwide focus of litchis post-harvest biology research. Progress has been made in litchi pericarp browning and colour maintenance. The fruit should be kept in high humidity and cooled to 5 °C as quickly as possible. Hydro-coolers or cold stores are frequently used for this purpose. Sulphur fumigation has so far been the main post-harvest handling technology in prevention of litchi browning and maintenance of fruit quality. However, it has recently been questioned by both scientists and customers owing to the chemical S residue and off-putting taste.

3. Grading

Grade designation	Grade requirements	Grade tolerances
1	2	3
Extra class	Litchis must be of superior quality. They must have the shape, development and colouring that are typical of the variety and/or varieties type. They must be free of defects, with the exception of very slight superficial defects, provided these do not affect the general appearance of the produce, the quality, the keeping quality and presentation in the package.	5% by number or weight of Litchis not satisfying the requirements for the grade, but meeting those of Class I grade or exceptionally coming within the tolerances of that grade.

Grade designation	Grade requirements	Grade tolerances
Class I	<p>Litchis must be of good quality. They must be characteristic of the variety and/or commercial type. However, the following slight defects may be allowed provided these do not affect the general appearance of the produce, the quality, the keeping quality and presentation in the package.</p> <ul style="list-style-type: none"> - slight defects in shape - slight defects in colouring; - slight skin defects <p>Provided these do not exceed a total area of 0, 25 sq.cm.</p>	10% by number or weight of litchis not satisfying the requirements of the grade, but meeting those of Class II grade or, exceptionally, coming within the tolerances of that grade.
Class II	<p>This grade includes litchis which do not qualify for inclusion in the higher grades, but satisfy the minimum requirements specified in general characteristics. The following defects may be allowed, provided the litchis retain their essential characteristics regarding the quality, the keeping quality and presentation.</p> <ul style="list-style-type: none"> - defects in shape, - defects in colouring, - skin blemishes <p>provided these do not exceed a total area of 0,5 sq. cm.</p>	10% by number or weight of litchis not satisfying the requirements of the grade, but meeting the minimum requirements.

4. Packing

Litchis are packed as loose fruit and all unnecessary twigs or stems must be removed to ensure neat packing. Litchis can be packed as separate fruit or in bunches. Because of the problem of decay in export fruit, the manner of packing must be aimed at allowing for maximum ventilation within the

container. Standard telescopic cartons (300 mm x 400 mm with a maximum depth of 87 mm) are used. For loose packing, the use of nylon-net bags or smaller plastic containers inside the standard carton should give good results.

5. Storage

Litchis are mainly exported by air so that long-term storage is of no concern. The usual storage temperature is 0 to 1 °C. At this temperature, no fungal growth takes place and the fruit retains its fresh texture and colour fairly well. Such fruit must be chilled to about 0 °C as soon as possible after packing, and kept at this temperature for as long as possible during the marketing period.

Litchis destined for the local market should NOT be chilled as the exposure to hot; humid conditions after cold storage create particularly favourable conditions for rapid decay of the product. If the fruit is kept dry, it will remain fresh for weeks. In fact, it is known that if litchis are kept dry they eventually dry out like a raisin and are still edible months later.

6. Marketing

Litchi fruit is sold locally and overseas and is to increasing extent used for canning. Although the marketing possibilities for fresh litchi fruit are somewhat limited by a short season, there is a growing demand for this fruit with its delicate flavour. The export of our fruit to England and the continent continues to offer great possibilities. The fruit reaches the markets when there is practically no competition from other countries because South Africa is the only important producer of litchis in the Southern Hemisphere. There is the additional advantage that the litchis reach these markets during the European winter when the fruit prices are usually high.

PART IV: PRODUCTION SCHEDULES

Activities	January	February	March	April	May	June	July	August	September	October	November	December
Soil sampling												
Soil preparation												
Planting												
Fertilisation												
Irrigation												
Pest control												
Disease control												
Weed control												
Pruning												
Leaf sampling												
Harvesting												

PART V: UTILISATION

Litchis are marketed locally and overseas as fresh fruit and are used for canning.

PART VI: REFERENCES

OOSTHUIZEN, J.H., *The cultivation of litchis in South Africa* pg 32-37

Farming in South Africa bulletin no 260

ANONYMOUS, 1992. *The cultivation of litchis*. Bulletin 425 of the Agricultural Research Council -ITSC pp 61.

MENZEL, C.M., 1990. *The lychee (Litchi chinensis Sonn.) in South Africa, Reunion and Mauritius*. Queensland Department of Primary Industries. pp 18.

OOSTHUIZEN, J.H., 2001. *Lychee cultivation in South Africa*. Yearbook of the Australian Lychee Growers' Association. 1, 51-55.

Notes

A series of horizontal dotted lines for writing notes.

