



# HIGH DENSITY PLANTING



**A**dvancing knowledge in litchi tree architecture, growth physiology, possibility of using growth retardants has enabled farmers to adopt closer planting and maintaining reachable canopy. This system is popularly known as the High Density Planting (HDP). It enables profitable cropping, high regular yields and improved farm management practices, leading to higher productivity. Today new orchards of litchis are being attempted to plant in this system with a view to produce higher fruit yield and increased profitably. Use of growth retardants which restricts tree growth and encourages early flower induction, have also been found helpful for these high-density planting systems.

High density planting technique is a modern method of litchi cultivation involving planting of litchi trees densely, allowing small or dwarf trees with modified canopy for better light interception and distribution and ease of mechanised field operations. Control of pests and diseases, weeds and pruning of tree canopy can be carried out by machine. Irrigation and fertigation are automatically controlled. Such system produces precocious cropping, high and regular yields of good quality fruits and low labour requirement to meet ever rising production costs.

## **Merit of HDP over Normal Planting**

Increasing pressure on land owing to diversion of orchard lands to various other obvious reasons as well as rising energy and land-costs, together with mounting demand for fruits have made it imperative to achieve higher productivity of litchi from limited space. One should be very conscious in case of high density litchi because closer spacing may bring negative impact in growers' fields if the complete package of high density has not been properly understood and followed.

The normal planting distance in litchi has been 9-10 m. Such orchard takes 10-15 years to provide economic returns depending upon the cultivar, and cultural practices. Due to poor early returns and clash between the cultural requirements of the intercrop with main crop, litchi orcharding so far is done by large farmers who can afford tall trees and vacant inter space in

the early stages of orchard life. When the tree is full of vigour, then the dominance of vegetative phase prevails over reproductive phase, which adversely affects flowering and fruiting in litchi due to high competition for photosynthates between vegetative and reproductive phases of the tree. Such things can be taken care off through High Density Planting.

The tall trees of normal density at high productive stage require heavy machinery and equipment for spraying of pesticides and crop harvest because outer tree canopy is the major fruiting area extending outwardly with the enlargement of the tree. High density orcharding appears to be the most appropriate answer to overcome low productivity and long gestation period for early returns and export quality fruits of litchi.

### Components of High Density Planting

There are four major components of high density planting system. These are:

1. **Planting Density:** Even though a small canopy with a high number of well-illuminated leaves is efficient in photosynthesis but it is very poor in light interception, which leads to low potential yield per hectare. Light interception could be improved by increasing tree density. An optimum tree density is the level of density which is required to facilitate optimum light distribution and interception leading to high photosynthesis. As a result, yield per hectare is maximized. An optimum light interception is a factor of plant form, planting density, tree arrangement and leaf response to light for photosynthesis. Optimum light interception can be defined as a level of light intercepted by an orchard system above or below which, the economic yield will be reduced. Depending on the planting system, tree density under different system of high density planting in litchi ranges from as low as 400-700 plants per hectare.
2. **Planting Geometry:** Planting system is a combination of tree arrangement and plant form. Tree arrangement in HDP system must have sufficient alleyways for movement of farm machinery. The way trees are arranged also determines the light distribution pattern and light interception level. In litchi, single hedge row and double hedge row system and or square system with 4-5 m apart having enough alley space is being practiced in developed countries for HDP (Fig. 6.1).
3. **Pruning System:** The tree growth of litchi in high density planting remains similar as in low density upto eight years. The training begins when the tree is first planted and continues throughout its productive life. Proper tree forms, branch angle and limb spacing in itself aids in growth control. First training is done after one growing season. Each plant is allowed to maintain single stem (main stem) with upward growth upto 60-80 cm and then four scaffold branches are allowed in four directions to make the tree frame. Thereafter, 2 shoots arising from each primary branch at a distance of 60-75 cm from main stem is allowed to form secondary and likewise the tertiary branches. After start of bearing in plants, shoots arising from secondary and tertiary branches are given



**Fig. 6.1: High Density Planting at National Research Centre for Litchi with a spacing of 2x2 m and 4x4 m**

15-20 cm deep pruning soon after fruit harvest. Spray of 1% urea combined with 0.2% Blitox-50 or any other copper fungicide should be done soon after pruning.

The trees of high density orchard show slightly higher growth in terms of height from 8<sup>th</sup> year onwards than those of normal density because of more pressure from side plants and want of sun light. A reverse trend occurs in the growth of crown circumference and main stem girth and the differences in the growth of trees in different densities wideness after 10<sup>th</sup> year. Once the trees have filled their allotted spaces, crowding may occur and canopies of adjacent trees begin to overlap. This may lead to excessive shading and reduction in photosynthesis by layered leaves within the tree canopy resulting in poor yields. In high density orcharding this situation should not arise and therefore, the frame development and formative pruning should be followed from initial stage. Once the tree is mature, excessive growth can be regularly removed by pruning to provide a short term or immediate benefit. In high density planting, the main objective of pruning is to develop plant form which is good in light distribution, small in size and easy to manage especially in terms of mechanization.

The tree height, circumference and main stem girth in high density can be reduced by regular back pruning or dehorning of branches after crop harvest in 11<sup>th</sup> and 15<sup>th</sup> years, along with light pruning of fruited shoots every year. Dehorning is a process of removal of some selected branches from their place of origin on limb for vigour control and light and air penetration. Regular pruning induces new shoot production within 45-60 days during July-August. In general, every pruned shoot produces more than one shoot. After harvest of crop, about 50% branches of the tree canopy should be dehorned in high density orchard when the plant starts intermingling of canopies and the remaining 50% branches should be dehorned in next July after crop harvest to have a proper balance. In single hedge row or double hedge row system, the orchard is developed with a concept of single canopy with multiple roots and therefore, only side branches are pruned to develop alley of space.

Good light distribution within tree canopy increases the number of well illuminated leaves. This condition induces a high rate of canopy photosynthesis that leads to high yield/

tree. Small and compact canopy plant form is desired for high density which can be achieved by constant pruning and dehorning.

4. **Mechanization:** Another component in high density litchi planting is the system automation which contributes to high production efficiency. One of the important farm operations that can be automated is irrigation and fertigation *vis-à-vis* indiscriminate mechanical pruning. In fact, irrigation and fertigation have been identified as one of the key factors for the success of high density orchards in case of litchi. Plant should not be kept under stress after pruning therefore, assured irrigation coupled with fertigation is essential after pruning and during fruit development in high density litchi orchards.

### Management of High Density Orchards

Soil application of full doses of P and K should be done in July; whereas N may be given in two equal doses in March after fruit set and after crop harvest in July. In case of fertigation, the standard schedule should be followed during vegetative and reproductive growth phase and fruit development stage. Leaf litter should be allowed to decompose in the orchard soil.

High density litchi orchard should be irrigated as and when required particularly soon after paclobutrazol application during September-October, and from panicle emergence to crop harvest at 15-20 days interval. No irrigation is applied from first shower of the rains in June to February-end. Tillage operations should be done in October-November to keep the orchard free from weeds and also to mix fertilizers and leaf litter into the orchard soil.

The pest and disease problem in HDP litchi remains similar to normal planting rather some times severe in case of some pests. Hence to control the pests and disease, the recommended practices and chemicals should be followed. Weed cause some problems in initial stage of orchard. These should be removed and mulching may be done.

Litchi plants under high density planting system start fruiting after 4-5 years. These orchards have more number of tertiaries per unit area, hence, orchard become economical earlier than normal planting. There is also better light interception and distribution thus improved fruit quality. The increase in yield, early and maximized return, reduced cost of production and improved fruit quality result in greater orchard profitability and provide better competitive advantage of local litchi growers. An estimated yield of 14-16 tons/ha can be obtained from High Density litchi orchard if complete package of practice for HDP is adopted.