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Modern Method of Training in Fruit Crops

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Introduction

Plant training entails moulding or adopting specific forms in order for them to function more efficiently or effectively. Tying, fastening, staking, or supporting a trellis or pergola in a specific manner, or removing some of its pieces to produce a specific frame-work, is considered training. Grape vines are trained by bending and supporting their branches on wire trellises or pergola roofs. The selection of a training system is a component of overall orchard management, influencing planting distances, light interception, and ultimately, the orchard's success in terms of quality and quantity of fruit produced. Tree training employs a variety of procedures, including pruning, to direct tree growth or form, as well as the development of the tree's structural structure.

Training: Training can be defined as "Judicious removal of plant parts to develop a proper shape and strong framework of plant to make capable of bearing heavy crop load".

Objectives:

- Manage the vitality of the plant
- Intensify lighting for plants and fruits
- Prevent illness by increasing air movement
- Streamline the mechanization of the thinning and harvesting processes
- Manage crop succession on an annual basis

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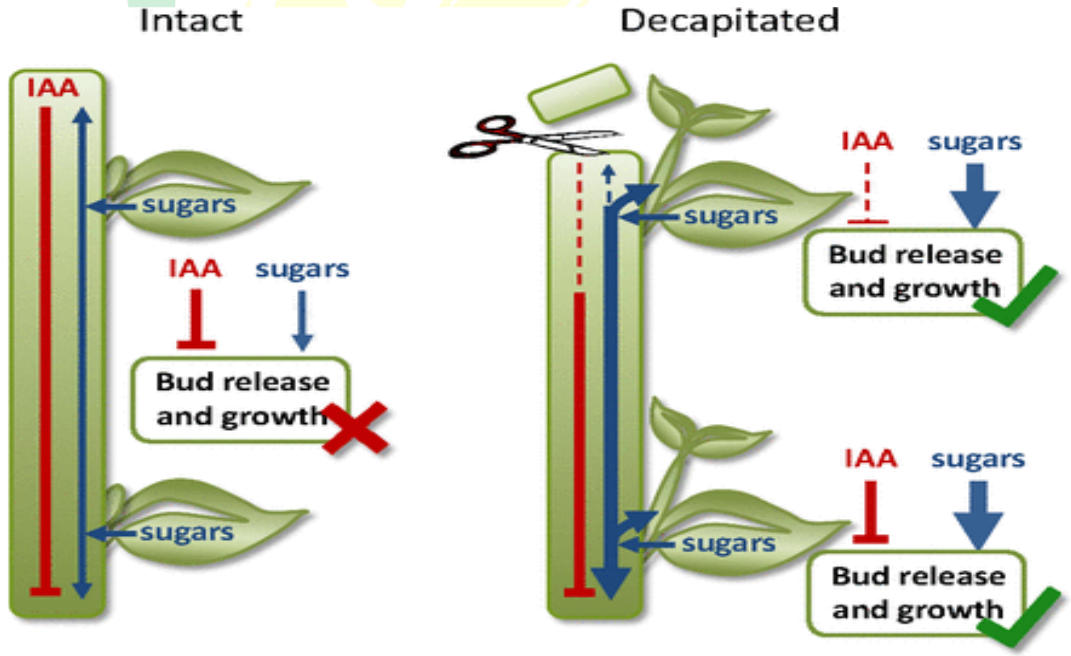
General rules of training:

- In spite of pruning, train the tree through limb arrangement to grow properly
- Expansion of the branches
- Remove any unwanted shoots during the summer months when they are still small
- Training regimens should be followed and completed as frequently and completely possible

Physiology of training:

- Improved photosynthesis efficiency and carboxylation efficiency by more exposure of leaf surface to solar radiation
- C: N ratio is influenced as more carbon assimilation in reproductive organs (fruits) than vegetative ones
- Balance between assimilation and respiration is maintained
- Fruit quality enhanced as fruit color, TSS, firmness also affected by light distribution in different plant canopies
- Suppression of apical dominance & promotion of lateral growth



Conventional method of training:

1. Central leader system
2. Open centre system
3. Modified central leader system

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Modern method of training:

Spherical-shaped canopy systems	Conic-shaped canopy systems	Flat planar canopy systems:	V-shaped Canopy Systems:
• Spindle-bush system	• Slender spindle • Vertical Axis system • Solaxe system • Super-spindle system • Tall Spindle system	• Palmette system • Lincoln canopy system • Espalier system	• Tatura trellis • Geneva Y-trellis • V-Trellis system

Spindle bush system: A single leader held by a pole, with branches trained horizontally, is depicted here. The spacing between plants in this training system is 2.5 meter, with a height of 2 meter and it can accommodate 1000 to 1500 plants per hectare. This strategy, which is often used throughout the summer months, aids in the creation of early fruit, the production of high-quality fruit and the ease with which it may be managed. This method makes use of the apple rootstock M-9 as well as the pear rootstock Quince C.

Slender spindle or fussetto: A single permanent layer of branches is formed by either heading an unbranched tree (whip) at planting or by planting a branched tree (feathered) from the nursery, and it is maintained indefinitely.

Vertical axis system: A single vertical trunk that serves as a support for small-diameter top fruiting branches that are supported by a single- to multiple-wire trellis that can reach up to 3 m in height. The goal is to develop limbs in zone B that will produce the highest quality fruit. It is intended to take advantage of the natural fruiting and growing characteristics of each cultivar. In this method, the spacing between trees is normally maintained at 1.0-2.0 m by 4.0-5.0 m, with 400-1000 trees per acre. This method makes use of semi-dwarfing and dwarfing apple rootstocks such as M.9 and M.26, among others.

Solaxe system: When using this kind of training, the central axis and fruiting branches are bent in the same way as they are with the free-growing fruiting branches. Row spacing is 1.6 meter, and there are 1562 plants per hectare. Fruiting branches are distributed spirally down the trunk of the tree, which improves light penetration and yields more fruit. The vertical-axis system is a very precocious training system, and in this system, competing vegetative branches from the vertical-axis system are removed.

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Super spindle system: The German adaptation of the slender-spindle tree is characterized by its slimness and the presence of spurs along the central leader, which are spaced extremely closely in single rows. There are no permanent branches in this system, which is a good thing. The application of plant growth regulators has a significant impact on the size of the trees and the amount of crop produced. The distance between trees in this system is 3 m 45–80 cm, with 1500 to 3000 trees per acre.

Espaliers: Scaffold branches are trained in both directions on a 4-5 layer of wires that run parallel and at 30-45 cm intervals on the scaffold. This strategy necessitates extensive pruning in order to keep sprouts on top of horizontal branches under control. It was necessary to take into consideration the species and vigor of the plant, and the initial expense of erecting the training structure was significant. When using espalier tree architecture, the yield efficiency and quality were both excellent.

Lincoln system/ T bar: Four equal-diameter shoots with a large calliper and tall whip are allowed to grow. At 1.5 m height, these branches become fruiting laterals, forming a single layer of fruiting laterals. On each side of the tree row, the height and width are 1.5 and 1.2 meter, respectively. Shade of the fruit and spurs within the canopy is caused by excessive shoot growth from the top of the canopy. Significant biological resources are diverted from fruit production to the production of undesirable shoot growth.

V trellis system: The trees are planted in a row (1.5-2.0 m) with spacing of 6 m and a density of 800-900 trees per hectare. Instead of leaning on the trellis, the entire plants alternately lean on the trees on each side of a V-trellis at a 60° angle. Cone form allows plants better light penetration and requires minimal pruning when planted. Mechanical harvesting is a possibility; however the expense of setup and first tree training is significant. Fruit size is smaller in horizontal systems than in vertical systems.

Multi leader systems: Multi-leader trees are primarily trained to diminish secondary structure, resulting in fruit growing centripetally, nearer to the trunk. As a result, a fruit wall will be formed, allowing the canopy to get more light and produce fruit that is more consistent in size and colour. It's possible that a pedestrian orchard, which doesn't require ladders or platforms, could reduce production costs by distributing the tree's energy more evenly among its leaders.

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Tall spindle: Tree Density Tree density with Tall Spindle orchards can vary from a high of 1452 trees/acre (3' x 10') to a low of 838 trees/acre (4' x 13'). The proper density is decided by considering the vigor of the variety, vigor of the rootstock, and soil strength. With vigorous scion cultivars, growers should use a more dwarfing stock and greater planting distances. With weak scion cultivars, a more vigorous rootstock and/or closer planting distances should be used. Despite some latitude in planting distances, growers should remember that to obtain high early yields high tree densities are essential.

Palmette system: Medium-high plant densities (700–1,100 trees/ha in peaches and 1,500–2,000 trees/ha in regular apple cv) are ideal for the palmette, which can grow up to 4 m in height (peach in fertile soils). For large planting densities, the Palmette method is not a good choice. Self-shading occurs when trees are planted too close together, reducing the amount of fruit produced on the lower limbs. The palmette may be less ideal than a slender spindle, low vase, or even a Y-trellis when a vigor-controlling factor is available (for example, growth habit, rootstock, growth retardants, or combinations of these). For species that are more difficult to control, it is still extensively utilized in deep, fertile soils (e.g. peach, plum, apricot, pear on seedling).

Tatura trellis: With the Tatura trellis, trees are trained to form a V-shaped canopy near to each other. Trees must be trained to create a V shape and supported by a trellis in order to harvest the crop. A trellis is required for each line of trees. Wires and anchors are used to secure the trellis in place. Thirty percent of total planting expenditures may be spent on the trellis construction, which includes materials and labour. Crop loss could be considerable if the trellis fails. Therefore, the trellis's design and erection must be meticulously planned. Dwarfing and semi-vigorous rootstocks such as MM.107 and Gisela 5 are typically used. A density of 2000 trees per hectare with a spacing of 1 m 5 m.

Conclusion:

Major fruit-growing regions have long recognized the significance of training as a key factor in increasing yields of high-quality fruit per unit of land. With the development of growth retardants, pruning and training procedures in tropical and subtropical fruit, the concept of high density planting is gaining traction. The management of plant canopies through standardization of training and practices can be used to exploit orchards with high densities of planting.

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