HIGH DENSITY PLANTING OF CARAMBOLA (*AVERRHOA CARAMBOLA* L.)

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Introduction

High density planting is a new concept of orchard practice which is currently carried out in the cultivation of temperate fruits such as apple and peach. This new system of fruit cultivation has resulted in a manageable tree size, early flowering and fruiting, better quality fruits and higher yield per unit area. In Malaysia, most fruits tress are still planted following the traditional system of wide planting of small number of large trees, which are difficult to manage, having long juvenile period, and incurring high labour cost when the fruits need to be wrapped to protect from fruit flies. Therefore, a study was undertaken to determine the feasibility of planting carambola under high density with root confinement as a mean of tree-size control.

Materials and Methods

Four experiments were conducted to investigate the growth and development of carambola under high density planting. Experiment 1 studied the response of two clones of carambola (B10 and B17) to planting systems with density ranging from 277 - 3330 trees per hectare and training methods including conventional palmette, close-planting palmette, Y-shape, modified spindle, T-shaped, and saw-tooth. This experiment was carried out in the field without root-confinement. Experiment 2 was carried out to study the response of young carambola (B10) to 3 between-plant distances (20, 35, and 50 cm) and 2 root-restriction depths (20 and 50 cm) under control environments. Experiment 3 repeated treatments similar to that of Experiment 2 under field conditions. Experiment 4 studied the effect of 4 root-restriction systems (side and bottom restricted, only side restricted 45 cm deep, only side restricted 90 cm, and all side unrestricted) combined with 3 plant forms (modified spindle, parallel palmette hedgerow, and Y-shaped hedgerow). Planting distance between plant for all treatments was 50 cm. In all experiments, growth data (plant height, total shoot length, trunk-cross-section area) while yield was recorded for Experiments 3 and 4. Fertigation was used for all experiments, except Experiment 1.

Results and Discussion

Experiment 1 revealed that plant height and trunk cross-section areas were significantly affected by planting systems with no significant effect due to clonal differences. Reducing between-plant and between-row distances within the range of 6 m to 3 m did not affect plant height. However, when between-plant distance was reduced to 0.8 m or 0.5 m the plant height increased significantly (e.g. modified spindle and saw-tooth system). With modified spindle planting system where pruning was minimum, the trees grew to more than 4 m height. on the other hand, plant heights of other planting systems were controlled through various training methods such as palmette and T-shaped systems. At the same time, trunk cross-section area was significantly reduced when between plant distance was reduced to 0.5 m (e.g. Palmette and T-shaped systems). This experiment revealed that close planting of the carambola with density above 3000 plants per hectare could reduce trunk size of trees. However, when pruning and training was minimised the tree grow to a great height, for example, the saw-tooth system. In the case of modified spindle system (density of 2000 plants per hectare) the trees reached a height of over 4 m after four years of planting. At such a height, wrapping and harvesting of fruits would be difficult. In the same experiment it was found that through proper training, such as T-shaped system, height of trees could be reduced. However, this system was difficult to maintain due to the sprouting of water shoots, which needed to be removed regularly. The vegetative vigour shown by these high density trees suggested that despite root competition from neighbouring trees this natural root restriction has not offered a good control of vegetative growth in carambola. Experiment 2 showed that at 36 weeks after planting, plant height, total shoot length and trunk cross-sectional area were not affected by between-plant distances but were significantly affected by root restriction treatments. Plants whose roots were restricted to depth of 20 cm recorded significantly lower extension growth (plant height and total shoot length) as well as trunk cross-sectional area when compared to root-restriction depth of 50 cm. Similar results were obtained in Experiment 3 where the plants were grown under field conditions. Results from Experiments 2 and 3 indicated that with decrease in between-plant distances from 0.5 m to 0.2 m (thus increasing the plant density from 5,000 to 12,500) no further increase in height was obtained. The higher density also did not cause a reduction in trunk growth thus revealing that increasing density did not affect the growth efficiency of individual trees. This was further supported by recording of higher interception of light by the increased plant density. In these experiments, high-density planting was combined with root restriction, achieved by artificial barriers which resulted in different soil volumes available to the root system. These artificial means of root restriction appeared to be a more effective ways of controlling vegetative vigour in high-density planting. Artificial root barriers have controlled vegetative growth of peach in humid regions with avundant spring rains and deep fertile soil (Williamson and Coston, 1990; Boland et al. 1994). Collections of yield data from Experiments 3 and 4 are still on going.

Conclusions

Although proper aerial pruning and training could be used for tree-size control, they required more labour in regular pruning of water-shoots. Natural root restriction by planting the trees close together was not an effective mean of tree-size control. Artificial root-restriction has been found to be an effective way of controlling tree size in carambola planted under high density. This would result in a manageable tees where the fruits could be wrapped and harvest easily and thus could reduce the production cost of the fruit crop.

References

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