Tree Size Maintenance Pruning of Mango Trees after Harvest: Is Cropping Negatively Affected or Not?

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ABSTRACT

Zill, Tommy Atkins, Sensation, Heidi, Kent and Keitt mango trees were pruned shortly after they were harvested to assess the effect of size maintenance pruning on flowering intensity, cropping, and stage of fruit maturation at harvest during the months after pruning. The outer branches on each tree were headed back to remove the new shoots which developed after harvest the preceding season (simulation of hedgerow pruning).

In the pruned trees, uniform and prolific flushing occurred shortly after pruning. Flushing in the unpruned trees was prolific, but was less uniform and more protracted. In the pruned trees (as opposed to the unpruned trees), the following also occurred: Flowering was delayed. A difference in flowering intensity were not observed in Zill or Tommy Atkins. In the remaining cultivars, fewer terminal shoots produced inflorescences. Fruit retention and tree yield were reduced in all of the cultivars except for Zill. Average fruit weight (fruit size) was only greater in Sensation. At harvest, a difference in stage of maturation was not apparent. It is concluded that future studies be aimed at gaining an understanding of the effect of climatic conditions during the flowering period on the flowering response of mango trees of the various cultivars to hedgerow pruning.

INTRODUCTION

High density planting provides mango growers with the opportunity of dramatically increasing orchard productivity (Chadha, 1989; Oosthuyse, 1993; Pandey and Singh, 1993). It is well known that mutual tree shading, caused by continued canopy development, eventually results in reduced yield owing to the failure of the shaded portions of the canopies to initiate inflorescences.

Canopy size maintenance implies the regular removal of outer branches with a view to indefinitely maintaining the canopy dimensions desired. Pruning to maintain tree size is not necessarily severe.

It has been recognized that the ideal time to prune is directly after harvest (Anon., 1985; Mullins, 1986; Oosthuyse, 1993; Ram, 1993). The rationale for this is that of allowing maximum time for canopy recovery, shoot maturation, and quiescence, to maximize the flowering probability of the new shoots arising after pruning. No direct evidence has been presented to support this inference, although is has been demonstrated that older shoots are more likely to initiate inflorescences than younger ones (Scholefield *et al.*, 1986). The need for quiescence might relate to the extent of a reduction of endogenous gibberellin (Chen, 1987; Chacko, 1991) and accumulation of starch reserves in the new shoots (Singh, 1960; Suryanarayana, 1978; Chacko and Ananthanarayanan, 1982).

The present study was performed to evaluate size maintenance pruning shortly after harvest as a measure to maintain the size of Tommy Atkins, Zill, Sensation, Kent, Keitt, or Heidi mango trees, and to specifically assess the effect of postharvest pruning on flowering intensity and cropping ability.

MATERIALS AND METHODS

Twenty adjacent four- to five-year-old mango trees in each of six cultivar blocks (Tommy Atkins, Zill, Sensation, Kent, Keitt and Heidi) were selected at a mango estate in the Hoedspruit region. The trees were irrigated regularly, and inflorescence and fruit diseases were effectively controlled by frequent sprays of fungicides. Commercial recommendations were followed concerning tree fertilization and pest control.

The experimental procedure for each cultivar was identical. The procedure is described in what follows:

Two to three weeks after harvest, 10 trees were pruned. The outer branches on each tree were headed back to remove the new shoots which developed after harvest the preceding season (simulated hedgerow pruning). After pruning, the flushing and flowering behaviour of the trees was observed. When the inflorescences were in bloom, flowering intensity was estimated. In each tree, the percentage of terminal shoots initiating inflorescences was approximated. Prior to harvest and once fruit drop was no longer occurring, the number of fruit on each tree was counted. At harvest, the fruits on each tree were weighed (in Keitt, average fruit weight and tree yield could not be ascertained due to inadvertent harvesting). Ten randomly selected fruit per tree were cut to assess stage of maturation (extent of pulp colouration). The Zill colour chart was used.

The randomized complete blocks design was adopted. There were two treatments (pruning versus absence of pruning). Single trees served as plots.

RESULTS

In the pruned trees, uniform and prolific flushing occurred shortly after pruning. Flushing in the unpruned trees

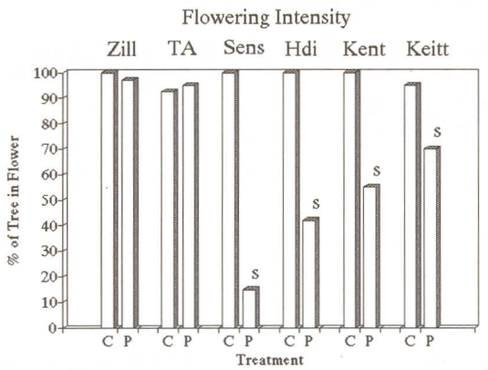

Fig. 1 *Estimated proportion of terminal shoots initiating inflorescences. "S" denotes a statistically significant difference (p < 0.05). C = unpruned; P = pruned.*

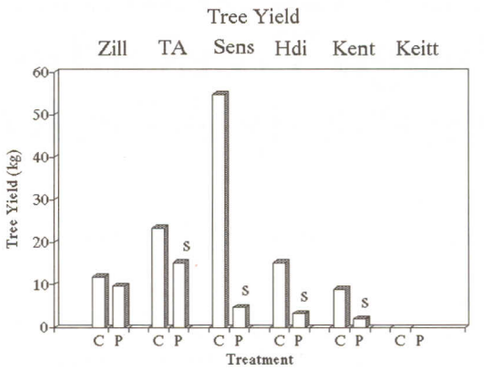

Fig. 2 *Number of fruit retained per tree. "S" denotes a statistically significant difference (p < 0.05). C = unpruned; P = pruned.*

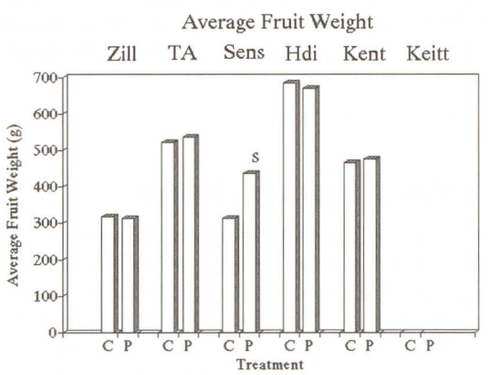

Fig. 3 *Average fruit weight (fruit size). "S" denotes a statistically significant difference (p < 0.05). C = unpruned; P = pruned.*

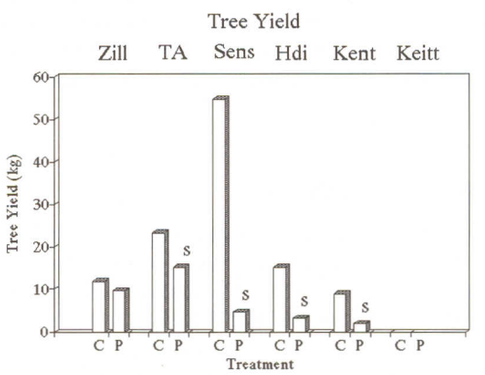

Fig. 4 *Tree yield. "S" denotes a statistically significant difference (p < 0.05). C = unpruned; P = pruned.*

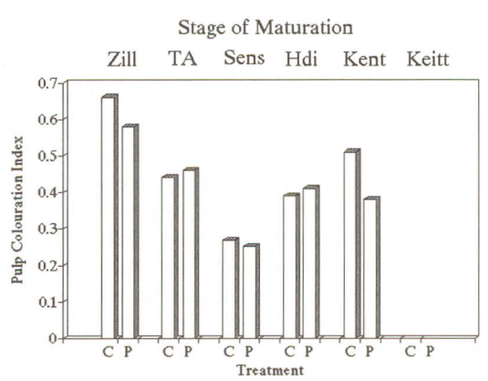

Fig. 5 *Stage of maturation estimated with the Zill pulp colour chart. "S" denotes a statistically significant difference (p <0.05). C = unpruned; P = pruned.*

was prolific, but was less uniform and more protracted than in the pruned trees.

On July 15 1996, inflorescence development and anthesis (flower opening) were occurring in the unpruned trees. At this stage, terminal bud swell was generally apparent in the pruned trees. On August 25 1996, inflorescence development and anthesis were occurring on the pruned trees.

A difference in flowering intensity in relation to treatment was not apparent in Zill or Tommy Atkins (Fig. 1). In Sensation, Heidi, Kent or Keitt, the proportion of terminal shoots initiating inflorescences was reduced in the pruned trees. The greatest reduction occurred in Sensation, and the smallest reduction in Keitt.

The number of fruit retained was diminished as a result of postharvest pruning in all of the cultivars except for Zill (Fig. 2). In the pruned trees, average fruit weight (fruit size) was increased in Sensation, but not in the other cultivars (Fig. 3). Tree yield in the pruned trees was diminished in all of the cultivars except for Zill (Fig. 4). At harvest, differences in stage of maturation relating to treatment were not apparent.

DISCUSSION AND CONCLUSION

Regrowth was prolific and flowering delayed in the pruned trees. Regrowth has been reported to be prolific following size maintenance pruning of mango trees (Charnvichit and Tongumpai, 1991; Ram, 1993). Gibberellin levels increase in mango shoots during their development, decline during their maturation, and are at low levels at the time of flowering (Chen, 1987). Paclobutrazol, which inhibits gibberellin bio-synthesis (Dalziel and Lawrence, 1984), advances flowering time in mango (Tongumpai *et al.*, 1991; Burondkar and Gunjate, 1993; Nunez-Elisea *et al.*, 1993). In view of these findings, it might be considered that pruning, in causing prolific regrowth, causes a delay in flowering due to an increase in endogenous gibberellin levels.

Few detailed studies have been performed to evaluate pruning of mature mango trees to maintain their dimensions. Favourable reports of light pruning or hedging have been made (Anon., 1985; Toohill *et al.* 1989; Pandey and Singh, 1993; Ram, 1993; Oosthuyse, 1994). Annual or biannual size maintenance pruning is practiced commercially in south Florida (USA), Puerto Rico, and Queensland (Australia) by mechanical hedging directly after harvest (Mitchell, pers. comm. - Mitchell Mangoes, Homestead, Florida, USA; Segal, pers. comm. - Pango Mango, Puerto Rico; Anon., 1992). Iyer and Subramaniam (1973), in performing detailed pruning experiments, found that the annual increase in canopy size could be minimized by heading the previous season's terminal shoots back to 5 cm stumps. Flowering and fruit-set were found to be negatively affected in certain cultivars. Cull (1991) stated that mango is poorly suited to hedgerow pruning in view of it having a terminal flowering habit, and there being a need for quiescent dormancy of up to three months for flowering to occur. Clarke and Clarke (1987) did not recommend pruning of mature mango trees unless pruning was confined to the removal of diseased, pest infested, or dead shoots and branches.

Postharvest pruning of Sensation has been found to be effective in maintaining tree size without there being an adverse effect on yield (Oosthuyse, 1994). Prolific regrowth after pruning and the general ability of the new shoots produced to initiate inflorescences were stated to be preconditions for "the success" of size maintenance pruning performed after harvest.

In the present study, regrowth in response to pruning was prolific. Flowering and cropping were generally depressed, however. It would appear that flower inductive conditions occurring during June, July, August, or September of 1996, and the cultivar relationship between such conditions and their effectiveness in causing flowering of pruned trees, were factors influencing the effect of pruning on flowering and cropping.

Future studies should be aimed at gaining an understanding of the influence of climatic conditions on the flowering of mango trees having being pruned at or shortly after harvest.

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