The effect of time of pruning on yield, fruit size and greening disease incidence of Valencia citrus trees

F.J. Joubert and P.J.C. Stassen

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Abstract

Valencia trees, spaced at 6 x 3 m, were pruned annually from the third year after planting during different months of the year, to determine the most suitable time of pruning. Greening disease is endemic to the area in which these trials were conducted. Data collected included yield, fruit size and the incidence of greening disease. Hand selective pruning over three successive seasons indicated the optimal time of pruning to be from mid-summer (January) to early autumn (April). A significant increase in yield and fruit size, as well as a lower incidence of greening disease was obtained during this period. Summer pruning may also be used to regulate fruit load (fruit thinning), modify alternate bearing habits, and to control tree size and shape.

Introduction

Pruning is becoming an accepted practice in citrus management in order to maintain productivity with an appropriate tree size and shape. The industry trend is to prune citrus from post-harvest to the pre-bloom stage (Moss, 1973; Bacon & Bevington, 1980; Bacon, 1981; Rabe, 1991; Punt et al., 1999).

The specific phenological stage at which pruning is done, will induce different reactions with perennial crops. At a certain stage, pruning will stimulate strong watershoot growth, while at another stage, it will only induce the removal of leaves and bearer branches. When pruning during the fruit development stage, a number of fruit are removed which may be beneficial for optimal development of the remaining fruit, or it could also have a negative effect on yield (Moss, 1973; Klang & Biggs, 1981; Mika, 1986). Pruning responses are therefore complex and may take several years to evaluate since climatic factors can greatly influence fruit set and cropping (Moss & Muirhead, 1971). An aspect of concern, especially in areas with a high incidence of greening disease, is that pruning may increase the occurrence of greening disease (Cattlin, 1969a).

The aim of this study was to quantify the effects of different pruning times in order to determine the optimal phenological stage for pruning Valencia trees by means of hand selective pruning.
Material and Methods

Three-year-old Delta Valencia trees, spaced at 6 x 3 m and grown at the ARC-Institute for Tropical and Subtropical Crops (ARC-ITSC), Nelspruit were used.

Experimental design was according to a randomized complete block design with 10 single tree replicates. Trees were selected for uniformity of size and vigour. Treatments consisted of 12 pruning times (months) and an unpruned control. Selective pruning was applied annually during the middle of a specific month for each month group over three successive seasons. This once-off selective pruning consisted of the removal of watershoots and unwanted branches, and the cutting back of branches to shape the trees into a pyramidal form with slanted sides of approximately 20° from the vertical. During the trial period pruning applications did not include the removal of branches with greening disease symptoms. The incidence of greening disease was quantified during harvest time in July 1999, after which the infected branches were removed by pruning. Trees were rated on a scale from 1-5 according to the severity of visual symptoms of greening disease, with zero indicating no visual symptoms present and five indicating a 100% disease infected tree.

Yield and fruit size data were collected over a period of 2 years. Fruit size groupings were as following: small (≤66 mm), medium (67-86 mm) and large (>86 mm).

Data was statistically analysed by using variance analyses and the Tukey test. All results are presented as treatment means at a 5% level of significance.

Results and discussion

The effect of hand selective pruning on 2 years cumulative yield of Valencia trees pruned at different months of the year is shown in Fig 1. Fruit yield of trees pruned during spring (Aug-Sep) are significantly lower compared with the control. These results are in agreement with similar work done by Kiang and Biggs (1981), who found that excessive spring to summer pruning before the time of natural fruit drop, resulted in excessive vegetative growth with a subsequent yield loss. Trees pruned from mid-summer to early autumn produced much higher fruit yields. Trees pruned during January and March performed significantly better with yield increases of respectively 21.2% and 29.4%, compared to the unpruned control. Yields were relatively consistent from year to year with no definite "on-or-off" year.

The effect of pruning at different times during the year on fruit size is clearly shown in Fig. 2. Pruning considerably increased the number of medium sized (export) fruit. An increase in export fruit yield of 28.2 tons/ha over 2 years was obtained from trees pruned in March (Fig. 2). Although fruit was removed during the pruning operation, the remaining fruit increased in size and weight. This is due to the fruit thinning effect of pruning. Kiang and Biggs (1981) refer to summer pruning as a "physiological thinning" of fruit. Future research will attempt to combine pruning and fruit thinning at the optimal phenological stage, as discussed by Stassen et al. (1999), for the mango crop.

Fig. 3 illustrates the effect of the different pruning times on the incidence of greening disease as observed after 3 years of pruning. A disease incidence of up to 36.2% was observed during the spring period compared to much lower levels during mid-summer (8.3%) to early autumn (almost 0%). Mid-summer to early autumn pruning did not stimulate excessive vegetative growth, compared to the spring and early summer period of pruning. Fig. 3 therefore presents a trend as a guideline for pruning Valencia trees in an area where this disease is endemic. Catling (1969a & b), found that the vector of greening disease is dependant on the flushing rhythms and occurs mainly during a period of lower temperature and high humidity levels. Pruning should therefore be practised during the period with the lower disease incidence. A spray program is recommended to control the vector (Buitendag, 1976; Van Vuuren & Da Graca, 1978) and to keep population levels down (Schwarz et al., 1974; Moll & Van Vuuren, 1982).

Conclusion and Recommendation

This study clearly indicates that selective pruning of Valencia trees should be scheduled from mid-summer to early autumn. This holds benefits such as higher yield, improved fruit size and lower incidence of greening disease. Pruning from late winter to early summer is discouraged due to the negative effects obtained in this study.

In an area such as Nelspruit where greening disease is a major production constraint, pruning should be limited to the months of February and March. It is also recommended that selective pruning be started at an early stage, about 2-4 years after planting (Joubert et al., 1999), to train and shape trees to prevent dense tree canopies and overcrowding of orchards. It is necessary therefore to prune unwanted branches and watershoots, and to cut back laterals. Since the stimulus of pruning is more or less localized, the cuts should be distributed over the whole canopy for best results.

This program should be applied on a yearly basis in order to maintain light management and tree shape, which would result in an efficient tree with increased yield and fruit quality (Stassen & Davie, 1996a & b).
Fig. 1  Two year cumulative yield of six-year-old Valencia trees pruned annually in different months of the year. Bars with the same letter are not significantly different at P= 0.05.

Fig. 2  Cumulative fruit size pattern of Valencia trees over two seasons, pruned annually in different months of the year.

Fig. 3  Greening disease incidence of Delta Valencia trees after a three year period, during which selective pruning was applied annually in different months of the year. Disease incidence was recorded directly after harvest during end-July.
References


References (continued from page 27)


