

The effect of fruit and inflorescence pruning on fruit size and yield of dwarf golden apple (*Spondias cytherea* Sonn.)

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ABSTRACT

An experiment was conducted to determine the effects of eight combinations of fruit and inflorescence pruning on fruit size and yield of dwarf golden apple (*Spondias cytherea* Sonn) grown in Belvedere, Grenada, W. I. Pruning treatments were 1: 0% fruit + 50% inflorescence, 2: 25% fruit + 50% inflorescence, 3: 50% fruit + 50% inflorescence, 4: 75% fruit + 50% inflorescence, 5: 0% fruit + 0% inflorescence, 6: 25% fruit + 0% inflorescence, 7: 50% fruit + 0% inflorescence, 8: 75% fruit + 0% inflorescence. Fruit pruning increased fruit size. At 75% it was highly significantly different ($P < 0.001$) from the 25% and 0% levels but was not significantly different from pruning at 50%. There was a significant interaction between fruit pruning and inflorescence pruning on fruit size with inflorescence pruning giving smaller fruits at 75% fruit pruning, but not at other levels of fruit pruning. Fruit and inflorescence pruning reduced fruit weight and number thus yield. 0% and 25% fruit pruning had a highly significant difference ($P < 0.001$) from 75% on total number of fruits. 0%, 25% and 50% had a highly significant difference ($P < 0.001$) from 75% on total weight of fruits. Generally pruning led to larger fruits but lower total yields.

INTRODUCTION

The golden apple (*Spondias cytherea* Sonn.) is native to the Society Islands of the South Pacific (Weir et al, 1982). From there it has been widely distributed around the tropics. It was first introduced into the Caribbean in the 18th century (Morton, 1961) where it has adapted well to local conditions and become a natural part of the agricultural landscape. It is grown on a small scale in many tropical and subtropical areas like Indonesia, Florida Keys, Hawaii, the Caribbean, Venezuela and Suriname (Popenoe 1979; Weir et al. 1982, Morton 1987). In other countries the golden apple is also referred to as June Plum, Pomme-Cythere, Ambarella, Mokak, Coe, Hevi, among others (Morton 1987; Geurts et al 1986).

Even though the golden apple is distributed worldwide and has become a popular fruit for West Indian consumers it has received little recognition from the scientific community of the region (Bauer et al, 1993). This may be attributed to the fact that historically it was a fruit of insignificant commercial importance. In Grenada, the importance of golden apple as a commercial export crop has been realised since 1985 when extra-regional export to the USA began.

Keywords: Grenada, Pruning, *Spondias cytherea*

Formerly small quantities of the crop were exported by hucksters to the neighbouring island of Trinidad. After 1985, the golden apple quickly rose to prominence as one of the major non-traditional export crops. In 1996, 368 tonnes of golden apple were exported and it was the second most important non-traditional export crop after mango. Despite the increased importance of golden apple, the crop still continues to be grown mainly in a disorganised manner as scattered trees among the more important tree crops like cocoa and banana. The Grenada Agricultural Census of 1995 estimated pure stand national cultivation at 10.9 hectares.

In the present system of golden apple production, no formal method of crop production is practiced. As a result, trees grow very tall making harvest difficult and dangerous, leading to increased incidence of fruits damaged during harvesting and also increased postharvest losses (Daulmerie, 1994). In 1993, the Inter-American Institute for Co-operation on Agriculture (IICA) introduced a dwarf type of golden apple which bears relatively small fruits on a short tree. This introduction was viewed as a means to obtain a larger proportion of undamaged fruits since the dwarf trees are easily harvested at the ground level. One disadvantage of the dwarf type is that the fruits are smaller than the traditional type and these fruits are not readily accepted on the local and export markets.

This experiment was aimed at increasing fruit size of the dwarf golden apple through fruit and inflorescence pruning so that larger fruits can be obtained from the dwarf trees to facilitate easier marketing of the fruits.

MATERIALS AND METHODS

The trial was superimposed on 2-year old dwarf golden apple trees growing on a private farm in the Belvedere, St. John's region of Grenada. Soil type was of the Capitol clay loam series.

The trial consisted of eight treatments in a 4 x 2 factorial arrangement. The factors are four levels of fruit pruning and two levels of inflorescence pruning. Treatments were set out as follows:

<u>TREATMENT NO.</u>	<u>DESCRIPTION</u>
1	0% fruit pruning, 50% inflorescence pruning.
2	25% fruit pruning, 50% inflorescence pruning.
3	50% fruit pruning, 50% inflorescence pruning.
4	75% fruit pruning, 50% inflorescence pruning.
5	0% fruit pruning, no inflorescence pruning.
6	25% fruit pruning, no inflorescence pruning.
7	50% fruit pruning, no inflorescence pruning.
8	75% fruit pruning, no inflorescence pruning.

The trial was laid out in a randomised block design. There were 13 blocks of eight trees. Each block received each of the experimental treatments. The trees were grown on a slope at the side of a ravine therefore each block was selected based on geographical proximity along the contours and relative uniformity of size.

At the beginning of the experiment, the mature fruits from each tree were harvested, weighed and counted. The following week the treatments were applied. Further application of the treatments was done every 2 weeks while further harvesting of mature fruit was done as necessary. One application of

12.8.24 fertilizer at the rate of 190 kg/ha was made. Manual and chemical weed control with paraquat and glyphosate were practised.

At each harvest the fruits were weighed and counted. Harvesting was performed on nine occasions.

RESULTS AND DISCUSSION

Analyses of variance for the main and interaction effects were conducted on average fruit weight, total fruit weight and total number of fruits over the whole period.

Fruit Size

For ease of measurement average fruit weight was used as an indicator of fruit size.

Analysis of the effect of fruit pruning regime revealed that fruit pruning tended to increase fruit size. Fruit pruning at 75% with no inflorescence pruning gave the largest fruit size of 58g followed by fruit pruning at 50%, with 54g (Table 1). The fruit size obtained by the former pruning regime was 9g greater than the no pruning regime. Fruit pruning at 75% and 50% levels were highly significantly different ($P < 0.001$) from the 25% and 0% levels. There was no significant difference between the 75% and 50% fruit pruning levels.

Inflorescence pruning at 50% tended to reduce fruit size but the effect was not significant ($P > 0.05$).

The interaction effect between fruit pruning and inflorescence pruning on fruit size, was significant ($P < 0.001$). At the fruit pruning level of 25% there was a small increase in fruit size, the 50% level had no effect while the 75% level reduced fruit size. Fruit pruning at 75% together with no inflorescence pruning gave larger fruits than those from fruit and inflorescence pruning combinations at 25% and 0% fruit pruning levels.

Table 1 Effect of fruit and inflorescence pruning on average fruit weight of dwarf golden apple

Fruit Pruning (%)	Average Fruit Weight (AFW) (g)		Mean AFW (g)
	Inflorescence Pruning		
	0%	50%	
0	49	49	49
25	49	51	50
50	54	54	54
75	58	53	55
Mean AFW (g)	53	52	

SEM Overall fruit pruning = 0.87
 (84 d.f.) Overall Inflorescence pruning = 0.62
 Body of table = 1.23

Total Fruit Weight

No fruit pruning (0%) gave the highest yield (Table 2). Fruit pruning regimes of 0%, 25% and 50% were highly significantly different ($P<0.001$) from 75%, the latter producing the lowest yield.

Inflorescence pruning had a negative effect on yield. The best yield was obtained with no inflorescence pruning. The effect on yield by pruning of inflorescences at 50% was significantly different ($P=0.007$) to no inflorescence pruning.

The interaction between inflorescence pruning and fruit pruning was significant ($P<0.001$). At 25% fruit pruning, inflorescence pruning had no effect on total fruit weight, but at other levels of fruit pruning, inflorescence pruning gave lower yields.

Table 2 Effect of fruit and inflorescence pruning on total fruit weight of dwarf golden apple

Fruit Pruning (%)	Total Fruit Weight (kg) (TFW)		Mean TFW (kg)
	Inflorescence Pruning		
	0%	50%	
0	17.57	14.12	15.85
25	13.44	13.38	13.41
50	14.74	12.34	13.54
75	12.31	5.94	9.13
Mean TFW (kg)	14.51	11.45	

SEM Overall Fruit Pruning = 1.11
(84 df) Overall Inflorescence Pruning = 0.79
Body of table = 1.57

Total Number of Fruits

Analysis of the effect of fruit pruning on total number of fruits harvested showed that 0% and 25% fruit pruning were highly significantly different ($P<0.001$) from 75% fruit pruning. The highest mean total yield of 326 fruits came from 0% fruit pruning while 75% fruit pruning resulted in the lowest mean total yield of 165 fruits (Table 3). Fruit pruning therefore tended to reduce total number of fruits harvested. As severity of fruit pruning increased total number of fruits harvested decreased.

For the inflorescence pruning effect, 50% pruning was significantly different ($P<0.001$) from 0% pruning. No pruning produced the higher number of fruits.

The interaction between fruit pruning and inflorescence pruning was significant ($P<0.001$). Generally inflorescence pruning increased the negative effect of fruit pruning on total number of fruits harvested with the exception of fruit pruning at the 25% level.

Table 3 Effect of fruit and inflorescence pruning on total number of fruits of dwarf golden apple

Fruit Pruning (%)	Total No. of Fruits (TNF)		Mean TNF
	Inflorescence Pruning		
	0%	50%	
0	358	293	326
25	271	270	271
50	278	227	253
75	217	112	165
Mean TNF	281	226	

SEM Overall Fruit Pruning = 21.7
(84 df) Overall Inflorescence Pruning = 15.3
Body of table = 30.7

As we have seen the fruit size of dwarf golden apple was successfully increased through the influence of fruit pruning while yield was reduced. The increased fruit size was expected since the removal of some fruits allowed the plant to distribute the available nutrients to a fewer number of fruits hence increasing individual fruit size.

Although no record of pruning work on dwarf golden apple was discovered in the literature, this result is similar to that obtained by Pawar et al (1994) on pomegranate, where fruit size improved with increasing severity of pruning and total yield was reduced by pruning.

CONCLUSIONS

The best pruning regime to increase fruit size of dwarf golden apple was 75% fruit pruning. Increased fruit size through this practice is however obtained at the expense of a reduction in yield both in terms of weight and number of fruits harvested. Therefore the recommendation of the practice of pruning would depend on whether cost/benefit analyses indicate that marketing of the increased fruit size would compensate for the reduced yield experienced. This is unlikely as the largest increase in fruit size obtained was only 9g which would not be significant in the market place. The development of the dwarf golden apple industry therefore depends on finding market niches which uses the fruit in its normal size.

Fruit and inflorescence pruning both reduced fruit yield while the latter reduced fruit size. Inflorescence pruning therefore is not a worthwhile practice.

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