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EFFECT OF LEAF AND FRUIT THINNING ON YIELD AND QUALITY OF PEACH CV. FLORDASUN

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KEYWORDS

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ABSTRACT

A field trial was conducted at Experimental farm of the Division of Horticulture, ICAR Research Complex for North Eastern Hill Region, Umiam, Meghalaya, India during 2011-12 to study the effect of leaf and fruit thinning treatments like, T0 (Control), T1 (20: 1 LFR), T2(30: 1 LFR), T3(40: 1 LFR) and T4 (50: 1 LFR) on yield and quality of peach cv. Flordasun. The best quality fruit with respect to fruit size (45.21 x 44.76mm), weight (45.78g), TSS (13.160Brix), acidity (0.65%), total sugar (6.21%), ascorbic acid (52.61mg/100 g), total anthocyanins (4.69mg), total carotenoids (10.72mg), total minerals (1.42%) and total phenols (150.19mg) were obtained with a leaf to fruit ratio (LFR) of 30:1. However, all the treatments significantly reduced total yield except control. In order to obtain the quality fruits of peach cv. Flordasun, thinning of leaf and fruit in the ratio of 30:1 is recommended for peach growers of North eastern region.

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INTRODUCTION

Peach (*Prunus persica* Batsch) is an important fruit crop being grown in the mid hills zone of Himalayas extending from Jammu and Kashmir, Himachal Pradesh, Punjab, Haryana and parts of Uttar Pradesh, Tamil Nadu to North eastern Hill region at an altitude of 1000-2000 m asl. Peach is good source of sugar, vitamins, calcium, potassium etc. and recommended for lowcholesterol, low fat, low sodium and weight reduction or diabetic diets. Among the deciduous fruits, low chilling peach is the most important in terms of adaptability and extent in Meghalaya. With the introduction of low chilling varieties its cultivation is extended in almost all the states of the north east India. Among the low chilling varieties, Flordasun, Shan-e-Punjab and Partap found suitable for mid hill conditions of northeast (Patel *et al.,* 2007). In Punjab, introduction of low chilling, high yielding and early ripening cultivars of superior quality traits has brought about miraculous change in peach cultivation. Due to early access to the commercial markets, peach cultivation has become a highly economic proposition and area under this crop has increased at a faster rate since it is being planted in solid blocks as well as a filler tree in orchards of mango, litchi, pear etc (Deshmukh *et al.,* 2013). Under favourable sub-tropical condition especially in north eastern region, low chilling peach cultivars like Shan-e-Punjab, Partap and Flordasun grow vigorously and set fruits heavily but, due to non practicing of pruning and maintaining the proper leaf to fruit ratio in the region, the fruits become undersized, mis-shape with inferior quality. Therefore, to maximize the benefit, the grower should aim at the production of reasonable quantities of high quality fruits with adoption of appropriate shoot, leaf and fruit thinning. Annual pruning plays the most important role in restricting the canopy growth of the trees and improved fruit quality (Das, 2014).

It is well established that heavy bearing of peach trees adversely affects the size and quality of fruits resulting in poor returns to the growers. In addition, breakage of limbs under heavy crop load and increasing susceptibility to late winter frost particularly in the temperate zones are the other adverse effects of heavy bearing. The practice of fruit thinning often leads to improvement in the quality and size of the fruits. Hence, the present investigation was undertaken to standardize the leaf fruit ratio to enhance the yield and fruit quality in Flordasun peach.

MATERIALS AND METHODS

The present investigation was carried out at Horticultural Research Farm of ICAR Research complex for North Eastern Hills Region Umiam, Meghalaya, India during 2011-2012. The experimental site was situated at 25o41′-21″ North L and 91°55′-25″East L and at an elevation of 1010 m above mean sea level. The climate of the site can be characterized as subtemperate with minimum and maximum temperatures ranging from 6 to 29°C and with average annual rainfall of 2841 mm. Five years old peach cv. Flordasun was selected from the peach orchard of the Experimental Farm of Division of Horticulture, ICAR Research complex for NEH Region, Umiam, Meghalaya. The selected trees were marked with metal

tag for recording observation. The experiment was laid out in Randomized Block Design with five treatments viz., T0 (Control), T1 (20: 1 LFR), T2 (30: 1 LFR), T3 (40: 1 LFR) and T4 (50: 1 LFR). Three trees was the unit of treatment and each treatment was replicated four times.Ten fruiting shoots of uniform size were selected and number of leaves and number of fruits on each shoot were counted. The mean number of leaves per fruit was calculated and expressed as leaf to fruit ratio before the pit-hardening stage of fruits. Leaf to fruit (LFR) ratio was maintained through hand thinning of leaves and fruit as per treatments. All other cultural operation was followed as suggested by Patel *et al.* (2008). Number of days from fruit set to the date of first harvest was recorded. The maturity was adjudged when the shoulder near the suture line of the fruit lost firmness and showed highest total soluble solid content (TSS). Fruit yield per tree was calculated by multiplying the number of fruits with mean fruit weight and expressed in kg/tree. Weight of 10 fruits was recorded with the help of electronic pan balance and weight of individual fruit was calculated and expressed as mean fruit weight in gram.Length and breadth of 10 fruits was measured with the help of Digital Vernier calliper and their mean fruit size (length and breadth) was expressed in millimeters. Firmness of five fruits was measured using a Stable Micro System TA-XT-plus texture analyzer (Texture Technologies Corp., UK) fitted with needle. Weight of pulp and weight of stones of five fruits was recorded with the help of an electronic pan balance and expressed as mean weight in gram.Weight of pulp and stone of five fruits was recorded with the help of electronic pan balance and pulp: stone ratio was determined by dividing the pulp weight by stone weight. Total soluble solids of the fruits were recorded by using a digital refractometer at room temperature and expressed in 0Brix. Total titratable acidity, sugarsand anthocyanin content were determined as per method suggested by Ranganna (1997). Ascorbic acid content was determined by using 2, 6-Dichlorophenol-indophenol dye method of Freed (1966). Total minerals were estimated as per the method suggested by Srivastava and Kumar (2002). Total phenol content was determined as per the methods described by Bray and Thorpe (1954). Total carotenoids were estimated as per the method described by A.O.A.C. (1980).

RESULTS AND DISCUSSION

Days taken from fruit setting to maturity and yield

All the treatments reduced the number of days taken from fruit setting to fruit maturity as compared to control when thinning was done before pit hardening stage (Table 1). However, treatment 30: 1 leaf to fruit ratio (LFR) was found to be the most effective which took 70 days as compared to control (75 days) from fruit setting to fruit maturity. The advancement in fruit maturity in different thinning treatments might be due to the faster accumulation of minerals and metabolites that helped in early fruit development than control trees. The present findings are in conformity with the findings of Chander and Khajuria (1983) and Kaur (1997).The data obtained with regards to fruit yield (Table 1) revealed that final yield was lower in all the treatments than the control. The control (T_0) trees gave the maximum fruit yield (19.42kg/tree) whereas the minimum yield (10.38 kg/tree) was recorded in T4 (50:1 LFR). Reduction in yield with this treatment could be attributed to decrease in number of fruits per tree. Similar findings were also reported by Chanana *et al.* (1998) and Casierra *et al.* (2007).

Table 1: Effect of leaf to fruit ratio on days to fruit maturity, fruit yield, fruit weight and fruit sizein peach cv. Flordasun

Treatments	Days to fruit maturity	Fruit yield (kg/ tree)	Fruit weight (g)	Fruit length (mm)	Fruit breadth (mm)
20 : 1 (T_1)	74	15.36	43.81	43.76	42.22
30 : 1 (T_2)	70	13.42	45.78	45.21	44.76
40 : 1 (T_3)	72	11.68	44.86	44.56	44.12
50 : 1 (T_4)	73	10.38	43.83	43.78	42.86
Control (T_0)	75	19.42	43.21	43.12	42.81
$CD_{(0.05)}$	-	0.3	1.16	0.98	0.94

Physical characteristics of peach fruit

All the treatments had significant affect on fruit weight as compared to control (Table 1). The fruit weight was maximum (45.78 g) in T_2 (30: 1 LFR) followed by T3 (44.86g), whereas minimum fruit weight (43.21g) found in control (T_0). Increase in fruit weight might be due to the reduction in the number of fruits per tree thereby increasing the availability of photosynthates and lesser nutritional competition among the developing fruits, thus improving the fruit weight. These results get support from Casierra *et al.* (2007) who reported fruit with 30 to 45 leaves produced larger fruit.The fruit size (length and breadth) was increased by all the treatments in comparison to control (Table 1). Maximum fruit length (45.21mm) and breadth (44.76mm) found in T_2 (30: 1 LFR) which was at par with T_3 (44.56mm and 44.12mm), whereas minimum fruit length (43.12mm) and breadth 42.81mm) was observed in control (T_0). The increase in fruit length and breadth might be due to the reduction in the number of fruits per tree thereby increasing the size of the cell and cell elongation which resulted in maximum accumulation of the food materials in the developing fruits, thus improving the fruit size. These results are in collaboration with the findings of Arora and Chanana (2001) and Casierra *et al.* (2007). The data (Table 2) revealed that there was a significant effect of thinning treatments on the fruit firmness. All the thinning treatments showed reduced fruit firmness as compared to control (0.1432 kg/cm^2), whereas minimum fruit firmness (0.1325 kg/cm^2) was found in T_2 which was at par with T_3 (0.1354 kg/cm^2). Reduction in fruit firmness might be due to larger fruit sizes which decreased the strength of cell wall and lesser cohesion

Table 2: Effect of leaf to fruit ratio on fruit firmness, pulp weight, stone weight and pulp: stone ratio in peach cv. Flordasun

Treatments	Fruit firmness (kg/cm^2)	Pulp weight (g)	Stone weight (g)	Pulp to stone ratio
20 : 1 (T_1)	0.141	39.87	3.8	10.49
30 : 1 (T_2)	0.133	41.76	3.96	10.55
40 : 1 (T_3)	0.135	40.98	3.9	10.51
50 : 1 (T_4)	0.139	39.82	3.81	10.45
Control (T_0)	0.143	38.54	3.71	10.39
$CD_{(0.05)}$	0.003	1.09	0.09	0.05

Table 3: Effect of leaf to fruit ratio on TSS, acidity, reducing sugar and total sugar in peach cv. Flordasun

Treatments	TSS (0 Brix)	Acidity (%)	Reducing sugar (%)	Total sugar (%)
20 : 1 (T_1)	12.69	0.7	1.72	6.02
30 : 1 (T_2)	13.16	0.65	1.81	6.21
40 : 1 (T_3)	12.98	0.67	1.79	6.13
50 : 1 (T_4)	12.66	0.69	1.71	6.06
Control (T_0)	12.26	0.71	1.69	5.71
$CD_{(0.05)}$	0.39	0.02	0.04	0.13

between the cells. These findings are in agreement with the findings of Saini *et al.* (2003) who reported that hand thinning before pit hardening stage reduced the fruit firmness. It was observed that all the treatments significantly affected the pulp weight, stone weight and pulp to stone ratio (Table 2). However, LFR with 30:1 was found to be the most effective in increasing pulp weight (41.76g), stone weight (3.96g)and pulp to stone ratio (10.55). Treatment T0 (Control) recorded the least pulp weight (38.54g), stone weight (3.71g) and pulp to stone ratio (10.39). The increase in pulp weight, stone weight, stone size and pulp: stone ratio could be attributed to increase in fruit size which resulted in higher proportionate pulp weight and increased marginal stone weight. The present findings are in close conformity with the findings of Casierra *et al.* (2007).

Chemical characteristics of peach fruit

It was observed that the total soluble solids, reducing sugars and total sugars increased in all the treatments in comparison with the control, although the highest total soluble solids (13.16 oBrix), reducing sugars (1.81%) and total sugars (6.21%) were found under 30:1 LFR (Table 3). Improvement in total soluble solids, total sugars, reducing sugars and non-reducing sugars might be attributed due to reduced crop load due to thinning of young fruitlets, which resulted in more synthesis, transport and accumulation of sugars in the remaining fruits. The results are in close conformity with Casierra *et al.* (2007). All the thinning treatments reduced the acidity in comparison with control, however, 30 leaves per fruit were found to be highest in reducing titratable acidity (0.65%). The reduction in acidity might be due to the conversion of organic acid to sugar. These findings get support from Kaur (1997) and Saini *et al.* (2003) who reported reduction in acidity by hand thinning when done at before pit hardening stage.From the present investigation, it was observed that the ascorbic acid, total anthocyanins, total carotenoids, total minerals and total phenols were increased in all the thinning treatments (Table 4). However, 30:1 leaf to fruit ratio was found to be the most effective in increasing ascorbic acid (52.61mg/100g), total minerals (1.42%), total phenols (150.19mg/100g), total anthocyanin (4.69 mg/100g) and total carotenoid (10.72mg/100g). The increase in anthocyanin and total phenols might be due to maximal accumulation of anthocyanines and flavonols. These results get support from Cevellos *et al.* (2002) and Marinova *et al.* (2005).

Table 4: Effect of leaf to fruit ratio on ascorbic acid, total minerals, phenol, anthocyanin and total carotenoid in peach cv. Flordasun

Treat-ments	Ascorbic acid (mg/100g)	Total minerals (%)	Total phenol (mg/100g)	Total anthocyanin (mg/100g)	Total carotenoid (mg/100g)
20:1(T_1)	51.08	1.27	148.78	4.21	10.39
30:1(T_2)	52.61	1.42	150.19	4.69	10.72
40:1(T_3)	52.34	1.32	149.86	4.59	10.62
50:1(T_4)	50.94	1.29	148.68	4.23	10.36
Control (T_0)	50.69	1.23	148.5	4.15	10.25
$CD_{(0.05)}$	1.19	0.04	1.27	0.12	0.3

CONCLUSION

From the study, it could be inferred that 30:1 leaf to fruit ratio (LFR) found most effective to reduce the crop load and improved the physico-chemical characteristics viz., TSS (13.160Brix), acidity (0.65%), total sugar (6.21%), ascorbic acid (52.61mg/100g), total anthocyanins (4.69mg), total carotenoids (10.72mg), total minerals (1.42%) and total phenol (150.19mg) content in peach cv. Flordasun. Therefore, thinning of leaf and fruit in the ratio of 30:1 is recommended for peach growers to obtain the best quality fruits for fetching of higher market price.

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