Indian Journal of Agricultural Sciences **82** (3): 267–9, March 2012

Effect of fruit load on yield and quality of peach (*Prunus persica*) in mid hills of Sikkim Himalaya*

ASHOK KUMAR[1], R K AVASTHE[2], BRIJESH PANDEY[3], BONIFACE LEPCHA[4] and H RAHMAN[5]

ICAR Research Complex for NEH Region, Sikkim Centre, Tadong, Gangtok 737 102

Received: 3 September 2010; Revised accepted: 4 July 2011

Key words: Fruit load, Peach, Shan-e-Punjab, Thinning

Stone fruits commonly produce an excessive number of flowers, and thinning is required to set an acceptable yield of large fruits thereby maximizing the returns. Therefore, thinning practices conducted preferably during the growing season are necessary to optimize the fruit size and quality, and to balance tree growth and cropping (Byers 1989, Webster and Lyons 1984a.). In commercial horticulture some part of the crop is removed early in fruit development to improve fruit quality of the remaining crop, in particular the fruit size. However, the effect of fruit thinning is not limited to improvement of fruit characteristics in the current season but may also interfere with tree behaviour in the following year or even years later. A heavy fruit load in one year is reflected in a strong reduction of flower production and fruit yield for the following season resulting in an alternation of 'on' and 'off' years with respect to fruit load. An important tool to prevent biennial bearing is thinning by hand, done at a time when the natural fruit drops (Tromp, 2000). Batjer (1965) suggested that the increase in fruit size was roughly proportional to the degree of thinning. The amount of fruit left on a tree should be determined by the vigour and general condition of the tree. Leaf area/fruit affects the number of spurs flowering the following season. It can be difficult to separate timing and fruit number effects in crop loading studies, as abscission rates after hand thinning of retained flowers/fruitlets tend to vary with the time of hand thinning (Racsko 2006). Soluble solids and fruit firmness suggest a slight advancement in crop maturity by blossom thinning (Elina and John 2006).

The lower reaches of the entirely mountainous state of Sikkim where the altitude ranges from 300 to 8 598 m above mean sea level have been observed to support good production of local peach cultivars. Keeping this in mind, improved and proven var. Shan-e-Punjab was introduced in 2007 to bolster the economy of farmers of Sikkim. It is a well established fact that good quality fruits command higher premium in markets. No study has ever been done in Sikkim on the effect of fruit load/tree and its effect on quality. Since these were the initial years of tree growth it was imperative to quantify the fruit load per tree for prolonged production of quality fruits. Hence, this study was carried out with the objective to find the suitable crop load for good quality fruits with optimum yield of peach under the mid hill conditions of Sikkim Himalayas.

Field experiments were conducted during 2008–10 for consecutive two years on grafted seedlings of peach var. Shan-e-Punjab planted at ICAR Sikkim Centre, Tadong in January 2007, at an altitude of 1 400 m amsl in high density planting of 3 m × 3 m spacing. The experiment was laid out in randomized block design with three replications and 10 plants/ replication of uniform health and vigour. Treatments were designed for manual fruit thinning to retain fixed number of fruits on individual plant, viz retaining 50 fruits, 75 fruits, 139 fruits and control/ no fruit thinning. Data were recorded for fruit weight, pulp weight and stone weight. Waste Index was calculated as per Winfried Roland (2004). Fruit length and width was measured by verneer calipers to record the fruit shape index (Tachibana and Yahata 1998).

Fruit shape index = fruit diameter/fruit length × 100

TSS was measured by hand held refractometer and acidity with titration method. Total sugar, reducing and non-reducing sugars were determined by Shaffer-Somogyi micro method (Ranganna 1991). The data was statistically analyzed following the method of Panse and Sukhatme (1985).

*Short note

[1] Scientist (Senior Scale), Horticulture (e mail: ashokhort@gmail.com);

[2] Head (e mail: ravisikkim@yahoo.co.in), Human Resource Development, CSWCRTI, 218, Kaulagarh Road, Dehra Dun (Uttarakhand), 248 195;

[3] Research Associate (e mail: mr.brijeshpandey@ gmail.com), [4] Technical Assistant (e mail: yenob18@gmail.com);

[5] Director (e mail: hricar@gmail.com), Project Directorate on Animal Disease Monitoring and Surveillance, Bangalore

The study indicated a significant difference among the various treatments for yield and physical quality parameters as depicted in table 1. No thinning/control produced the highest fruit yield (9.23 tonnes/ha and 8.31 tonnes/ha respectively) for 2008–09 and 2009–10 which was significantly higher than the treatments where thinning was done. Increase in yield in the next year of fruiting was recorded in the treatment of retaining 50 fruits/tree and 75 fruits /tree (3.46 tonnes/ha and 4.91 tonnes/ha respectively), whereas decrease in yield was recorded for the treatment of retaining 139 fruit/tree and control (5.98 tonnes/ha and 8.31 tonnes/ha respectively). This was on the expected lines in view of the large difference in the initial fruit load per tree. The treatment where 50 fruits were retained/tree resulted in the lowest yield (2.0 tonnes/ha) in first year. The fruit yields of other three treatments were also significantly lower than control which clearly suggested that yield was determined by the initial fruit load/tree. The findings are in conformity with Tromp (2000). It was observed that retention of lowest fruit load resulted in highest pulp weight (33.3 g and 32.26 g respectively) and and lowest waste index (0.10 and and 0.22 for 2008–09 and 2009–10) which was significantly higher than all other treatments but similar to the treatment retaining only 75 fruits/plant. Similarly, the process of thinning to 50, 75 and 139 fruits/tree significantly increased the pulp weight and pulp: stone ratio as compared to control. However, it was seen that retention of 139 fruits/tree had a higher waste index than other three thinning treatments which were at par with each other. No thinning/control produced smaller sized fruits with low pulp content and hence, had the highest waste index (0.20g and 0.26g respectively) which was significantly higher than all the four thinning treatments. Fruit shape index perhaps the most important marketable character was significantly higher for retaining 75 fruits/ plant as compared to all other treatments. Byers (1989) and Batjer (1965) reported good quality of fruits in the treatment with lesser number of fruits retaining on the plant. Minimum waste index was also recorded with lesser fruit retaining treatment. The findings are in conformity with Siham *et al.* (2006) and Davarynejad *et al.* (2008).

Data presented in Table 2 indicated that quality was significantly influenced by fruit load/tree. Retention of 50 fruits significantly improved the fruit quality with low acidity (1.10%), highest TSS (6.91%), total sugar (4.50%), reducing sugar (3.06%) and the TSS/ acid ratio (6.28) as compared to all other treatments during first year of study, while decrease in acidity (1.20%) and increase in TSS, total sugar, reducing sugar and TSS/acid ratio (6.79%, 4.40%, 3.0% and 5.66 respectively) was recorded in second year of fruiting. The acidity of fruit increased with increase in fruit load/tree additionally it was perused that with the increasing fruit load the TSS, reducing sugar and TSS:acid ratio decreased with highest value recorded for no thinning/control. Reduction in fruit load did not result significant decrease in acidity with all the treatments being statistically at par with each other. The various thinning treatments significantly increased the

Table 1 Physical quality of peach var. Shan-e-Punjab

Fruits/tree	Fruit weight (g)		Stone weight (g)		Pulp weight (g)		Pulp /stone ratio		Waste index		Shape index		Fruit Yield (q/ha)	
	2008–09	2009–10	2008–10	2009–10	2008–09	2009–10	2008–09	2009–10	2008–09	2009–10	2008–09	2009–10	2008–09	2009–10
50	52.10	46.46	7.10	7.40	47.20	44.96	6.65	6.08	0.10	0.22	76.80	76.84	20.00	34.60
75	50.40	44.60	6.20	6.60	42.10	39.90	6.79	6.05	0.10	0.22	84.00	83.96	30.10	49.10
139	45.30	39.12	6.20	6.60	36.20	35.32	5.84	5.35	0.12	0.24	75.00	75.40	70.60	59.80
Control	40.30	40.06	7.40	7.60	33.30	32.26	4.50	4.24	0.20	0.26	82.10	81.90	92.30	83.10
SEm±	0.71	0.65	0.07	0.09	0.98	9.97							1.20	1.35
LSD (P=0.05)	1.50	1.46	0.17	0.18	2.20	2.21							2.60	2.76

Table 2 Chemical quality of peach var. Shan-e-Punjab

Fruits/tree	Acidity (%)		TSS (%)		Total sugar (%)		R. Sugar (%)		TSS /acid ratio	
	2008–09	2009–10	2008–09	2009–10	2008–09	2009–10	2008–09	2009–10	2008–09	2009–10
50	1.10	1.20	6.91	6.79	4.50	4.40	3.06	3.00	6.28	5.66
75	1.15	1.25	6.89	6.71	5.00	4.92	3.20	2.80	5.99	5.37
139	1.30	1.26	6.25	6.35	4.05	4.10	2.60	2.74	4.81	5.04
Control	1.40	1.20	5.80	6.20	4.04	4.02	2.50	2.66	4.14	5.17
SEm±	0.08	0.07	0.03	0.02	0.34	0.31	0.02	0.03		
LSD (P=0.05)	0.18	0.18	0.08	0.06	0.20	0.18	0.05	0.07		

TSS as compared to control and within the thinning treatments TSS was significantly different from each other. However, highest total sugar (5.0% and 4.92% respectively) for two consecutive years was recorded for 75 fruits/tree which were significantly higher than all other treatments. Retaining 50 and 75 fruits/tree did not significantly influence the reducing sugar content amongst them but were significantly higher than 139 fruits/tree and control, which also were significantly different from each other. The thinning process resulted in significant variation in the TSS/acid ratio amongst all the treatments and over no thinning/control. Fruit quality determining parameters like TSS, sugar, TSS/acid and acidity was found best in the treatment with lesser number of fruit retained. Siham *et al*. (2006) and Davarynejad *et al.* (2008) also found that more the number of fruits retained showed inferior quality of fruit.

SUMMARY

Manual fruit thinning had a significant influence on both yield and fruit quality. Retaining 75 fruits/plant produced better shaped fruits, good yield and without severe fall in the quality could be recommended for two years old plants of peach var. Shan-e-Punjab in the mid hills of Sikkim Himalayas. The fruit yield increased with increase in the number of fruits retained/tree with concurrent decrease in fruit quality.

REFERENCES

Batjer L P. 1965: Fruit thinning with chemicals. *USDA Agriculture Information Bulletin* **289**: 1–27.

Byers R E. 1989. Response of peach trees to bloom thinning. *Acta horticulturae* **254**: 125–32.

Byers R E and Lyons Jr C G. 1984a. Flower thinning of peach with dessicating chemicals. *HortScience* **19**: 545–6.

Davarynejad G H, Nyéki J, Szabó T and Szabó Z. 2008. Influences of hand thinning of bud and blossom on crop load, fruit characteristics and fruit growth dynamic of Újfehértói fürtös Sour Cherry Cultivar *American-Eurasian Journal of Agriculgtural and Environment Sciences* **4** (2): 138–41.

Elina D C and John A C. 2006. Blossom thinners reduce crop load and increase fruit size and qulity of peaches. *HortScience* **41** (5): 1253–8.

Panse V G and Sukhatme P V. 1985. *Statistical Methods for Agricultural Workers*. 3rd edn, pp 258–68. Indian Council of Agricultural Research, New Delhi.

Racskó J. 2006 Crop Load, Fruit Thinning and their Effects on Fruit Quality of Apple (*Malus domestica* Borkh.). *Journal of Agricultural Sciences*, Debrecen **24**: 29–35.

Ranganna S. 1991. *Handbook of Analysis and Quality Control of Fruits and Vegetable Products*, pp 203–26. Tata McGraw Hill Publishing Co. Ltd, New Delhi.

Siham M, Bussi C, Lescourret F, Genard M, Habib R and Gilreath J. 2006. Pruning intensity and fruit load influence on vegetative and fruit growth in 'alexenrda' peach. *Proceedings of the Florida State Horticultural Society* **118**: 266–9.

Tachibana S and Yahata S. 1998. Effects of organic matter and fertilizer applications on fruit quality of Satsuma mandarin in high density planting. *Journal of Japan Society of Horticultural Sciences* **67** (5): 671–6.

Tromp J. 2000. Flower-bud formation in pome fruits as affected by fruit thinning. *Plant Growth Regulation* **31**: 27–34.

Webster A D and Andrews L. 1986. Flower and fruit thinning of 'victoria plum (*Prunus domestica* L.) with paclobutrazol. *Acta Horticulturae* **179**: 703–4.

Winfried R and Ronald M P. 2004. Utilizing Waste Products from the Food Production and Processing Industries. *Critical Reviews in Food Science and Nutrition* **44**: 57–62.