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Effect of pruning time, severity and tree aspects on harvesting period and fruit quality of low chilling peach (*Prunus persica*)

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ABSTRACT

Studies were conducted to find out the effect of pruning severity, time and tree aspects on early fruiting, yield and quality characters of Partap peach. Ten years old grafted trees were pruned at fortnightly intervals, i e on 30 October, 15 November and 30 November with two pruning levels, i e 50% and 70% severity (retaining 50% and 30% shoot). Flowering and fruiting was earlier by 15 days in trees pruned on October 30. Fruit size and yield was recorded maximum in trees pruned on October 30 with 50% shoot retention, whereas quality characters, viz. Total soluble solids and acidity was higher in fruits obtained from trees pruned on November 30 with 50% shoot retention. Reducing, non-reducing and total sugars were highest in 50% severity on 30 October. Colour reflectance values were found highest in fruits obtained from trees pruned on October 30 with 50% severity. While comparing the different aspects of the tree, all the physico-chemical parameters were found maximum in fruits of east direction followed by south and minimum in west direction. It was concluded that low chilling peach Partap pruned on 30 October with 50% shoot retention yielded fruits 15 days earlier of superior quality in general and east and south direction of trees particular.

Key words: Early harvest, Pruning, *Prunus persica*, Quality, Tree aspects

Peach (*Prunus persica* (L) Batch.) is an important fruit crop being grown in the mid hills zone of Himalayas extending from Jammu and Kashmir to Khasi hills of Meghalaya at an altitude of 1 000–2 000 m. Peach is good source of sugar, vitamins, calcium, potassium etc and recommended for low-cholesterol, 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).

Under the climatic conditions of Meghalaya, the ripening of low chilling varieties coincide with early rains in May, which resulted high infestation of fruit flies and brown rot that mars the eating quality, marketability and storage life of fruits. It is therefore, early harvesting of fruits before onset of monsoon is desirable. Peach trees bear laterally only on previous season's growth which bears only once in its life time therefore requires regular annual pruning. Manipulating time and severity of pruning can be used for avoiding rainy season crop effectively. Work on standardization of pruning techniques and time has been done by many workers in guava (Dhaliwal and Kaur 2003, Mohammed *et al*. 2005), peach (Singh and Chauhan 1998, Lanzelotti *et al*. 2005) and *ber* (Gill and Ball 2006) etc in different parts of the country but information on crop regulation in peach through pruning schedule is lacking in northeast particularly. Thus, the prime objective of this study was to ascertain pruning scheduling to get early harvest of quality peach.

MATERIALS AND METHODS

Present investigation on the effect of pruning severity, time and tree aspects in peach cv. Partap were carried out on ten years old grafted trees at Horticultural research farm, ICAR Research complex for NEH Region, Umiam, Meghalaya during 2007–09. The experimental site is situated at an elevation of 900 meters and lies between 25° 40' to 25° 21'N latitude and 90° 55'15 to 91°55'16 E longitude. The climate of the site is sub temperate with minimum and maximum temperature between 6°C and 29°C and with

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average annual rainfall of 2841 mm.

Ten years old grafted trees were pruned at fortnightly intervals, i e on October 30, 15 November and November 30 with two pruning levels, i e 50% and 70% severity (retaining 50% and 30% shoot). The experiment was laid out in randomized block design with factorial arrangement and three trees were put under one treatment and replicated thrice. Four fruiting branches on each side of the tree (east, west, north, south) were randomly selected and data were recorded for all four tree aspect separately. Date of 50% flowering, bloom, first and last fruit harvest were noted. Physio-chemical parameters were recorded on the basis of 20 fruits per replication. Yield and other physical parameters were recorded using standard method followed by Patel *et al.* (2007). The total soluble solids (TSS) were determined with Erma Hand Refractometer (0-32°Brix). The tritratable acidity (%) and sugars content (%) were estimated by the standard method described by Rangana (1994). Colour reflectance of the peach fruits was measured as the 'Huntor colour values (L, a and b) by Hunter lab (Colour Quest XE). 'L' is a measure of lightness on a scale ranging from '0' (black) to 100 (white); 'a' denote redness when values are positive and greenness when values are negative, similarly '+ b' denotes yellowness and ,– b, indicates blue colours. The average data of two years were subjected to statistical analysis as per the method outlined by Gomez and Gomez (1984). Least significant difference at 5 per cent level was used for testing the significant differences.

RESULTS AND DISCUSSION

The effect of time and severity of pruning on duration of flowering, harvesting period and early fruiting was quite glaring. Duration from 50% flowering to 100% flowering, first picking to last picking and over all early harvesting from normal harvesting (Table 1) were significantly affected by the time of pruning and severity.In general severity of pruning had non-significant effect, but time of pruning altered harvesting period, growth and quality of fruits. It was noticed that trees pruned on 30 October with 50% severity produced flowers in between 16-25 January, however flowering period from normal pruning schedule (50% severity on 30 November) was from 30 January to 7 February, whereas flowering period ranged from 9–12 days irrespective of different treatments.

Similarly duration from first picking to last picking also ranged from 7–10 days and it was recorded earliest in tree pruned on 30 October with 50% pruning severity, starting from April 10 and ended to April 20 which was 15 days earlier than normal harvesting time in mid hill of Meghalaya conditions. Trees pruned at their normal time of pruning produced fruit from 25 April to 15 May, i e all the fruits were ready for harvesting at quick succession and last within eight days. However, pruning of peach tree during middle of November either with 50% or 70% severity produced fruit from 22 April to 2 May which was 3–7 days earlier than normal fruiting period. It is a well established fact that the time of pruning determines the vegetative growth, tree canopy and advances the bud sprouting and therefore, induces early flowering and fruiting. Gill and Ball (2006) reported that low intensity of pruning in ber improved the fruit yield and quality. They further reported that early pruning advanced bud sprouting and early harvest and improved fruit yield and quality.

Fruit yield and quality parameters were recorded from east, west north and south direction separately and it was noticed that fruit weight (45.88 g) was maximum from east facing of trees and minimum from west side of the trees. Similar results were also obtained for yield and it was recorded highest in east direction and lowest in north facing. Among the pruning time and severity, fruit weight was found maximum in 50% pruning severity on 30 October followed by 30 November. Interactions of pruning and tree aspects showed that east side of tree recorded highest fruit weight (51.16 g) pruned on 30 November followed by 30 October with 50% severity. Yield was also recorded highest (24.66 kg) with 50% pruning severity on 30 October. Interaction effect showed that east side of trees pruned on 30 October with 50% severity contributed highest yield followed by 30 November. Fruits obtained from east direction were bigger in size (42.04 mm × 37.0 mm) in all the pruning time and severity and statistically significant than other directions. Different pruning treatments exhibited non-significant effect on fruit size even though fruit length was recorded maximum (41.60 mm) from 30 October with 50% severity followed by 30 November with 50% severity, whereas fruit diameter was recorded maximum with 50% severity on 30 November. Interactions also exhibited significant effect as trees pruned on 30 October with 50% severity recorded maximum fruit

Table 1 Effect of pruning time and severity on flowering and fruiting of peach

Pruning date and severity	Duration of flowering	Flowering period (days)	Duration of harvesting	Harvesting period (days)	Earliness from normal pruning (days)
30 October, 50%	16–25 Jan.	10	10–20 April	10	15
30 October, 70%	25 Jan.–2 Feb.	9	20–29 April	9	5–7
15 November, 50%	25 Jan.–5 Feb.	12	22–29 April	7	3–7
15 November, 70%	25 Jan.–2 Feb.	9	22 April–2 May	10	3
30 November, 50%	30 Jan.–7 Feb.	9	25 April–l5 May	8	

Table 2 Effect of pruning time, severity and tree aspect on fruits weight, size and yield of peach

Pruning date and severity	Fruit weight (g)					Fruit length (mm)					Fruit breadth (mm)					Yield (kg)				
	Tree aspects																			
	East	West	North	South	Mean	East	West	North	South	Mean	East	West	North	South	Mean	East	West	North	South	Total (kg/ tree)
October 30, 50%	49.2	44.8	39.3	42.5	43.9	44.7	38.4	40.7	42.5	41.6	39.9	31.2	32.5	35.1	34.7	7.88	5.86	4.69	6.23	24.7
October 30, 70%	45.9	42.5	38.3	40.7	41.8	41.1	38.1	39.0	41.5	39.9	36.4	31.9	30.2	33.7	33.1	7.23	5.25	4.50	4.62	21.6
November 15, 50%	40.8	40.7	33.9	37.3	38.2	41.4	33.5	36.0	38.9	37.4	35.2	32.8	29.5	32.8	32.6	7.00	5.50	5.25	4.50	22.23
November 15, 70%	42.3	40.2	35.5	38.2	39.1	39.9	32.8	36.5	37.4	36.7	34.5	30.3	30.0	33.4	32.1	6.50	4.20	5.50	4.25	20.5
November 30, 50%	51.2	40.7	37.3	45.3	43.6	43.1	41.4	38.5	41.8	41.2	39.0	33.4	32.2	38.1	35.7	7.25	5.50	4.50	6.75	24.0
Mean	45.9	41.8	36.9	40.8		42.0	36.8	38.2	40.43		37.0	32.0	30.8	34.6		7.17	5.26	4.89	5.27	
CD (P=0.05) T				2.38			1.26				0.86				1.08					
CD (P=0.05) P				1.88			NS				NS				1.56					
CD (P=0.05) T × P				1.96			1.69				0.89				1.14					

size (44.75 mm × 39.88 mm) than other pruning schedule.

This increment in number of fruit, size and yield at medium pruning level (50%) on earliest date (30 October) might be due to the stimulation of optimum vegetative and floral growth, which might have brought about balance between the fruiting wood and leaf area. Gill and Ball (2006) reported, increase in fruit size and weight might be attributed to better source-sink relationship and lesser competition for assimilates among the fruits in pruned trees. Similar observations were also obtained by Shaban and Haseeb (2009) during the study of effect pruning severity and chemical sprays on guava. Lanzelotti *et al.* (2005) reported non-significant difference on yield and fruit quality at different dates of pruning peach and concluded that, according to condition peach pruning may be performed at any time of the period considered, the same yield and fruit quality obtained in all pruning dates. It is well known that flowering intensity in a number of subtropical trees is influenced by ambient temperature and duration radiation interception. The higher radiation interception by different parts of the canopy may have improved flowering and initial fruit set which ultimately affect the yield and quality. Under supra-optimal radiation, and canopy temperature by tree aspect and pruning schedule, shading may have the opposite effect of increasing fruit weight because of a reduction in photo-inhibition. Similar observations were also reported by Stephan *et al.* (2008) on light interception and partitioning between shoots in apple cultivars influenced by training.

Quality characters such as total soluble solids, non-reducing, reducing and total sugars were non-significantly altered by different pruning treatment, whereas acidity was non-significantly affected by tree aspects (Tables 4,5). Maximum TSS (10.95^{0}B), reducing sugars (5.89%), total sugars (8.74%) and minimum acidity (1.13%) were recorded in fruit harvested from east direction, whereas west direction of trees registered minimum. Interactions also showed significant effect on different quality parameters. Maximum TSS (12.10.0^{0}B) was recorded in fruits obtained from trees pruned on 30 November with 50% severity from east direction which was significantly higher than other pruning tretments, whereas acidity was found highest (1.85%) in southern aspect of trees pruned on 30 October with 70% severity. Non reducing sugars was recorded highest (3.75%) in west direction from 30 October pruned tree with 50% severity, whereas reducing (7.39%) and total sugars (10.52%) were recorded highest from east side of tree pruned on 30 October with 50% pruning severity.

Colour reflectance of the peach fruits was measured as Hunter colour values (L, a, b and a/b). The maximum lightness value (67.8) was recorded in fruit peel harvested from west aspect of tree pruned on 15 November with 50% severity, while fruit harvested from east direction, pruned on earliest date with 70% severity registered lowest L values (36.6). However, fruits from east direction obtained from 50%

Table 3 Effect of pruning time, severity and tree aspect on TSS (^{0}B) and acidity (%) of peach

Pruning date and severity	TSS (^{0}B)					Acidity (%)				
	Tree aspect									
	East	West	North	South	Mean	East	West	North	South	Mean
30 October, 50%	10.70	9.60	10.50	10.60	10.35	0.79	1.32	0.83	1.20	1.04
30 October, 70%	10.50	10.10	10.20	10.10	10.23	1.41	1.47	1.47	1.85	1.55
15 November, 50%	10.03	8.70	11.00	10.30	10.01	0.84	0.92	0.76	1.32	0.96
15 November, 70%	11.40	10.20	10.50	9.80	10.48	1.22	1.86	1.34	1.60	1.51
30 November, 50%	12.10	9.90	10.20	12.00	11.05	1.41	1.80	1.41	1.44	1.52
Mean	10.95	9.70	10.48	10.56		1.13	1.47	1.16	1.48	
CD (P=0.05) T	0.18					NS				
CD (P=0.05) P	NS					0.11				
CD (P=0.05) T × P	0.23					0.10				

Table 4 Effect of pruning time, severity and tree aspect on sugars content of peach

Pruning date and severity	Non reducing sugar					Reducing sugar					Total sugar				
	Tree aspect														
	E	W	N	S	Mean	E	W	N	S	Mean	E	W	N	S	Mean
30 October, 50%	3.08	3.75	3.13	3.52	3.37	7.39	4.81	5.25	5.34	5.70	10.52	8.33	8.33	9.09	9.07
30 October, 70%	2.98	3.02	3.10	2.58	2.92	5.89	4.69	4.98	4.23	4.95	8.06	7.36	8.23	7.76	7.85
15 November, 50%	2.82	3.08	2.90	2.15	2.74	5.35	4.70	4.92	5.44	5.28	8.33	6.67	6.45	7.36	7.20
15 November, 70%	2.56	2.89	2.78	2.92	2.89	5.33	5.10	5.70	4.98	5.28	7.72	7.46	6.23	7.12	7.13
30 November, 50%	2.98	2.96	2.75	2.85	2.89	5.51	5.10	5.39	5.30	5.33	9.09	6.25	7.14	7.41	7.47
Mean	2.88	3.14	2.93	2.80		5.89	4.88	5.25	5.06		8.74	7.21	7.28	7.75	
CD (P=0.05) T			NS				0.34				0.56				
CD (P=0.05) P			NS				NS				NS				
CD (P=0.05) T × P			0.28				0.31				0.69				

Table 5 Effect of pruning time, severity and tree aspect on Hunter colour value of peach

Pruning date and severity	L					a					b				
	Tree aspect														
	E	W	N	S	Mean	E	W	N	S	Mean	E	W	N	S	Mean
30 October, 50%	48.2	61.7	56.9	60.5	56.8	22.32	8.27	10.63	11.90	13.28	14.45	18.09	20.90	23.74	20.8
30 October, 70%	47.9	59.3	54.0	56.6	54.5	21.19	13.2	5.17	16.88	14.12	19.42	18.92	21.58	20.95	21.9
15 November, 50%	43.9	61.7	56.2	50.5	53.1	18.18	4.42	3.20	10.22	9.0	16.25	15.88	13.68	20.93	21.6
15 November, 70%	36.6	59.3	59.1	56.9	52.9	13.12	6.50	3.60	10.23	8.36	14.32	12.23	15.43	24.16	21.5
30 November, 50%	58.6	67.8	55.6	58.9	60.2	25.06	6.67	7.74	16.90	14.09	20.43	19.00	16.31	23.79	25.4
Mean	49.1	61.9	56.4	56.7		19.97	7.22	6.06	13.22		16.97	16.82	17.58	22.71	
CD (P=0.05) T- 3.67						2.16							2.12		
CD (P=0.05) P- 3.12						2.28							2.56		
CD (P=0.05) T x P-3.96						2.24							2.34		

pruning severity on 30 November registered maximum values (25.06) for redness followed by 30 October with same pruning intensity, whereas fruits with minimum redness were harvested from northern side of the trees pruned on 15 November with 50% severity. Colour reflectance for yellowness (b value) recorded maximum (24.16) under 70% pruning severity on 15 November followed by 30 November with 50% pruning. In general, it was observed that rather

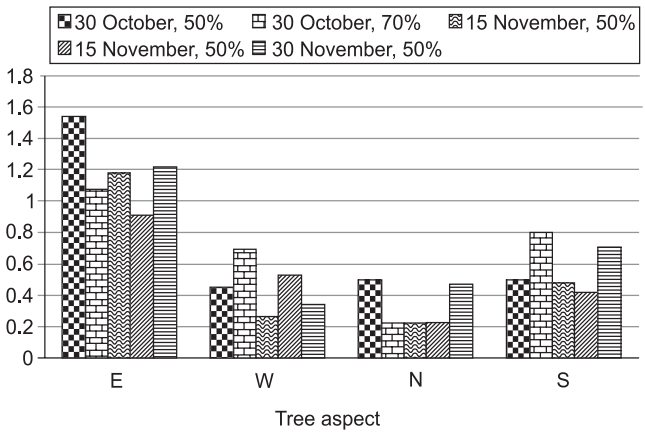

Fig 1 Colour reflectance of peach fruits (a/b ratio)

than pruning severity and time, tree aspect was more glaring for colour values.

The a/b ratio is considered to be an important parameter, which determines the visible impression of fruit colour. In peach fruits, higher values of a/b ratio were recorded in fruits harvested from east direction irrespective of pruning time and severity (Fig 1). This may be due to long exposure of fruit for sunlight which accelerate higher accumulation of total carotenoid pigment in the fruit peel. Among the pruning treatments 50% pruning severity registered higher a/b value than 70% and it was found highest on 30 October followed by 30 November.

It is a well established fact that pruning alone at the right time and to the adequate extent improves the size, colour and quality of fruits by making more sun shine fall on the leaves, fruits and on a larger portion of the plant (Singh 2003). Increased yield and quality due to medium pruning at early stage might be due to the fact that besides light penetration and fulfilling of chilling hours, it also encourages more flow of nutrients and water to the remaining shoots which flower and that is how the percentage of flowers that develop to form fruits is increased invariably. Higher and early yield of quality peach fruit with higher total soluble solids, sugars, lower acidity and more intense coloured fruit from early pruning might be due to increased nutrient uptake by the tree and consequently more synthesis of carbohydrates and other metabolites and their translocation to the fruit. Secondly the fruit load is also reduced with medium severity pruning at early stage. These findings are in agreement with those of Gill and Ball (2006).

Lewallen KAS (2000) found that position of the fruit on the tree also affected fruit quality characteristics; peaches from the medium pruning intensity and outer canopy were redder and darker than those from the lower canopy which also have better quality fruits. The position effect was probably due to the degree of light exposure and not to the distance from the roots. Fruit on the east side of the tree canopies received much higher photosynthetic photon flux (PPF) than other aspect of trees.

It was concluded that low chilling peach Partap pruned on 30 October with 50% shoot retention yielded fruits 15 days earlier of superior quality in general and east and south direction of trees particular.

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