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Short communication

Effect of different pruning intensities on the growth, flowering, yield and quality of nectarine

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ABSTRACT

The studies were conducted to see the effect of nine different pruning intensities on vegetative growth and yield of nectarine. The highest pruning intensity, *viz.*, 60% thinning out + ¾ heading back was given to the plants, resulted in significant increase in the trunk growth, leaf area and fruit weight. The increased pruning intensity decreased the time taken for leaf emergence and flower initiation of the plants. The fruit set and yield were highest with treatment where minimum pruning intensity *viz.*, 20% thinning out and ¼ heading back was applied on the plants. The best fruit quality in terms of total sugars and sugar: acid ratio was observed with the treatment, 40% thinning out + ¾ heading back. Among the two cultivars, Silver King exhibited better growth and yield performance.

Key words: Pruning intensity, nectarine, quality.

The peach is third most important temperate fruit cultivated in India and is mainly cultivated in the states of Himachal Pradesh, Jammu and Kashmir and Uttarakhand (Chundawat and Sen, 3). Nectarines (*Prunus persica* var. *nucipersica*) are the smooth skinned fruits which have apparently originated from peach by mutation. The lack of pubescence is controlled by a single recessive gene. Two important cultivars namely; Silver King and Snow Queen have shown promise in the recent years for cultivation in the mid hills of Himachal Pradesh.

The nectarine fruits are born laterally on one-year-old wood, which becomes barren afterwards. Hence, they require a heavy pruning to strike a balance between growth and fruitfulness, otherwise fruit bearing area on shoots gets far away, which becomes unmanageable. The stone fruit plants are pruned generally in two ways, *i.e.* heading back and thinning out. When only a part of terminal portions of the branches, having their basal portion intact are removed, it is heading back. The apical dominance of the twig is destroyed and the lateral buds are stimulated to grow. When the branches are considered undesirable, they are removed entirely from the base without leaving any stub, it is thinning out (Kaur, 6). Performance of nectarine trees depends heavily on the proper pruning annually. In terms of pruning, both peach and nectarines can be treated in the same way as their flowering and fruiting habits are the same. On the parts, once fruits bear, no flower bud differentiation or subsequent fruit formation takes place. If the trees are not pruned annually, the volume of fruiting wood reduces each year (Yadav, 12). The pruning levels have been standardized for peaches under different agro-climatic conditions, which show variation from region to region and cultivar to cultivar (Singh *et al*., 11). However, the information regarding pruning in nectarine is lacking.

The trial was conducted in the experimental orchard of the Department of Fruit Science, Dr Yashwant Singh Parmar University of Horticulture and Forestry, Nauni (H.P.) in a randomized block design with nine pruning treatments and three replications using five-year-old plants of two cultivars, *viz.*, Silver King and Snow Queen during the year 2009-2011. The pruning was done during third week of December and the experimental plants were kept under uniform orchard management practices. The fruits of both the cultivars were harvested in the month of May at optimum maturity. The following were the treatment details T_1= 20% TO + ¼ HB; T_2= 20% TO+ ½ HB; T_3= 20% + ¾ HB; T_4= 40% TO+ ¼ HB; T_5= 40% TO+ ½ HB; T_6= 60% TO+ ¼ HB; T_7= 60% TO + ½ HB; T_8= 60% TO + ¾ HB; T_9 control = 40% TO + ¾ HB. The control treatment represented standard pruning intensity for July Elberta peach.

Observations were recorded on different growth, flowering, fruit yield and quality parameters following standard methods. The trunk growth was measured by finding the increase in trunk girth at the beginning and at the end of growing season. The leaf area was determined with the help of Automatic Leaf Area Meter (LiCor Model-3100). The dates of leaf emergence and flower initiation were noted. The per cent fruit set was calculated on the basis of the number of fruits which were set out of the total number of flowers. The total sugars of the fruit were estimated by volumetric method as suggested by AOAC (1).

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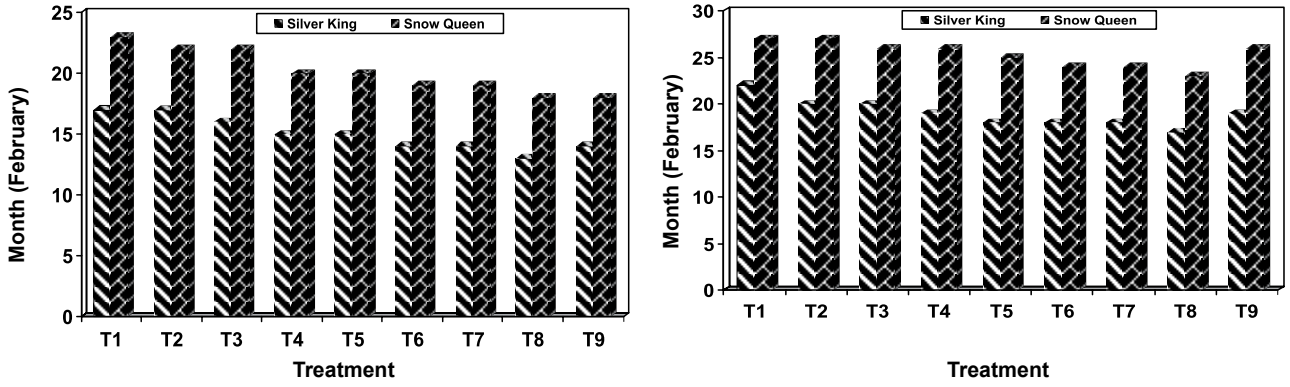

A. Leaf emergence B. Flower emergence

Fig 1 (A&B). Effect of pruning intensities on the time of (a) leaf emergence and (b) flower initiation in nectarine cvs. Silver King and Snow Queen.

The data in Tables 1 & 2 revealed that pruning had significant influence on the growth and yield of nectarine. The highest trunk growth and leaf area were observed with treatment T_8 (60% TO + ¾ HB) where the pruning intensity was highest. The trunk growth and leaf area of the cultivar Silver King were more than that of Snow Queen. Growth responses due to pruning severity may be attributed to certain physiological changes, particularly altered hormonal and nutritional translocation in the plant, which promote development of vascular system and activate nutrient transport, thereby intensifying the already initiated growth (Chandel, 2). These observations were supported by Rathi *et al*. (8) who suggested that the severe pruning treatments result in higher amount of photosynthates and nutrients, which in turn enhance cell division and formation of more tissues resulting into more vegetative growth.

Observations on leaf emergence (Fig. 1) revealed that pruning had significant effect on leaf emergence date in both the cultivars. The leaf emergence was advanced with the increasing pruning intensity. The leaves emerged earliest, i.e. on 17th February and 23rd February with T_8 (60% TO + ¾ HB) treatment in the cvs. Silver King and Snow Queen, respectively. The flower initiation was also significantly affected by

Table 1. Effect of different pruning severities on the trunk growth and leaf area of nectarine cvs. Silver King and Snow Queen.

Treatment	Trunk growth (%)			Leaf area (cm^2)		
	Silver King	Snow Queen	Mean	Silver King	Snow Queen	Mean
T_1 (20% TO* + ¼ HB**)	5.1 (2.3)	4.8 (2.2)	4.9 (2.2)	33.3	29.2	31.3
T_2 (20% TO + ½ HB)	6.8 (2.6)	5.6 (2.4)	6.2 (2.5)	35.2	32.3	33.8
T_3 (20% TO + ¾ HB)	7.0 (2.6)	6.6 (2.6)	6.8 (2.6)	38.4	34.3	36.4
T_4 (40% TO + ¼ HB)	5.7 (2.4)	5.1 (2.2)	5.4 (2.3)	36.3	33.4	34.9
T_5 (40% TO + ½ HB)	6.0 (2.5)	6.9 (2.6)	6.5 (2.5)	40.2	38.5	39.3
T_6 (60% TO + ¼ HB)	5.7 (2.4)	6.5 (2.6)	6.1 (2.5)	42.3	40.8	41.6
T_7 (60% TO + ½ HB)	6.9 (2.6)	7.2 (2.7)	7.1 (2.7)	44.7	43.5	44.1
T_8 (60% TO + ¾ HB)	8.9 (3.0)	7.8 (2.8)	8.4 (2.9)	47.7	44.4	46.1
T_9 (control)***	7.7 (2.8)	7.5 (2.7)	7.6 (2.8)	45.1	46.2	45.7
Mean	6.7 (2.6)	6.4 (2.5)		40.4	38.1	

Figures in parentheses are square root transformed values

TO* : Thinning Out; HB** : Heading Back; T9 (Control)*** : 40% TO + ¾ HB

$CD_{0.05}$

Treatment	=	0.1	2.3
Cultivar	=	NS	1.1
Treatment × cultivar	=	0.2	NS

pruning the plants. The earliest flower initiation i.e. on 13th February in Silver King and on 18th February in Snow Queen was observed.

Both fruit set and fruit yield reduced after severe pruning (Table 2). The highest fruit set and fruit yield were recorded with the least pruned plants (T_1= 20% TO + ¼ HB). However, both parameters were better in Silver King than Snow Queen cultivars. These results are in conformity with those of Hua *et al*. (5) and Robinson *et al.* (9) who also reported that lightly pruned trees resulted in greater yield as compared to heavily pruned. This might be due to the fact that the severe pruning reduced the number of floral buds and fruiting area. The decrease in fruit set with the increase in pruning severity may be attributed to active utilization of carbohydrates, nutrients and water

Table 2. Effect of different pruning severities on fruit set and yield of nectarine cvs. Silver King and Snow Queen.

Treatment	Fruit set (%)			Fruit yield (kg/plant)		
	Silver King	Snow Queen	Mean	Silver King	Snow Queen	Mean
T_1 (20% TO* + ¼ HB**)	83.2 (9.1)*	77.4 (8.8)	80.3 (9.0)	13.3	12.3	12.8
T_2 (20% TO + ½ HB)	81.2 (9.0)	75.6 (8.7)	78.4 (8.9)	11.9	10.7	11.3
T_3 (20% TO + ¾ HB)	79.5 (8.9)	72.3 (8.5)	75.9 (8.7)	10.5	9.4	9.9
T_4 (40% TO + ¼ HB)	82.0 (9.1)	76.2 (8.7)	79.1 (8.9)	12.1	11.3	11.7
T_5 (40% TO + ½ HB)	77.6 (8.8)	74.5 (8.6)	76.1 (8.7)	10.5	9.3	9.9
T_6 (60% TO + ¼ HB)	78.9 (8.9)	73.4 (8.6)	76.2 (8.7)	7.5	6.2	6.9
T_7 (60% TO + ½ HB)	74.7 (8.6)	70.4 (8.4)	72.5 (8.5)	9.8	8.7	9.2
T_8 (60% TO + ¾ HB)	73.8 (8.6)	68.2 (8.3)	71.0 (8.4)	11.5	10.1	10.8
T_9 (Control)***	74.2 (8.6)	71.1 (8.4)	72.6 (8.5)	8.3	8.3	8.3
Mean	78.3 (8.8)	73.2 (8.6)		10.6	9.6	

*Figures in parentheses are square root transformed values

$CD_{0.05}$

Treatment	=	0.3	1.6
Cultivar	=	0.1	0.7
Treatment × cultivar	=	NS	NS

Table 3. Effect of different pruning severities on the fruit weight, total sugars and sugar acid ratio of nectarine cvs. Silver King and Snow Queen.

Treatment	Fruit weight (g)			Total sugars (%)			Sugar:acid ratio		
	Silver King	Snow Queen	Mean	Silver King	Snow Queen	Mean	Silver King	Snow Queen	Mean
T_1 (20% TO* + ¼ HB**)	30.4	29.8	30.1	8.72	8.07	8.39	12.1	10.3	11.2
T_2 (20% TO + ½ HB)	37.8	34.3	36.1	9.32	9.30	9.31	13.5	12.4	12.9
T_3 (20% TO + ¾ HB)	45.6	37.4	41.5	9.65	10.12	9.89	14.6	14.3	14.3
T_4 (40% TO + ¼ HB)	42.6	41.7	42.1	9.21	9.50	9.36	14.2	13.8	14.0
T_5 (40% TO + ½ HB)	49.4	45.1	47.3	9.52	10.21	9.87	15.4	16.2	15.9
T_6 (60% TO + ¼ HB)	55.4	48.6	52.0	10.04	9.27	9.65	16.2	15.2	16.1
T_7 (60% TO + ½ HB)	62.5	55.6	59.0	10.13	10.36	10.24	18.1	17.9	18.0
T_8 (60% TO + ¾ HB)	75.1	70.6	72.8	11.13	10.92	11.02	21.8	19.9	20.8
T_9 (Control)***	73.1	68.4	70.8	11.11	11.02	11.06	21.0	20.8	20.9
Mean	52.4	47.9		9.87	9.86		16.2	15.2	

$CD_{0.05}$

Treatment	=	5.7	0.41	1.9
Cultivar	=	2.7	NS	NS
Treatment × cultivar	=	NS	0.57	NS

by the newly grown vegetative shoots which reduced the fruit set.

Pruning had a marked effect on the fruit weight. There was an increase in fruit weight with the corresponding increase in pruning intensity. The maximum fruit weight was observed with T_8 (60% TO + ¾ HB) where, highest pruning intensity was given. The cultivar Silver King was observed to have heavier fruits than the Snow Queen. The increased weight of fruits in respect of heavy pruning have led to the moderate crop on the plants which in turn got adequate food materials for their optimum development. Pruning decreased the number of flower buds and consequently the fruit weight increased. Similar results of increase in the fruit weight with increasing severity of pruning have also been reported by Mahajan and Dhillon (7), and Hassani and Rezaee (4).

The maximum total sugars were observed with T_9 (40% TO + ¾ HB) treatment where, heavy pruning was performed. The enhanced total sugars in the fruits with the increasing severity of pruning might possibly be associated with the increase in leaf fruit ratio. This augmented the availability of more photosynthates and uptake of nutrients from the soil, which subsequently terminated into better fruit quality. These findings are in agreement with Sharma and Chauhan (10) who observed maximum total sugars in those July Elberta peach trees where the annual shoots were cut back to 75 per cent of their original length as compared to 25 and 50 per cent.

The sugar:acid ratio increased with the increasing pruning intensity. The highest sugars acid ratio was observed with the fruits harvested from plants where highest pruning severity, *i.e.*, T_8 (60% TO + ¾ HB) was given whereas, on decreasing the pruning severity, the ratio decreased. The cultivar Silver King had more sugar:acid ratio than that of Snow Queen. The interaction effect of treatment and cultivar was recorded as non-significant in both the observed ratios. The increased sugar acid ratio with increased pruning intensity may be attributed to increased sugar content and reduced level of titratable acidity.

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