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Growth, yield, quality and leaf nutrient status as influenced by planting densities and varieties of apricot

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ABSTRACT

The two planting densities (3.5 m × 3.5 m and 5 m × 5 m) as main plot and four apricot varieties (CITH-Apricot-1, CITH-Apricot-2, Harcot and Erani) as sub-plot treatment were laid out in split plot design with three replication. Experimental results clearly indicated that maximum trunk cross-sectional area (TCSA) of tree (118.38 cm^2), fruit number (2,044), fruit weight (56.43 g), fruit size (4.87 cm × 5.06 cm) and yield (118.68 kg/ tree), stone weight (3.50 g), stone size (2.59 cm × 2.24 cm), kernel weight (1.13 g) and size (1.66 cm × 1.39 cm), TSS (15.90°Brix) and leaf N,P,K content (1.17, 0.149, 1.69%) were recorded at wider spacing 5 m × 5 m. Whereas, fruit yield per hectare (52.05 t/ha) and acidity (0.71%) was maximum in closer plant spacing (3.5 m × 3.5 m) in main plot treatment. Among variety, maximum trunk cross-sectional area, fruit weight, size, fruit yield, TSS and leaf NPK contents were recorded in CITH-Apricot-1. However, fruit number, stone weight, size, kernel weight, size and acidity were recorded in CITH-Apricot-2. TSS/acid ratio was highest in Harcot.

Key words: Plant density, apricot, yield, quality, leaf nutrient status.

INTRODUCTION

Apricot (*Prunus armeniaca* L.) is one of the important stone fruits of temperate region of India, mostly grown in the states of J&K, Himachal Pradesh and Uttarakhand in an area of 17,397 ha with total production of 48,200 metric tonnes and national productivity is only 2.77 t/ha. In J&K, it is cultivated over an area of 5,856 ha with an annual production of 15,573 metric tonnes (NHB,10). The productivity is very low (2.65 t/ha) as compared to other apricot growing countries like Austria, Slowania, USA etc. The chilling requirement of this crop ranges from 300 to 900 (chill unit) depending upon the variety. The main reason for its low productivity is non availability of high yielding varieties and lack of appropriate production technology especially planting density suiting to different climatic zones and region. Traditionally, apricot orchards are planted at a wider spacing resulting into low productivity. The planting density plays an important role in improving the productivity of apricot. The different planting density /system have been successfully demonstrated in sub-tropical and temperate fruit crops (Bose *et al.*, 1; Kumar and Singh, 5; Mahajan *et al*., 7; Loreti *et al*., 6; Holubowicz, 2). However, very little information is available on high density and other planting systems in apricot. High density planting increased yield per unit area in apricot (Mehta *et al*., 8). Availability of solar radiation in high density planting system is an important factor as it governs photosynthesis and accumulation of carbohydrates its efficient utilization under abundant availability conditions will determines the final yield to great extent. The Institute (Central Institute of Temperate Horticulture, Srinagar) during the last few years has developed apricot varieties such as CITH-Apricot-1, CITH-Apricot-2 and CITH-Apricot-3, with higher productivity (12-15 t/ha) which is comparable to the productivity obtained in developed countries like Austria and USA. The varieties CITH-Apricot-1, CITH-Apricot- 2, Harcot and Erani are performing well under Kashmir conditions. The variety CITH-Apricot-1: It is self-fertile and mid season blooming type. Fruits are very large, round, yellowish orange with redish blemishes, early maturing and good quality. CITH-Apricot-2: Self fertile and early to mid season blooming type. Fruits are large, asymmetrical with slightly pointed beak, yellowish orange with redish on exposed surface, early maturing and superior quality (Sofi *et al.*, 11). The varieties Harcot and Erani are also good yielder and widely accepted by growers. Keeping this in view, an attempt was made to study the effect of planting density and variety on growth, yield and quality of apricot.

MATERIALS AND METHODS

The experiment was conducted at Central Institute of Temperate Horticulture, Old Air Field, Rangreth, Srinagar, Jammu & Kashmir during 2009-10 and 2010-11 to study the effect of different planting densities and

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varieties on growth, fruit yield, quality and leaf nutrient status of apricot. The Research farm at Srinagar is situated at a latitude of 34° 05'N and longitude of 74° 50'E and at an altitude of 1640 m above msl. The soils of this experimental field are sandy clay loam (45-55% sand, 10-20% Silt and 20-25 % clay; 6.5-7.5 soil pH, 0.50% organic carbon, 462.1 kg N/ha, 9.59 kg P/ha and 278.85 kg K/ha) with poor drainage. The experiment was laid out in split plot design with two planting densities (3.5 m x 3.5 m and 5 m x 5 m) as main plot and four apricot varieties (CITH-Apricot-1, CITH-Apricot-2, Harcot and Erani) as sub-plot treatment with three replications. The planting was done during 2003-04 in the experimental field. The experimental farm falls under temperate region having cold conditions from November to February and total average annual rainfall received during the cropping season was 718.9 mm. Observations on growth, yield, quality and leaf nutrient status were recorded. The trunk cross-sectional area was calculated by using formula TCA = Girth 2/4 π (Westwood *et al.*, 14). Fruit was harvested at maturity and yield per tree was estimated in kilogram. Fruit, stone and kernel size was determined by observing the length and diameter and measured by Vernier callipers. Ten fruits were randomly selected from each tree and pooled as per replication in all treatments for quality analysis. The total soluble solids (TSS) of fruits was estimated by hand refractometer. To estimate TSS, fruit pulp was crushed in a pestle and mortar and then squeezed through a muslin cloth for extraction of juice. The titratable acidity expressed in terms of percentage of citric acid was recorded by titrating 2 ml of juice against N/10 sodium hydroxide using phenolphthalein indicator. Leaf samples were collected as per the treatments from the middle part of bearing shoots of the apricot tree. Fully developed 30 leaf samples were collected from the tree for estimation of major nutrients during leaf fall stage, *i.e.*, June month. The leaf samples were kept in hot oven for drying. After drying the leaf sample ground to pass a 0.5 mm mesh and analysed for macro-nutrient content. Nitrogen, phosphorus and potassium were estimated by the modified micro-Kjeldahl, Vanado-molybdate (Jackson, 3) and flame photometric methods respectively. The data of two years were pooled and analyzed statistically as per Steel and Torrie (12) for interpretation of results and drawing conclusions.

RESULTS AND DISCUSSION

The data on growth and fruit yield have been presented in Table 1 as influenced by planting densities and varieties in apricot. The trunk cross sectional area of tree, fruit number and yield increased with decreasing the plant density from 816 to 400 plants/ha. Significantly higher trunk cross-sectional area, fruit number, fruit weight, size and yield per tree were recorded in wider spacing of 5 m x 5 m and it was significantly higher (55.85% fruit number, 11.60% fruit weight, 18% fruit size and 86.07% fruit yield) over closer spacing (3.5 m x 3.5 m). This might be due to sufficient availability of natural resources i.e. space, light, moisture and nutrient thereby carbohydrates reserves resulted better TCSA, fruit number and yield at wider spacing. The highest fruit yield per hectare was recorded at closer spacing of 3.5 m x 3.5 m due to accommodation of higher number of plant per unit area. Similar findings were reported by Mehta *et al.* (8) and Kumar *et al.* (4) in apricot, Grzyb *et al*. (2) and Singh *et al*. (14) in plum, Marini and Sowers (9), and Singh and Kanwar (13) in peach; and Yastass (19) in sweet cherry.

Table 1. Growth and yield as influenced by planting densities in apricot varieties.

Planting density	TCSA * (cm^2)	Fruit No./ tree	Fruit wt. (g)	Fruit size (cm)		Fruit yield	
				Length	Dia.	(kg/ plant)	(t/ha)
3.5 m × 3.5 m	63.80	1311.50	50.56	4.03	4.43	63.78	52.05
5 m × 5 m	118.38	2044.0	56.43	4.87	5.06	118.68	47.42
CD at 5%	30.24	318.12	5.11	0.32	0.29	26.54	2.11
Variety							
CITH-Apricot-1	118.72	2001.5	59.94	4.84	4.88	122.58	66.46
CITH-Apricot-2	97.40	2082.0	55.64	4.70	4.80	119.38	65.10
Harcot	68.83	925.5	51.99	4.70	4.71	62.41	33.72
Erani	79.41	1447.5	41.41	4.63	4.64	60.82	33.67
CD at 5%	28.78	412.32	5.23	0.21	0.18	31.24	3.12

*TCSA: Trunk cross-sectional area of tree

The trunk cross-sectional area and fruit yield contributing characters were also influenced by different varieties of apricot (Table 1). Maximum TCSA (97.40 cm^2), fruit wt. (59.94 g), fruit size (4.84 cm x 4.88 cm), fruit yield (122.58 kg/tree and 66.46 t/ha) were recorded in CITH-Apricot-1 which was closely followed by CITH-Apricot-2. Highest fruit number (2082 per tree) was recorded in CITH-Apricot-2. The better performance might be due to inherent vigour and bearing habit of apricot variety. Similar findings were reported by Sofi *et al*. (11) and Kumar *et al*. (4).

A perusal of data presented in Table 2 revealed that stone and kernel character as influenced by planting density and varieties in apricot. The stone weight & size and kernel wt. & size increased with decrease in the planting density (816 to 400 plants/ ha). Maximum stone weight and size (3.5 g and 2.59 cm x 2.24 cm) and kernel weight and size (1.13 g and 1.66 cm x 1.39 cm) were recorded at wider spacing, which was significantly higher than the closer spacing of 3.5 m x 3.5 m. This may be due to higher uptake of nutrient from root to aerial part of plant and source to sink. Similar findings were reported by Kumar *et al*. (4).

Significantly higher stone weight & size and kernel weight & size were recorded in CITH-Apricot-1 in comparison to other varieties (Table 2). The higher weight and size of stone as well as kernel might be due to inherent character of CITH-Apicot-1. The findings are in conformity with the findings of Kumar *et al*. (4). The TSS and TSS/ acid ratio increases with decreasing the planting density from 816-400 plants/ ha (Table 3). Highest TSS (15.90°Brix) and TSS/ acid ratio (33.82) were recorded at wider spacing. Whereas, acidity was maximum at closer spacing. Possibly higher photosynthesis and availability of metabolites due to higher interception of PAR by individual tree might have improved fruit quality at wider spacing as suggested by Mehta *et al*. (8) and Verma *et al*. (13). Fruit quality was also influenced by different apricot varieties (Table 3).The highest TSS was estimated in CITH-Apricot-1, whereas higher acidity (0.67%) was recorded in CITH-Apricot-2. The TSS/acid ratio was maximum in Harcot variety of apricot. The highest TSS and TSS/acid ratio in CITH-Apricot-1 and maximum acidity in CITH-Apricot-2 might be due to inherent character of particular variety. Similar findings were reported by Kumar *et al*. (4).

Table 3. Fruit quality as influenced by planting densities and varieties in apricot

Planting density	TSS (°Brix)	Acidity (%)	TSS/acid ratio
3.5 m × 3.5 m	13.96	0.71	19.66
5 m × 5 m	15.90	0.46	33.82
CD at 5%	1.15	0.12	-
Variety			
CITH-Apricot-1	16.35	0.55	29.72
CITH-Apricot-2	14.62	0.67	21.82
Harcot	14.96	0.47	31.82
Erani	13.80	0.66	20.91
CD at 5%	1.21	0.13	-

The leaf nitrogen, phosphorus and potassium content increased with decrease in planting density from 816 to 400 plant/ha (Fig. 1a & b). Maximum leaf nitrogen, phosphorus and potassium content (N: 1.17, P: 0.149, K: 1.69%) were recorded in wider spacing and minimum in the closer spacing. The wider spacing might be responsible for higher uptake and translocation of nutrient from soil to aerial part of the plants. Leaf nutrient content also influenced

Table 2. Stone and kernel characters as influenced by planting densities in apricot varieties.

Planting density	Stone wt. (g)	Stone size (cm)		Kernel wt. (g)	Kernel size (cm)	
		Length	Dia.		Length	Dia.
3.5 m × 3.5 m	2.65	2.24	1.99	0.88	1.59	1.31
5 m × 5 m	3.50	2.59	2.24	1.13	1.66	1.39
CD at 5%	0.31	0.22	0.18	0.25	0.11	0.05
Variety						
CITH-Apricot-1	3.17	2.31	2.05	0.98	1.68	1.33
CITH-Apricot-2	3.81	2.68	2.26	1.11	1.66	1.46
Harcot	2.30	2.32	2.05	0.82	1.57	1.29
Erani	3.03	2.38	2.16	1.14	1.59	1.45
CD at 5%	0.61	0.12	0.11	0.21	0.09	0.12

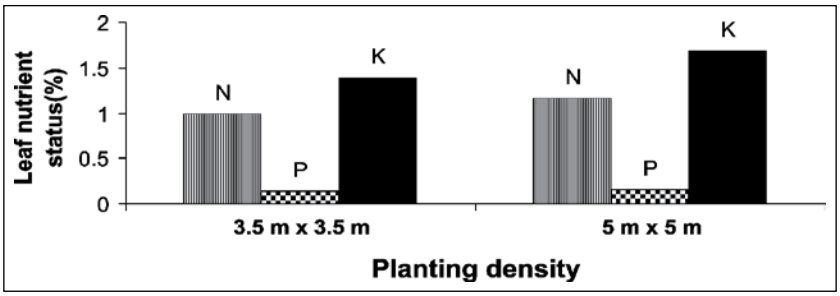

Fig. 1a. Leaf nutrient status as influenced by planting densities in apricot.

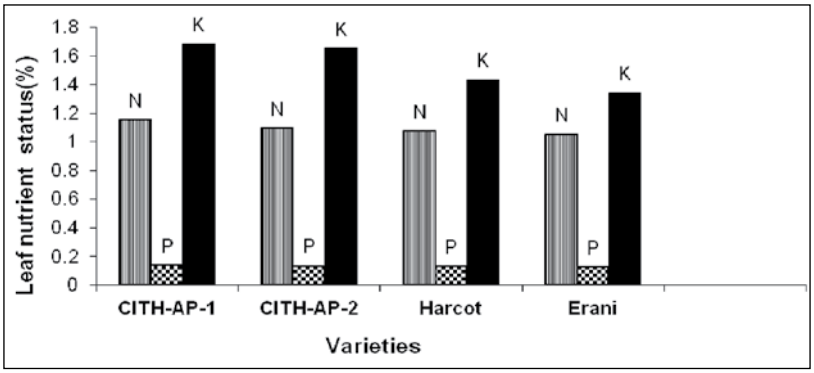

Fig. 1b. Leaf nutrient status as influenced by apricot varieties.

by different apricot varieties (Fig. 1b). Maximum leaf NPK content (1.15, 0.136, 1.68%) were recorded in CITH-Apricot-1 followed CITH-Apricot-2, Harcot and Erani. The differences in nutrient content higher nitrogen, phosphorus and potassium content among the varieties might be due to inherent character of varieties. The role and importance of leaf nutrient status in apricot as reported by Milosevic and Milosevic (9).

The interaction of the variety and spacing shows that the variety CITH Apricot-1 resulted in higher growth and yield per plant with appreciable quality at wider spacing. It also resulted in highest yield per unit area at closer spacing.

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