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Evaluation of apricot cultivars based on physico-chemical characteristics observed under temperate conditions

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The investigation was undertaken to evaluate improved cultivars on the basis of physico-chemical characteristics in Australian Sweet, Kaisha, Conian Italy, Roundel, Quetta and Charmagz cultivars. Physico-Chemical characteristics of apricot cultivars at harvest revealed that the maximum fruit length can be (37.06) mm and diameter (38.19) mm in cultivar Conian Italy. The shape of the fruit varied from flatish round (Conian Italy and Kaisha) to oval or heart shaped (Australian Sweet, Charmagz, and Roundel). Maximum fruit weight was recorded in cultivar Conian Italy (34.5g) and cultivar Quetta recorded the minimum fruit weight (24.00g). Maximum fruit volume (33.82cm³) was recorded in cultivar Conian Italy. Maximum fruit density (1.04g/cm²) was recorded in cultivar Quetta. Fruit firmness differed significantly and maximum fruit firmness (3.11lbs/sq inch) was recorded in cultivar Roundel followed by Charmagz (2.62lbs/sq inch). Fruit skin colour score of (6.00pt) orange was recorded in cultivar Quetta followed by Kaisha (5.00pt) light orange. Maximum organoleptic rating of (9.00pt) excellent was recorded in cultivar Charmagz. Maximum TSS (21.80%) was recorded in cultivar Charmagz and minimum was recorded in cultivar Quetta. Maximum fruit acidity (1.92%) was recorded in cultivar Conian Italy and minimum was recorded in cultivar Australian Sweet (0.39%). Maximum TSS/acid ratio (83.85) was recorded in cultivar Charmagz. Maximum ascorbic acid content was recorded in cultivar Australian Sweet (17.00mg/100g). Maximum content of reducing, nonproducing and total sugars' was recorded in cultivar Quetta (2.96%), Australian Sweet (9.95%) and Charmagz (15.20%) respectively.

Key words: Evaluation, apricot, cultivar, physico-chemical-characteristics, variation, maturity.

INTRODUCTION

Apricot (*Prunusarmeniaca* L.) is an attractive, delicious and highly nutritious fruit being cultivated in temperate climates of all the continents of the world, Asia and Europe being the largest producers. In India, apricot is grown in Jammu and Kashmir, Himachal Pradesh, Utter Pradesh and to a limited extent in North-eastern hills. Its cultivation has not been successful in south India (Hayes, 1957). In Jammu and Kashmir the total production in the year 2009 was 15609 MT from an area of 5248 hectares (Anonymous, 2009). Most of the cultivars grown in the valley are of European origin, the flowering of which start from late March to early April. Flowering varies within the cultivar depending on prevailing weather conditions. The apricot fruit has

double sigmoidal growth pattern, having a retarded growth period at the time of pit hardening (Salunkhe et al., 1968). The yield and quality of apricots are appreciably affected by stage of maturity at which fruits are harvested. Apricot fruits develop maximum flavour and are very delicious when ripened on the tree but such fruits cannot be transported to distant markets because of their perishable nature. Fruits harvested sufficiently in advance of ripening do not attain full taste. The fruit colour, flesh colour, size, firmness, total soluble solids, titratable acidity, days from full bloom and accumulated heat units above 7°C are the main maturity indices. Hence the studies were undertaken to ascertain the proper time of fruit maturity.

MATERIALS AND METHODS

The studies were carried out in the Division of Pomology,

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Sher-e-Kashmir University of Agricultural Sciences and Technology of Kashmir, Shalimar, Srinagar, Kashmir in the year 2008. The experimental trees of cultivars viz., Australian Sweet, Kaisha, Conian Italy, Roundel, Quetta and Charmagz of uniform age (8 years old), vigor and receiving uniform cultural practices were selected. Single tree of each cultivar constituted an experimental unit and each cultivar was replicated four times. For statistical analysis RBD design was followed. At the commercial harvest forty eight fruits from each plant collected randomly and were brought to laboratory in polythene bags. The observation on fruit size, fruit weight, fruit volume, fruit firmness, fruit density, total soluble solids, acidity and ascorbic acid were recorded as per the standard procedure (A.O.A.C.1998). Fruit shape was obtained by dividing the fruit length by its corresponding diameter and the interpretations were made as ratio <1 (flat or flattish round), ratio = 1 (round), and ratio >1 (oval or heart shaped). 'Hedonic scale' was used to record fruit skin colour and organoleptic rating on the basis of appearance, taste and flavour by the panel of ten judges

RESULTS AND DISCUSSION

There were significant variations in fruit physico-chemical characteristics of apricot cultivars of same maturity group and between maturity groups. Table 1 revealed that average fruit length recorded in cultivars 'Conian Italy' (37.06 mm) and 'Kaisha' (35.59 mm) were statistically at par. However, these lengths differed significantly from the fruit lengths of other cultivars except 'Australian Sweet' (34.00 mm) which was found to be at par with 'Kaisha' (35.59 mm). Fruit lengths noticed in cultivars 'Quetta' (31.91 mm), 'Charmagz' (31.20 mm) and 'Roundel' (30.63 mm) showed non-significant difference. However, fruit length of these three cultivars differed significantly with that of cultivar 'Australian Sweet'. Maximum fruit diameter was recorded in 'Conian Italy' (38.19 mm) which was significantly much more than those of all other cultivars except 'Kaisha' (36.35 mm). Fruit diameters observed in cultivars 'Australian Sweet' (31.14 mm), 'Quetta' (30.54 mm) and 'Roundel' (29.78 mm) were statistically at par (Table 1). However, the fruit diameter of 'Roundel' was also at par with 'Charmagz' (29.00 mm). Fruits of cultivars 'Conian Italy' and 'Kaisha' were flattish round, recording L/D ratio of 0.97 and 0.98, respectively, which were significantly lesser than the ratios obtained in other cultivars. Cultivars 'Australian Sweet', 'Charmagz', 'Quetta' and 'Roundel' were oval or heart shaped recording L/D ratio of 1.09, 1.08, 1.04 and 1.03, respectively and were statistically at par with each other.

It is evident from Table 1 that highest fruit weight was noticed in cultivar 'Conian Italy' (34.5 g) which was statistically at par with 'Kaisha' (34.04 g). However, both the cultivars differed significantly from all other cultivars. Cultivars 'Charmagz', 'Australian Sweet',

'Roundel' and 'Quetta' noticed average fruit weight of 31.34, 29.00, 26.00 and 24.00 g, respectively. Average fruit volume was highest in cultivar 'Conian Italy' (33.82 cm³) which differed non-significantly from cultivar 'Kaisha' (32.79 cm³). Both these cultivars varied significantly from all other cultivars except 'Kaisha' which was at par with 'Charmagz' (32.65 cm³). Whereas cultivar 'Quetta' recorded lowest fruit volume of (22.96 cm³) which was significantly different from cultivar 'Roundel' (25.72 cm³). Table-1 also revealed that on average, fruits of cultivar 'Quetta' were significantly much dense (1.04 g/cm³) than fruits of cultivar 'Charmagz' (0.96 g/cm³), 'Conian Italy' (1.02 g/cm³) and 'Roundel' (1.02 g/cm³). However, significant difference in densities was recorded in cultivars 'Roundel' (1.01 g/cm³), 'Australian Sweet' (1.01 g/cm³), 'Conian Italy' (1.02 g/cm³) and 'Kaisha' (1.02 g/cm³). Whereas, lowest density recorded in 'Charmagz' (0.96 g/cm³) differed significantly from all other cultivars. These variations could be due to varietal characteristics. Similar variations in fruit shape, size and density have been reported by Kazankaya (2002) and Sharma *et al.* (2005).

On average cultivars 'Roundel', 'Charmagz', 'Quetta' and 'Conian Italy' recorded fruit firmness of 3.11, 2.62, 2.08 and 2.53 lbs inch⁻² respectively and were statistically at par with each other. Similarly, there was non-significant difference in firmness of cultivars 'Kaisha' (1.92 lbs cm⁻²) and 'Australian Sweet' (1.65 lbs cm⁻²). However, both these cultivars were also at par with 'Conian Italy' (Table-1). Higher firmness in 'Roundel' could be probably due to varietal characteristic. Less flesh thickness showed better firmness as compared to those which showed thicker flesh. Firmness of flesh may also vary as a result of variation in pectin substances (Vardzelashvili and Lebanidze, 1974) and due to variation in crop-load (Spayed *et al.*, 1986) Table-1 revealed that skin colour of fruit of all cultivars varied significantly except 'Charmagz' and 'Roundel' which showed cream-colour (3.00 and 3.25 pt respectively) at maturity level found at harvest. However, significantly higher colour score of 6.00 pt (orange) was noticed in 'Quetta' followed by cultivar 'Kaisha' (5.00 pt light orange). Whereas cultivars 'Australian Sweet' and 'Conian Italy' recorded colour score of 3.75 pt (light yellow) and 4.00 pt (yellow), respectively. This variation is possibly due to the extent of carotenoid accumulation, possibly governed by varietal genetic built up. Similar variations in fruit colour have been also reported by Bhatia *et al.* (1977). Significantly higher organoleptic rating of 9.00 (excellent) was recorded in 'Charmagz'. While as cultivars 'Australian Sweet', 'Kaisha' and 'Quetta' recorded scores of 8.00, 7.50 and 7.50 pt, respectively (good). Fruit flavour depended primarily on the ratio of sugars to acids (Guerriero *et al.*, 1995).

Chemical characteristics

There were significant differences in fruit chemical characteristics among different cultivars (Table 2). It was found that cultivar 'Charmagz' recorded

Table 1. Variations in some fruit physical characteristics of apricot cultivars at harvest.

Cultivar	Fruit length (mm)	Fruit diameter (mm)	Fruit shape L/D ratio	Fruit weight (g)	Fruit volume (cm ³)	Fruit density (w/v)	Fruit firmness (Lbs inch ²)	Fruit colour skin (pt)	Organoleptic rating (pt)
Charmagz	31.20	29.00	1.08	31.34	32.65	0.96	2.62	3.00	9.00
Conian Italy	37.06	38.19	0.97	34.50	33.82	1.02	2.53	4.00	6.50
Roundel	30.63	29.78	1.03	26.00	25.72	1.01	3.11	3.25	6.50
Kaisha	35.59	36.35	0.98	34.04	32.79	1.02	1.92	5.00	7.50
Australian Sweet	34.00	31.14	1.09	29.00	28.49	1.01	1.65	3.75	8.00
Quetta	31.91	30.54	1.04	24.00	22.96	1.04	2.08	6.00	7.50
C.D at 5%	1.93	2.04	0.07	1.75	1.04	0.01	0.74	0.33	0.77

Table 2. Variations in some fruit chemical characteristics of apricot cultivars at harvest.

Cultivar	TSS (%)	Acidity (%)	TSS/acidity ratio	Ascorbic acid (mg/100 g)	Reducing sugars (%)	Non-reducing sugars (%)	Total sugars (%)
Charmagz	21.80	0.26	83.85	14.78	5.15	9.55	15.20
Conian Italy	15.50	1.92	8.07	7.56	3.95	4.46	8.65
Roundel	17.38	0.78	22.28	6.45	2.97	8.38	11.79
Kaisha	18.20	0.45	40.44	9.57	4.17	5.04	9.22
Australian Sweet	16.20	0.39	41.54	17.00	4.95	9.45	14.90
Quetta	14.00	1.06	13.20	8.20	2.96	6.90	10.24

significantly much higher TSS (21.80%) than other cultivars at harvest. While as TSS noticed in cultivars 'Kaisha' (18.20%), 'Roundel' (17.38%), 'Australian Sweet' (16.20%) and 'Conian Italy' (15.50%) showed non-significant difference. However, cultivar 'Quetta' recorded least TSS of 14.00 per cent which was statistically at par with that of cultivar 'Australian Sweet' and 'Conian Italy'. Data revealed that on average, significantly highest acidity was recorded in cultivar 'Conian Italy' (1.92%). While as, acidity noticed in cultivars 'Australian Sweet' (0.39%) and 'Kaisha' (0.45%) were at par. However, acidity recorded in all other cultivars had significant difference. It is apparent from the data that on an average, significantly highest (83.85) TSS/acidity ratio was recorded in cultivar 'Charmagz'. TSS/acidity ratio of 40.44 and 41.54 recorded in cultivars 'Kaisha' and 'Australian Sweet' respectively were at par, however, both noticed

significantly different ratios from all other cultivars. While as lowest ratio (8.07%) was found in cultivar 'Conian Italy' which was at par with cultivar 'Quetta' (13.20). TSS/acidity ratio noticed in cultivar 'Roundel' (22.28) was also at par with.

On an average, significantly highest ascorbic acid was recorded in cultivars 'Australian Sweet' (17.00 mg/100 g) and lowest in cultivar 'Roundel' (6.45 mg/100 g) at harvest maturity (Table 2). All the cultivars showed significant difference in ascorbic acid content at harvest. These variations in above characteristics are principally governed by varietal genetic constitution built up. Similar variation in apricot cultivars have been reported by Sharma et al. (2005).

Table 2 also revealed that on an average reducing sugar content of all the cultivars varied significantly except in cultivars 'Quetta' (2.96%), 'Roundel' (2.97%), 'Kaisha' (4.17%) & 'Australian Sweet' (4.95%) and

'Australian Sweet' & 'Charmagz' (5.15%). Highest reducing sugar content was noticed in cultivar 'Charmagz' followed by 'Australian Sweet' (4.95%), 'Kaisha' (4.17%) and 'Conian Italy' (3.95%). All the cultivars recorded significantly different non-reducing sugar content except cultivars 'Australian Sweet' (9.45%) and 'Charmagz' (9.55 %) which noticed highest content as compared to all other cultivars. It is apparent from the data that on an average, total sugar content (15.20%) noticed in cultivar 'Charmagz' was at par with the total sugar content recorded in cultivar 'Australian Sweet' (14.90%). However, it was significantly more than the total sugar content recorded in other cultivars. Similarly, total sugar content noticed in cultivar 'Kaisha' (9.22%) was at par with that of 'Conian Italy' (8.65%), however, it was significantly less than the total sugar content recorded in all other cultivars. The above observations run almost parallel to observations made by (Joshi *et al.*, 1990).

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