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Average Daily Gain in Physico-Chemical Characteristics and Yield Efficiency of Some Apricot Cultivars Grown in Himalayan Temperate Region

Bilal A. Padder[1*], M.Y. Bhat[1], Wali M. Wani[1], Sartaj A. Wani[2], Sajad H. Wani[2], Saima Zahoor[2], Iqra Qureshi[2], Muneer A. Sheikh[2], Shabir A. Rather[2] and Wasim H. Raja[2]

[1]Division of Fruit Science, SKUAST-K, Shalimar - 190 025, Srinagar, J & K, India
[2]ICAR-Central Institute of Temperate Horticulture Rangreth, Srinagar- 191132, J & K, India
**Corresponding author*

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A B S T R A C T

The aim of this study was to determine average daily gain in physico-chemical characteristics, yield efficiency, Flesh thickness, Stone size, Pulp stone proportion and Leaf size of some apricot cultivars at commercial harvest. Correlation analysis was conducted to assess change in yield efficiency and flesh thickness with regard to leaf size. Bearing apricot trees of 6 different cultivars viz. Charmagz, Conian Italy, Roundel, Kaisha, Australian Sweet and Quetta of uniform age group (8 years), vigour and agronomic practice were investigated. Single tree in each cultivar constituted an experimental unit and each cultivar was replicated 4 times. Average Daily Gain (ADG) in physico-chemical traits, yield efficiency and other characteristics of apricot cultivars revealed that the maximum extent of average daily gain in fruit weight, length, diameter, volume and acidity can be 0.393 (g), 0.422(mm), 0.435(mm), 0.385 (cm^3) and 0.0219 (%) respectively, in cultivar Conian Italy. Maximum gain in TSS (0.256 %) was recorded in cultivar Charmagz while as minimum in cultivar Quetta (0.132%). Cultivar Charmagz noticed maximum average daily gain in ascorbic acid (0.173 mg/100g), reducing (0.60 %), non-reducing (0.107%) and total sugars (0.178). Cultivar Conian Italy recorded highest yield efficiency (0.177kg/cm^2) while as lowest (0.120 kg/cm^2) in cultivar Roundel. Maximum flesh thickness was observed in the fruits of cultivar Australian Sweet whereas minimum in Roundel. Stone weight was recorded highest (3.09g) in cultivar Kaisha and minimum (1.84g) in Quetta. Maximum pulp stone proportion (14.75%) was recorded in Australian Sweet. Maximum leaf size (27.55 cm^2) was recorded in Conian Italy whereas minimum was recorded in Roundel. Both yield efficiency flesh thickness of all the cultivars showed significantly ($P < 0.05$) high correlation with the leaf size ($\mathbf{r^2}$= 0.61 and 0.98, respectively)

Introduction

Apricot (*Prunus armeniaca* 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 (Bhat *et al.*, 2013). Distribution of cultivated apricot, its wild forms and allied species in temperate zone of Asia is confined between 33° and 70° east longitude and 53° and 30° north latitude (Kostina, 1936). In India, apricot is grown in Jammu and Kashmir, Himachal Pradesh, Uttar 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 2016 was 14142 MT from an area of

6097 hectares (Anonymous, 2016). 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 of apricot is highly variable from year to year and poor yields are of frequent occurrence. Fruit growers depend primarily on yield and quality to determine their net income (Castle, 1995). The yield and quality produce at harvest is highly influenced by genotype of the crops and its interaction with environment.

This variability is generally due to different accumulation rates in different quality traits which are purely associated with the genetic constitution of individual cultivars, which appears to be the principal factor controlling quality and yield. Average daily gain and yield efficiency is a performance measure which shows how efficiently the fruit is growing. Indicators of productivity have evolved in an attempt to provide a consistent basis for comparison of tree and orchard productivity. The most common of these are kilograms of fruit per square centimeter of trunk cross-sectional area (TCA) and kilograms of fruit per square meter of canopy volume TCA has proven to be a useful basis on which to express yield per tree size. This expression is based on the correlation of TCA to tree weight (Westwood and Roberts, 1970), which relates to potential bearing sites and to leaf area (Holland, 1968) and which in turn, relates to light interception and photosynthetic production. Total dry matter production and, in many cases, crop yield are related to total light interception (Agha and Buckley, 1986; Hunter and Proctor, 1986; Monteith, 1977; Palmer, 1976, 1989; Palmer and Jackson, 1974) which in turn is largely dependent on leaf area index and light distribution within the canopy (Lakso, 1980., Lakso, *et al.,* 1989., Robinson, *et al.,* 1983., Robinson and Lakso, 1991). This principle holds for essentially all crops (Monteith, 1977). Hence the studies were conducted to determine and compare the yield efficiency, average daily gain, fruit quality performances of different apricot cultivars.

Materials and Methods

Bearing apricot trees of different cultivars with uniformity in age (8 years old), root stock (wild apricot), vigour, health, bearing and agronomic practices were selected for experimentation at Experimental Farm of Division of Fruit Science, SKUAST-K, Shalimar situated at an altitude of 1587 meters above mean sea level and latitude of $34^{o}8'$ and longitude $74^{o}83'$. Six cultivar of apricot viz., Australian Sweet, Kaisha, Conian Italy, Roundel, Quetta and Charmagz were investigated. Single tree in each cultivar constituted an experimental unit and each cultivar was replicated four times. At commercial harvest forty eight fruits from each tree were collected randomly for subsequent physico-chemical analysis. The observation on fruit size, weight, volume, Stone size, pulp stone proportion, fruit flesh thickness, TSS, acidity, ascorbic acid and reducing, non-reducing and total sugar were recorded as per the standard procedure (A.O.A.C. 1998) and then average daily gain (ADG) in some fruit characteristics were obtained by dividing the values obtained at commercial harvest by the number of days after full bloom taken by each cultivar to reach this stage.

Yield efficiency obtained by dividing the weight of total fruits in kilograms (kg) harvested and those used for investigations, by trunk cross sectional area (cm^2) (Westwood, 1978). Leaf size five leaves from each quadrant were picked from each tree and their leaf area was measured by using leaf area meter and then reading was averaged in cm^2. Simple correlation coefficients were computed relating yield efficiency and fruit flesh thickness with different leaf size (Panse and Sukhatame, 1967).

Results and Discussion

Extent of average daily gain in some fruit physico-chemical characteristics of apricot cultivars during development after full bloom, varied significantly (Table-1).

Physical characteristics

The extent of average daily gain (0.422 mm) in fruit length was significantly much higher in cultivar 'Conian Italy' than the extent of increase noticed in all other cultivars. However, the daily average gain (0.366 mm) in fruit length of cultivar Charmagz was statistically at par with the extent of daily gain in cultivar Kaisha (0.357 mm) but was significantly higher as compared to rest of the cultivars. Cultivars Quetta recorded lowest gain of 0.302 mm fruit length per day. Average daily gain in the fruit diameter of cultivars Quetta (0.289 mm) and Australian Sweet (0.295 mm) were statistically at par, however, these were significantly much lesser than gains noticed in other cultivars. Cultivar Conian Italy recorded significantly highest (0.435 mm) extent of increase than all other cultivars followed by Kaisha (0.364 mm). It is evident from Table-1 that average daily gain in fruit weight of cultivar Quetta was significantly lesser (0.227 g) as compared to gain recorded in all other cultivars. Highest gain in weight was recorded by Conian Italy (0.393 g) followed by Charmagz (0.368 g). The average gains (0.385 and 0.383 cm^3) in cultivars Conian Italy and Charmagz were statistically at par, however, the extent volume of gain in both cultivars was significantly higher than Kaisha (0.334 cm^3). Average daily gain in the fruit volume of cultivar Quetta (0.217 cm^3) was significantly least as compared to fruit volume gains recorded in all other cultivars. The fact that the cultivar Conian Italy took lesser number of days from full bloom to commercial harvest, has higher leaf area index and yield efficiency can be considered as one of the reason for higher average daily gain in fruit physical characteristics

Chemical characteristics

Table-1 revealed that the average daily increase in total soluble solid content of cultivar Quetta (0.132%) was significantly lowest however cultivar Charmagz (0.256%) noticed significantly highest extent of gain than that of all cultivars. All cultivars varied significantly in average daily acidity gain. Cultivar Charmagz noticed significantly least (0.0030%) increase in acidity followed by Kaisha (0.0045%). Highest was recorded in Conian Italy (0.0219%). The average daily gain in ascorbic acid content was significantly least in cultivar Roundel (0.071 mg/100 g) however, the highest extent of increase was noticed in cultivar Charmagz (0.173 mg/100 g). Highest gain in reducing (0.060%), non-reducing (0.107%) and total sugars (0.178%) was found in cultivar Charmagz while as minimum in cultivar Quetta (reducing and total sugars) and Conian Italy (non-reducing sugar 0.05%).

As evident from table-2 flesh thickness, stone size and pulp stone proportion varied significantly at harvest among cultivars. Maximum flesh thickness (14.11 mm), stone size (3.09 g) and pulp stone proportion (14.75 %) was recorded in cultivars "Conian Italy", Kaisha and Australian Sweet, respectively and minimum 8.63 mm, 1.84 g and 9.84 per cent was noticed in cultivar Roundel, Quetta and Charmagz for flesh thickness, stone size and stone proportion, respectively. These variations are probably due to varietal characteristics. Similar variations in these characteristics have also been reported by other workers earlier (Bajwa and Mishra, 1972; Bhatia *et al.*, 1977; Fedchenkova, 1979; Nikolov, 1979; Sun and Pu, 1982; Sharma, 1994; Sofi *et al.*, 2001 and Polat *et al.*, 2004).

Table.1 Average daily gain in some fruit physico-chemical characteristics of apricot cultivars during development

Cultivars	Fruit length (mm)	Fruit diameter (mm)	Fruit weight (g)	Fruit volume (cm^3)	Total soluble solids (%)	Acidity (%)	Ascorbic acid (mg/100 g)	Reducing sugar (%)	Non-reducing sugar %	Total sugars (%)
Charmagz	0.366	0.340	0.368	0.383	0.256	0.0030	0.173	0.060	0.107	0.178
Conian Italy	0.422	0.435	0.393	0.385	0.177	0.0219	0.086	0.045	0.050	0.098
Roundel	0.338	0.328	0.287	0.283	0.191	0.0090	0.071	0.033	0.092	0.129
Kaisha	0.357	0.364	0.341	0.334	0.182	0.0045	0.096	0.042	0.050	0.092
Australian Sweet	0.322	0.295	0.274	0.270	0.153	0.0037	0.161	0.047	0.088	0.141
Quetta	0.301	0.289	0.227	0.217	0.132	0.0100	0.078	0.028	0.065	0.097
C.D at 5%	**0.023**	**0.023**	**0.023**	**0.040**	**0.036**	**0.0009**	**0.007**	**0.008**	**0.008**	**0.009**

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

Cultivars	Flesh thickness (mm)	Stone size (g)	Pulp stone proportion (%)	Leaf size (cm^2)	Yield efficiency (kg/cm^2)
Charmagz	10.86	2.90	9.84	21.60	0.167
Conian Italy	14.11	2.95	10.69	27.55	0.177
Roundel	8.63	2.20	10.83	19.25	0.120
Kaisha	9.98	3.09	10.02	20.80	0.117
Australian Sweet	10.86	1.85	14.75	22.00	0.159
Quetta	9.72	1.84	12.05	20.40	0.123
C.D at 5%	**0.80**	**0.12**	**0.98**	**5.83**	**0.020**

Fig.1 Correlation between yield efficiency (kg/cm^2) and leaf size (cm^2)

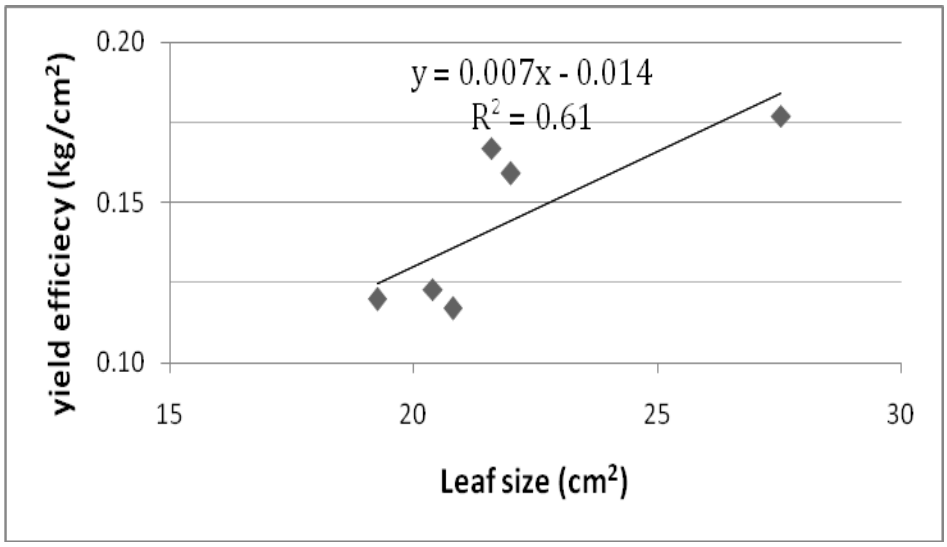
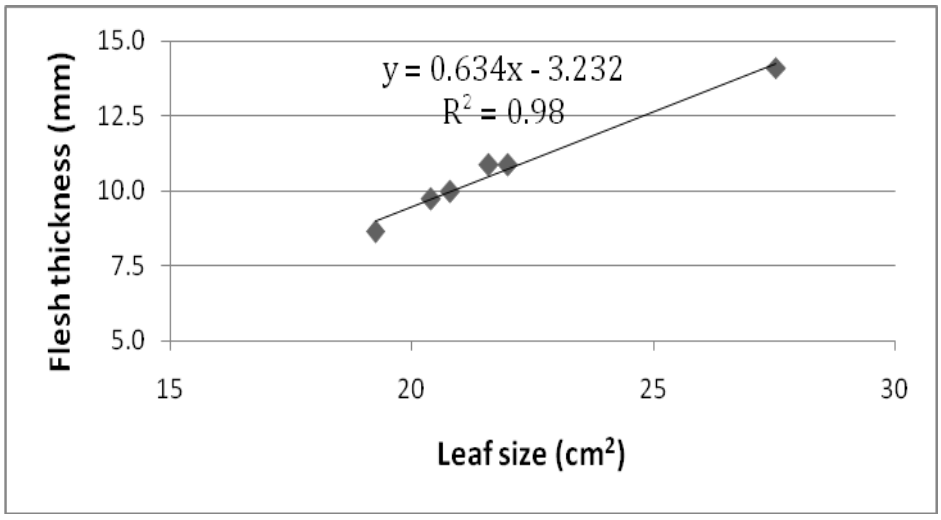


Fig.2 Correlation between flesh thickness (mm) and leaf size (cm^2)



Leaf size among cultivars varied less significantly, however the cultivar Conian-Italy had significantly highest leaf size as compared to all other cultivars and lowest leaf size was recorded in cultivar Quetta (Table-2). Variation in leaf size was possibly due to varietal character. Sharma (1994) observed variation of 8.20 to 39.20 cm^2 in leaf size in 700 apricot seedlings.

The yield efficiency varied significantly among cultivars. Cultivar Conian Italy (0.177kgcm^{-2}) recorded the highest yield efficiency, whereas cultivar Quetta (0.123 kgcm^{-2}) recorded the lowest. Higher yield efficiency in Conian Italy may be due the higher extent of ADG in physical characteristics and leaf area index which in turn, relates to light interception and photosynthetic production. This variation could be a varietal characteristic and due to prevailing weather conditions especially during the periods of bloom and fruits set (Webster and Shepherd, 1984).

Harsanyi (1985) reported that factors determining the yields were bloom density, number of fruits per hectare and estimated fruitification index calculated from bloom density and the number of fruits per hectare. Similar yield and yield efficiency variations in apricot has been reported by many workers (Nyujto *et al.,* 1986; Egea *et al.,* 1991; Guleryuz *et al.,* 1999; Strikic *et al.,* 2007). Yield efficiency (r^2= 0.61) and flesh thickness (r^2= 0.98) showed significant and positive correlation with leaf size (Fig. 1 and Fig. 2).

This positive relationship might be the reason for higher yield efficiency in cultivar Conian Italy. Liu-LiQiang *et al.,* (2005) found a significant positive correlation between main vein length, new branch and leaf area. They also found a positive correlation between leaf-fruit ratio and average single fruit weight of most apricot cultivars.

References

A.O.A.C. 1998. Official Methods of Analysis. 14th Edication, Association of Official Agriculture Chemists, Washington, DC, USA.

Agha, N.S.A., and Buckley, W.R. 1986. Assessment of canopy efficiency of apple trees in beds. L Canopy development assessed by direct light measurements. *J. Hort Sci.* 61:153-159.

Anonymous, 2016. Area and production statement. Department of Horticulture, Jammu and Kashmir Government, Srinagar.

Bajwa, M.S., and Mishra, K.A. 1972. Performance of apricot varieties at the Regional Fruit Research Substation, Kandaghat (Simla Hills). *Journal of Research, Punjab Agricultural University* 9(3): 438-441.

Bhat, M.Y., Padder, B.A., Wani I.A., Banday F. A., Ahsan, H., Dar, M. A. and Lone, A. A. 2013. Evaluation of apricot cultivars based on physico-chemical characteristics observed under temperate conditions. *International Journal of Agricultural Sciences* 3(5):534-537.

Bhatia, A.K., Singh, R.P. and Gaur, G.S. 1977. Important apricot varieties of Ladakh. *Progressive Horticulture* 8(4): 19-25.

Castle, W. S., 1995. Rootstock as a fruit quality factor in citrus and deciduous tree crops. *New Zealand Journal of Crop and Horticultural Science* 23: 383-394.

Egea, L., Berenguer, T., Garcia, J.E. and Burgos, L. 1991. Influence of the rootstocks on development and production of Bulida and Perla cultivar of apricot. *Acta Horticulturae* 293: 373-382

Fedchenkova, G.A., 1979. Black fruited apricot. *Sadovodstvo* 2: 28.

Guleryuz, M., Bolat, I. and Karayiannis, I. 1999. Investigation on characteristics of apricot cultivars in Erzincan, Turkey. *Proceedings of the 11th International Symposium on apricot Culture*, Veria-Makedonia, Greece, 25-30 May, 1997.

Harsanyi, J., 1985. Performance of apricot varieties and selections in a plot trial. *Acta Horticulturae* 192: 345-352.

Hayes, W.B., 1957. Fruit growing in India. Kitabistan, Allahabad, pp 444.

Holland, D.A., 1968. The estimation of total leaf area on a tree. *Rpt. E. Mailing Res. Sta.* 1967:101-104.

Hunter, D.M., and Proctor, J.T.A. 1986. The correlation of light interception with yield and fruit color of McIntosh apple strains. *Fruit Var. J.* 40:79-86.

Kostina, K.F., 1936. *Bul. Appl. Bot. Gen. Plant Brdg. Suppl.* 83.

Lakso, A. N., Robinson, T.L. and Pool, R.M. 1989. Canopy microclimate effects on patterns of fruiting and fruit development in apples and grapes, p. 263-274. In: C.J. Wright (cd.). Manipulation of fruiting, 47th Nottingham Easter School. Butterworths, London.

Lakso, A.N., 1980. Correlations of fisheye photography to" canopy structure, light climate and biological responses to light in apple trees. J. Amer. Soc. Hort. Sci. 105:43-46.

Liu-LiQiang, Liao-Kang., Xu, Lin., Zhang, DaHai., Xie, CaiMei., Fan-GuoQuan, 2005. Analysis on the correlation between leaf, new branch, fruit quality and leaf area of apricot cultivars in Xinjiang. *Journal of Xinjiang Agricultural University* 28(2): 55-58.

Monteith, J.L., 1977. Climate and efficiency of crop production in Britain. Phil. Trans. *R. Sot. London B.* 281:277-294.

Nikolov, N., 1979. New apricot variety - Silistrenska Kompotna. *Gradinarska-i-Lozarska-Nauka* 16(7-8): 63-67.

Nyujto, F.S., Kerek, M.M., Nyeki, J., Toth, M., Pete, A., Hersanyi, J. and Ifju, E. 1986. Introducing foreign apricot cultivars at three different areas of Hungary (Preliminary report). *Acta Horticulturae* 192: 353-360.

Palmer, J.W., 1976. Interception and utilization of light by apple orchards. PhD Diss., Univ. of Nottingham, U.K

Palmer, J.W., 1989. Canopy manipulation for optimum utilization of light, p. 245–262. In: C.J. Wright (cd.). Manipulation of fruiting, 47th Nottingham Easter School. Butterworths, London.

Palmer, J.W., and J.E. Jackson. 1974. Effects of tree population and variations in spacing within and between rows of Golden Delicious on M.9. *Rpt. E. Mailing Res. Sta*. 1973:66-68

Panse, V.G., and Sukhatame, P.V. 1967. Statistical Methods for Agricultural Workers. Indian Council of Agricultural Research, New Delhi

Polat, A.A., Durgac, C., Kamiloglu, O. and Caliskan, O. 2004. Investigation on the adaptation of some low-chill apricot cultivars to Kirikhan (Turkey) ecological conditions. *Acta Horticulturae* 636: 395-400.

Robinson, T. L., and Lakso, A. N. 1991. Bases of Yield and Production Efficiency in Apple Orchard Systems. *J. Amer. Soc. Hort. Sci*. 116(2):188-194.

Robinson, T. L., Seeley, E.J. and Barritt, B.H. 1983. Effect of light environment and spur age on 'Delicious' apple fruit size and quality. *J. Amer. Soc. Hort. Sci.* 108:855-861.

Salunkhe, D.K., Deshpande, P.B. and Do, S.Y. 1968. Effects of maturity and storage on physical and biochemical changes in peach and apricot fruits. *Journal of Horticultural Science* 43: 235-242.

Sharma, S.D., 1994. Variaiton in local apricots growing in district Kinnaur of

Himachal Pradesh (India). *Fruit Varieties Journal* 48: 225-228.

Sofi, A.A., Zaffar, G. and Mir, M.S. 2001. Genetic variability and association of component characters for fruit weight in apricot (*Prunus armeniaca* L.) cultivars in Kargil (Ladakh). *Indian Journal of Horticulture* 58(3): 239-243

Strikic, F., Radunic, M. and Rosin. 2007. Apricot growth and productivity in high density orchards. *Acta Horticulturae* 732: 495-499.

Sun, S., and Pu, C. 1982. A new botanical variety of apricot. *Acta Horticulturae Sinica* 9: 58.

Webster, A.D., and Shepherd, U.M. 1984. The effects of summer shoot tipping and rootstock on the growth, floral bud production, yield and fruit quality of young sweet cherries. *Journal of Horticultural Science* 59: 175-182.

Westwood, M.N., 1978. Temperate Zone Pomology. W.H. Freeman and Company, San Francisco, USA.

Westwood, M.N., and Roberts, A.N. 1970. The relationship between trunk cross-sectional area and weight of apple trees. *J. Amer. Soc. Hort. Sci.* 95:28-30.

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