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Performance of apple cultivars in Bhaderwah climatic condition, Jammu and Kashmir

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Abstract

Sixteen apple (*Malus X Domestica Borkh*) cultivars were evaluated under sub-humid temperate region of Bhaderwah, Jammu province (J&K) on the basis of plant growth and yield characteristics of fruits during the year 2012-13 cv. Lal Ambri exhibited maximum plant height (480cm), annual extension growth (60cm), plant spread (N-S= 122.33cm and E-W= 115.00cm) and plant volume (23.70M³) during investigations. Among the cultivars, three cultivars (Starkrimson, Silver Spur and Royal delicious) had showed early fruit maturity. However, the maximum fruit yield (5.67 kg) was noticed with hybrid 29 cultivar.

Keywords: Apple (*Malus X Domestica*), cultivars, fruiting and yield

Introduction

Apple (*Malus X Domestica Borkh*) is an important temperate fruit crop in the world and belongs to family Rosaceae (Westwood, 1993) [9]. Approximately more than 7,500 cultivars of apple are known (Elzebroek and Wind, 2008) [10], resulting in a range of desired characteristics. In India, the total area under apple cultivation is 283.90 thousand hectare producing 1,770. 20 thousand MT fruit with productivity of 6.3 MT/ ha (NHB, 2010) [11] and contributes 2.55% of the total world production. Apple is commercially grown in Jammu and Kashmir, HP, Uttarakhand (U.P.) and in small scale in the North-Eastern states of India. Apple requires a cool climate as buds of apple exhibit long rest period and require more chilling than buds of other temperate fruit crops. Among the states of India, Jammu and Kashmir leads the other apple producing states in India, in terms of fruit production 1852.41 thousand MT with productivity of 9.9MT fruit per hectare. It is major cash crop of temperate fruit growers in the state. Apple is a rich source of iron, carbohydrates, vitamins, minerals, sugars, fat, protein, and dietary fiber, calcium, magnesium, phosphorus, potassium and zinc (Fereaneand, 2008) [12]. Besides, its fruits have good appearance, attractiveness, crispy flesh, pleasant flavor and sweet taste. Good appearance, high nutritive value and sweetness are main reason to attract the consumers and marketing demand is very high. Recent research results clearly demonstrate the health and dietary benefits of eating apples (Goldman IL, 2003) [4]. Additionally apples contain phenols, pectin, sugar and acids, which have a generally positive effect on health. Moreover, the high antioxidant pools in apples are able to scavenge free radicals in human cells (Schirrmacher and Schempp, 2003) [6]. The different cultivars are adapted to various climatic conditions ranging from temperate to sub-tropical conditions to some extent (Malik, 1994) [11]. Many apple varieties have been evaluated by different scientists in different climatic and ecological zones of the world on the basis of fruit quality, dietary importance and marketing (Nasir MA, 2001) [8]. Fruit species and cultivars within species are greatly different in their performance in terms of color, taste, fruit size, fruit weight, fruit yield and TSS depending upon agro-climatic conditions. The experiment presented in this paper aimed at evaluation studies of apple cultivars concerning their vegetative growth, yield and quality characteristics to find out the best suited cultivar to be recommended for commercial cultivation to growers.

Materials and Methods

Present study was carried during 2012-13 in at the experimental field of RHRSS, Bhaderwah, (J&K), India. Experiment site is located 32° 53' and 34° 21' latitude and 75° 01' and 76° 47' E longitudes with an altitudinal 1600 m above the sea level.

The climate is characterized as sub humid temperate region, rainfall restricted mostly to winter months. Snowfalls during January and February months are also experienced. The aim of this study was to evaluate physio-chemicals characteristics of apple cultivars. The materials comprised sixteen apple cultivars (Silver spur, Vance Delicious, Royal delicious, Red chief, Well spur, Oregon Spur, Top Red, Mollies Delicious, Firdous, Lal Ambri, Golden Delicious, H60, Starkrimson, H24, Akbar and Shireen) and all scion wood propagated on seedling rootstock. All cultivars are planted in 2006-2007 with spaced 5x5m plant to plant and row to row. The experiment was laid out at randomized block design (RBD). Four representative branches from each treatment in each replication were selected randomly in the four direction of tree canopy to ensure precision. All sixteen cultivars had been grafted on seedling rootstock and trees were shaped as modified leader system. The soil pH was 5.6. The crop was taken under rainfed conditions; no irrigation was applied in the research trial. Fruits were harvested at full maturity stage. Although the first production was obtained five year after planting, but this was relatively poor. Mean data was recorded in six years old plants. By the six year after planting, the yield per tree was registered. This research showed that trees began bearing in the fifth year, with yield increasing in the subsequent year. Of each cultivar fruit trees were selected and marked. Observations were recorded on vegetative growth viz., plant height (cm), annual extension growth (cm) plant spread (E-W and N-S), and plant canopy volume were measured using a ruler.

Results and Discussion

Vegetative Characteristics

Data pertaining to the performance of sixteen cultivars of

apple is presented in table No. 1. The cultivars exhibited significant variations in all vegetative characteristics in terms of plant height, annual extension growth, plant spread and tree volume. The maximum plant height (480 cm), annual extension growth (60.0 cm) was registered in Lal Ambri cultivar and minimum plant height (215cm) and annual extension growth (34.0 cm) was noticed in Starkrimson during the investigation. The plant spread was also registered to differ significantly in both (N-S and E-W) directions. Out of sixteen cultivars, the plant spread was recorded approximately uniform in Lal Ambri, Golden delicious, Malicious Delicious and H29 cultivars. Again the same trend was noticed in relation of plant spread and canopy volume. Cultivar Lal Ambri exhibited maximum spread (N-S=122.33cm and E-W=115.67cm) and canopy volume (23.70 m³) followed by Golden delicious whereas minimum plant spread in both direction (49.67cm and 48.00) was noticed in starkrimson and followed by H60 cultivar (50.00 and 49.00cm). It confirmed the findings of (Nielson & Kappel, 1996) [3] who reported that scion influenced water relation, leaf exchange, minerals uptake and plant size. In the study of fruit maturity of different cultivars it was found that three cultivars (Strakrimson, Silver Spur and Royal Delicious) had showed the early fruit maturity in 3rd week of August. While Lal Ambri cultivar took maximum days (1st week of October) of fruit maturity. The remaining twelve cultivars (Red chief, Oregon Spur, Shireen, Vance Delicious, Well Spur, Firdous, H29, H60 Top Red, Mollies Delicious, Golden Delicious, Starkrimson and Akbar) showed fruit maturity in between 4th August to 3rd September. It is worth mentioning that similar results were obtained by Redalen *et al.* (1996) [7] who reported that different apple cultivars gain maturity at different times even in the same climatic conditions.

Table 1: Plant growth, date of fruit maturity and yield of apple cultivars under Bhaderwah climatic condition (2013-14)

Cultivars	Plant Height (cm)	Annual shoot growth (cm)	Plant Spread (cm)		Volume of tree (m ³)	Date of maturity	Firmness (kg/cm ²)	Fruit yield kg/tree
			N-S	E-W				
Silver Spur	300	40.00	93.00	94.00	8.76	3 rd wk Ag.	4.57	2.83
Vanc Delicious	345	45.00	98.00	76.00	10.80	1 st wk Sep.	5.23	3.59
Royal Delicious	360	40.00	75.67	64.00	9.90	3 rd wk Ag.	4.93	3.57
Red Chief	293	45.00	99.00	96.00	8.73	4 th wk Ag.	4.80	4.17
Well Spur	307	46.33	84.33	75.33	7.83	1 st wk Sep.	4.77	3.40
Oregan Spur	370	46.67	74.67	64.67	9.83	4 th wk Ag.	5.17	3.70
Top Red	280	40.23	102.00	99.33	8.28	2 nd wk Sep.	4.87	3.80
Mollious Delicious	367	42.00	105.00	98.33	14.23	2 nd wk Sep.	5.27	3.67
Firdous	267	41.33	92.00	90.67	6.83	1 st wk Sep.	5.07	3.33
Lal Ambri	480	60.00	122.33	115.67	23.70	1 nd wk Oct.	5.70	4.13
Golden Delicious	423	52.50	117.67	110.00	23.40	2 nd wk Sep.	5.07	3.56
H29	383	54.33	105.00	100.67	15.87	1 st wk Sep.	4.53	5.67
Starkrimson	215	34.00	49.67	48.00	4.63	3 rd wk Ag.	4.93	4.30
H60	303	34.33	50.00	49.00	4.72	1 st wk Sep.	4.83	1.83
Akber	300	44.33	108.33	105.00	10.17	4 th wk Sep.	5.10	3.00
Shireen	299	42.33	96.67	95.00	9.50	4 th wk Ag.	4.90	4.67
CD (0.05%)	0.90	5.77	3.09	1.27	0.64	-	0.54	0.97

Yield Characteristics

The genetic makeup of the cultivar, orchard management, proper canopy management, age of plant and season are the important factors influencing the yield. In the present study it was obtained that among the various apple cultivars, the maximum fruit yield (5.67kg) per plant was obtained in hybrid 29 cultivar and Firmness (5.70 kg/cm²) was registered in Lal Ambri cultivar. Cultivars Shireen, Strakrimson, Red Chief, Lal Ambri, Top Red, Oregon Spur, Mollies Delicious, Royal Delicious, Golden Delicious cultivars followed in decreasing order in the relation of fruit yield. Cultivar

evaluation can be somewhat subjective and what appears to perform well in one region may not perform well in another (Crassweller, RM, 2001) [2].

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