

*Short communication***Evaluation of spur and colour mutant cultivars of apple (*Malus domestica* Borkh.) for their suitability under mid hill conditions of Uttaranchal****Pankaj Kumar¹, M. P. Gangwar and D. C. Dimri**Department of Horticulture, College of Forestry and Hill Agriculture,
GBPUA&T, Hill Campus, Ranichuari-249199, Uttaranchal, India**ABSTRACT**

Out of 9 apple cultivars belonging to spur and colour mutants, Red Spur exhibited the largest fruit size (6.38 cm x 7.69cm) followed by Red Chief (6.37 cm x 7.11 cm) and Vance Delicious (5.95 cm x 6.68 cm). The maximum value of average fruit weight (170.4 g) and fruit volume (193.1 ml) were observed in Red Spur. Maximum value for firmness (1.35 kg/cm²) and T.S.S. (12.50°B) were observed in Red Chief with the lowest acidity in Vance Delicious (0.23%). The highest value for total sugars (8.45%) was recorded in Vance Delicious and for reducing sugars (6.98%) in Red Chief. On the basis of these characteristics, spur type cultivars Red Chief and Red Spur, with maximum yield/tree of 27.4 kg and 24.3 kg respectively, and the colour mutant cultivar, Vance Delicious with an yield of 25.1 kg were suitable for cultivation under mid-hill conditions of Uttaranchal.

Key words: Apple, spur, colour mutant, evaluation

Presently, a major area of apple cultivation in India is under standard cultivars of the Delicious group. Most of these cultivars, when grown in the mid -hills and in valleys produce low yield and exhibit a tendency to biennial bearing due to high chilling requirement. In the recent past, introduction of colour strains, viz., Top Red, Vance Delicious, Skyline Supreme Delicious, etc. have shown good performance in Himachal Pradesh and J&K (Chadha, 1993). These strains develop fruit colour early and also have a higher yield potential. Spur-type cultivars like Red Chief, Oregon Spur, etc. were introduced in to India during 1985-86 from USA and Italy. These are prolific bearers with better colour development hardiness against insect pests, diseases and adverse environmental conditions and require low pruning (Kanwar, 1991). These colour mutant and spur type strains have shown promise under the agro-climatic conditions of Himachal Pradesh and J&K. Therefore, the present investigation was undertaken to evaluate economic feasibility of these apple strains under humid temperate mid-hill conditions of Uttaranchal.

The investigation was carried out at the Horticulture Research Block, G.B. Pant University of Agriculture & Technology, Hill Campus, Ranichauri (Tehri Garhwal) during 2002 on nine apple cultivars belonging to the spur type and the colour mutants. Nine year old, uniform trees of apple on seedling rootstocks maintained under uniform

orchard management practices were selected for the study. A single tree was used for each treatment, replicated thrice in randomized block design. A composite sample of ten fruits from each treatment was drawn and subjected to various physical and chemical analysis. Titrable acidity and sugars were estimated as per the procedure of Ranganna (1986).

All the apple cultivars under study showed significant variation in fruit length and diameter, which varied from 3.92 cm (Tydeman's Early Worcester) to 6.38 cm (Red Spur) and 4.77 cm (Golden Spur) to 7.69 cm (Red Spur), respectively (Table 1). Jindal *et al* (1992) also measured the variation among different spur, standard and colour mutants in a range of fruit dia meter 5.90 cm (Vance Delicious, Golden Spur) to 7.80 cm (Hardeman, Starking Delicious). In addition, Farooqui *et al* (1986) recorded fruit diameter in the Delicious group of apple cultivars ranging from 6.52 cm to 8.24 cm.

Observations on fruit weight and volume also showed significant variation ranging from 118.1 g (Tydeman's Early Worcester) to 170.4 g (Red Spur) and 136.89 ml (Tydeman's Early Worcester) to 193.13 ml (Red Spur). In agreement with the present findings, Farooqui *et al* (1986) also noticed great variation, with maximum weight (224.18 g) and volume (120 ml) in cultivar Ambri.

¹Present address : TA (Farm Manager), KVK, VCSG College of Horticulture, Bharsar, via Chipalghat, Pauri Garhwal, Uttaranchal 246123

Table1. Physico-chemical parameters of fruit in various apple cultivars

Cultivar	Mean fruit length (cm)	Mean fruit diameter (cm)	Mean fruit weight (g)	Fruit volume (ml)	Fruit firmness (kg/cm ²)	T.S.S (°Brix)	Acidity (%)	Total sugars (%)	Reducing sugars (%)	Non-reducing sugars (%)	Yield/tree (kg)
Spur Type											
Red Spur	6.38	7.69	170.40	193.13	1.04	11.17	0.26	7.61	6.55	1.06	24.30
Stark Spur Gold	6.14	6.62	159.21	173.61	1.20	11.18	0.34	8.21	6.72	1.49	16.20
Golden Spur	4.31	4.77	132.22	151.05	1.04	10.34	0.39	7.95	5.86	2.09	15.60
Red Chief	6.37	7.11	164.40	181.43	1.35	12.50	0.31	8.27	6.98	1.29	27.40
Oregon Spur	4.50	5.71	149.53	163.17	1.27	11.60	0.28	7.41	6.59	0.82	20.10
Starkrimson	4.91	5.88	152.71	167.28	1.33	11.31	0.32	7.76	5.57	2.19	20.90
Colour Mutant											
Vance Delicious	5.95	6.68	161.30	178.65	1.13	11.60	0.23	8.45	6.32	2.13	25.10
Top Red	4.28	5.12	134.50	151.76	1.19	11.32	0.29	8.23	6.40	1.83	21.20
Tydemans Early Worcester	3.92	4.80	118.10	136.89	1.07	10.25	0.39	7.51	5.87	1.64	15.40
CD (<i>P</i> =0.05)	2.00	1.93	11.79	14.60	0.23	1.96	0.05	0.86	4.39	0.46	2.10

Fruit weight ranging from 142.0 g (Tydemans Early Worcester) to 186.3 g (Hardeman) was also estimated by Jindal *et al* (1992). Variation in fruit size (length and diameter), weight and volume in different apple cultivars is attributed to intervarietal differences associated with genetic make-up of the cultivars and is governed by the cell size and intercellular spacing of fruit tissues. Fruit firmness indicated maximum values of 1.35kg/cm² in Red Chief, followed by Starkrimson (1.33kg/cm²) as against the minimum value of 1.04kg/cm² in Golden Spur, which was at par with Red Spur and Tydemans Early Worcester. Change in fruit firmness is primarily attributed to breakdown of the insoluble proto-pectin to soluble pectin compounds which ultimately affects cell wall consistency.

A close perusal of data showed that all the quality attributes differed significantly in different apple cultivars. Maximum total soluble solids of 12.50° Brix were recorded in Red Chief and a minimum of 10.25° Brix in Tydemans Early Worcester. Various apple cultivars also showed marked difference in total acidity which varied from 0.23% (Vance Delicious) to 0.39% (Tydemans Early Worcester and Golden Spur). The highest value of total sugars was found in Vance Delicious (8.45%), while, the least value in cultivar Oregon Spur (7.41%). However, both the reducing and non-reducing fractions of the total sugars were recorded to be maximum in cultivars Red Chief (6.98%) and Starkrimson (2.19%), respectively, while their respective values were minimum in Starkrimson (5.57%) and Oregon Spur (0.82%). Farooqui *et al* (1986) also observed that total, reducing and non-reducing sugars varied from 7.80% (Ambri) to 11.36% (Golden Delicious), 6.20% (Ambri) to 7.5% (Golden Delicious x Ambri) and 0.75% (Golden Delicious x Ambri) to 5.17% (Golden Delicious),

respectively. Jindal *et al* (1992), on the other hand recorded reducing sugars in the range of 4.91% (Starking Delicious) to 6.89% (Top Red) and total sugars from 6.05% (Starking Delicious) to 9.01% (Top Red). The extent of variation in sugars in different apple cultivars is obviously due to leaf fruit ratio, abundance of chloroplasts and a highly variable amount of starch in young fruits.

The average yield/tree revealed that the cultivar Red Chief gave the maximum yield (27.4 kg), closely followed by Vance Delicious (25.1 kg) and Red Spur (24.3 kg), while, the minimum yield/tree of 15.6 kg and 15.4 kg was observed in the cultivars Golden Spur and Tydemans Early Worcester, respectively. Top Red also recorded significantly higher yield/tree (21.2 kg) than Stark Spur Gold and Golden Spur.

ACKNOWLEDGEMENT

The authors are grateful to the Dean, College of Forestry and Hill Agriculture, and Director, Experiment Station, G. B. Pant University of Agriculture & Technology Pantnagar for providing necessary facilities.

REFERENCES

- Chadha, T.R. 1993. Improvement of apple. **In:** Advances in Horticulture. Vol 1 Fruit Crops. (eds. K L. Chadha and O.P. Pareek), Malhotra Publishing house, New Delhi. pp. 25-33
- Farooqui, K.D., Dalal, M.A. and Ahanger, H.U. 1986. Genetic upgrading of apple. *Prog. Hort.* **18** : 19-23.
- Jindal, K.K. Karkara, B.K., Sharma, V.K. and Uppal, D.K. 1992. Evaluation of spur types and colour strains of apple. N.H.B. Tech. Comm. Bull. pp.29-42

Kanwar, S.M. 1991. Apple : Production Technology and Economics. Tata McGraw Hill Publishing Company Ltd., New Delhi. pp.51-153

Ranganna, S. 1986. Handbook of analysis and quality control of fruit and vegetable products 2nd ed. Tata McGraw Hill Publishing Company, Calcutta, pp. 279-309

(MS Received 4 May 2006, Revised 11 September 2006)