

Evaluation of early ripening grape genotypes under subtropical North Indian conditions

Ram Kumar, Shailendra Rajan, and S.S. Negi

Central Institute for Subtropical Horticulture, P.O.Kakori, Rehmankhera, Lucknow-227107, India.

Abstract

Four year field evaluation for yield and fruit characteristics of 14 early ripening genotypes was conducted to find out suitable grape varieties for North Indian plains, where pre-monsoon showers are limiting factor for its cultivation. Beauty Seedless and Flame Seedless were observed to be early ripening genotypes while B A x Per-75-32 and Gold were late. Overall, Flame Seedless and Pusa Navrang exhibited high yield in all the years (1997-2000). Bunch weight was highest in Pusa Seedless followed by Kishmish Charani and Flame Seedless while it was low in Pusa Navrang. Berry weight was more in Cardinal. High TSS was observed in Kishmish Beli, New Perlette, Flame Seedless and Gold. Overall performance of these genotypes for four years revealed that Flame Seedless can be recommended as table variety for subtropics of North India because of its high yield, bunch weight, TSS and early ripening characteristics. Pusa Navrang, which was also a high yielder with attractive juice colour can be recommended as processing variety for the region. Apart from these merits the genotypes were least affected by early rain showers.

Key words: Grape, varieties, genotypes, hybrids, Flame Seedless, Pusa Navrang, subtropics, quality, yield, year-to-year variation.

Introduction

Traditionally, grape is one of the most important fruit crops of temperate zones of the world and presently it has becoming an important commercial crop of tropics and subtropics in India. Due to precocity and high economic returns, its cultivation is becoming popular in Northern plains. Though, climatic conditions in these areas are considered to be marginal for grape cultivation, nevertheless, a lot of possibilities exist for commercial cultivation of grape in these areas by exploiting early ripening varieties with high quality and yield. Under these conditions, most of the varieties fail to perform well because of occasional early rains at time of ripening, which results into berry cracking, rotting and poor quality. Variable performance of grape cultivars with regard to yield and fruit quality in different locations has been reported by few workers (Randhawa and Singh, 1958; Daulta and Bakshi, 1978; and Childers, 1973). Keeping this in view, few newly developed early ripening hybrids and genotypes were included in this study for their multi year evaluation under Lucknow conditions so that suitable ones can be recommended for commercial cultivation in Northern plains.

Materials and methods

One year old plants of 14 early ripening grape genotypes (Table 1) were planted during 1995 at experimental farm of Central Institute for Subtropical Horticulture, Rehmankhera, Lucknow, in randomized block design with four replications at a spacing of 3 x 3m and trained on bower system. The soil of experimental plot was sandy to loam with pH 7.8, medium P and low in K. Vines were pruned in last week of January, every year, as per specific requirements of the variety.

Vines started fruiting from 3rd year *i.e.* 1997 and observations on the date of bud sprouting, harvesting, number of bunches vine⁻¹, bunch weight, yield vine⁻¹, berry weight, TSS and acidity were recorded. The yield was recorded at the time of harvesting and only marketable fruits were considered for this purpose. Average

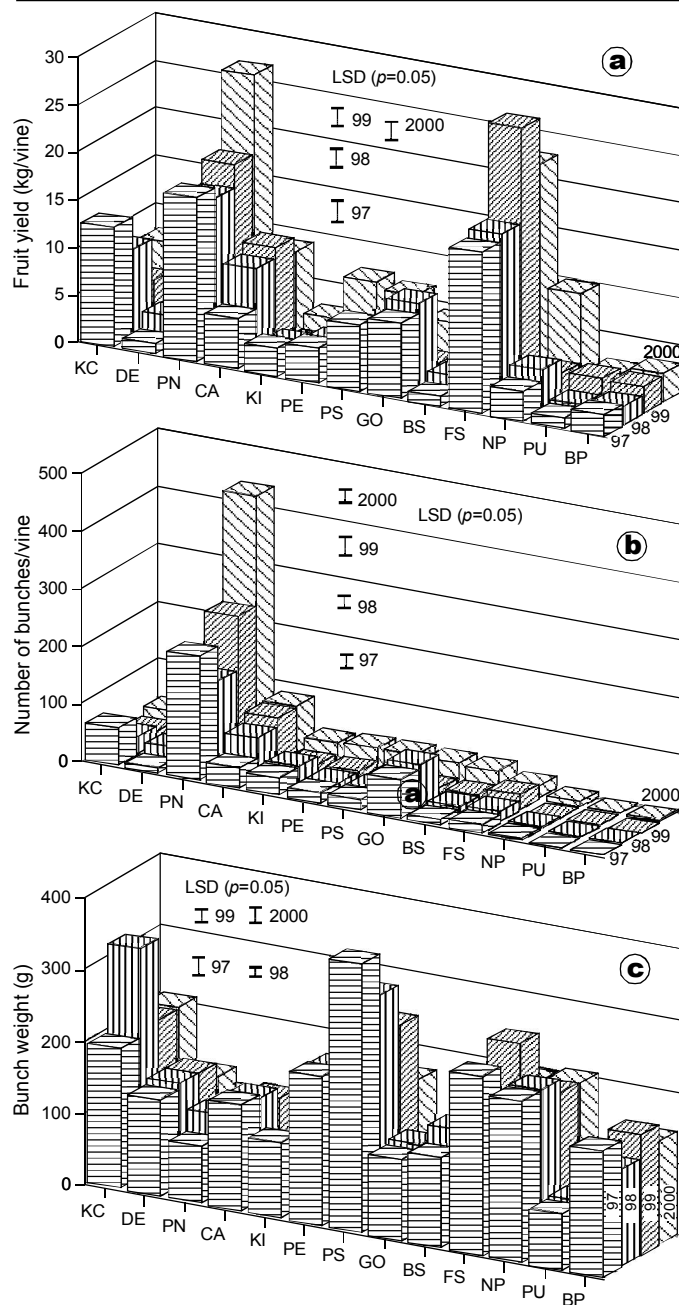
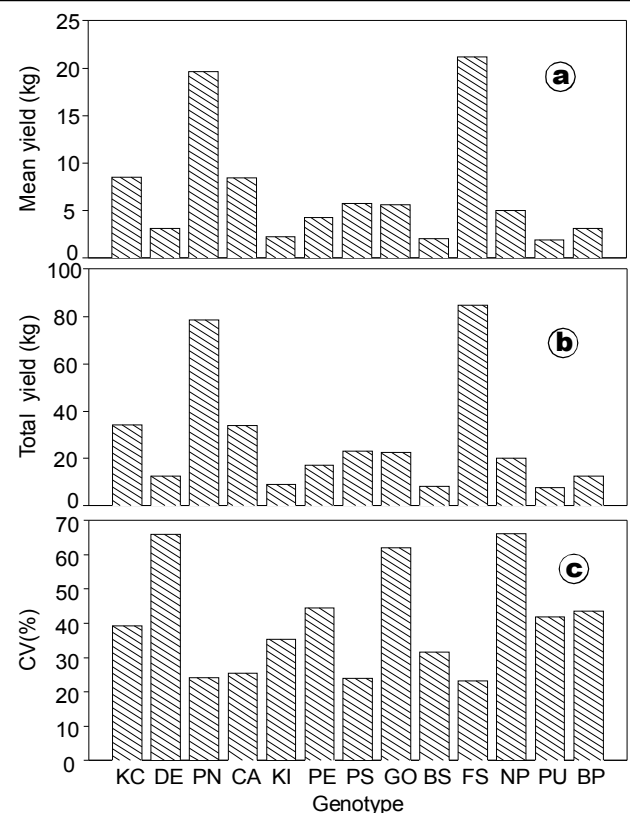
bunch weight was recorded based on the observations of a composite sample comprising of ten bunches chosen at random from a vine in each replication. The average berry weight was calculated on the basis of hundred berries, randomly picked, from ten bunches. The total soluble solids were determined with the help of a hand refractometer and reading corrected at room temperature. Acidity was estimated as per the method detailed in A.O.A.C. (1975). Data were analysed, year wise and pooled analysis was performed for four years in randomised block design (Gomez and Gomez, 1984).

Results and discussion

Data presented in Table 1 indicate that the time of bud sprouting and ripening differed from year to year even in the same variety. This is mainly due to variation in heat units accumulation in different years. It was also observed that early or late bud sprouting had not much influence on time of ripening. These results are in agreement with the findings of earlier workers who have reported that growth, fruit development and ripening are significantly influenced by heat unit accumulation and its requirement for various process differ with the genotypes (Uzun, 1997 and El-Hadi *et al.*, 1995). This might be due to less heat units accumulation during early fruit set and contribution due to early flowering seems to be negligible towards early ripening. Bud sprouting (20 Feb- 5 March) and ripening (16 May-5 June) were earliest in Beauty Seedless followed by Flame Seedless (bud sprouting 20 Feb -11 March and ripening 31 May-14 June). Ripening date for Beauty Seedless has been reported around 28th May under Delhi conditions (Jindal, 1998), which corroborates with our findings. Late bud sprouting (10-21 March) was recorded in Kishmish Charani while it took 90 days similar to Beauty Seedless (89 days) from bud sprouting to ripening. Compared to all other genotypes, fruit ripening was noticeably late in BA x Per -75-32 (10-26 June), Gold, Delight, and Kishmish Beli. On yield vine⁻¹ basis, comparison of genotypes show (Fig. 1a)

Table 1. Variation in date of bud sprouting and ripening in early ripening grape genotypes

Genotypes	Date of bud sprouting				Harvesting date			
	1997	1998	1999	2000	1997	1998	1999	2000
Kishmish Charani (KC)	17-Mar	10-Mar	10-Mar	21-Mar	16-Jun	8-Jun	10-Jun	16-Jun
Delight (DE)	10-Mar	26-Feb	26-Feb	10-Mar	19-Jun	10-Jun	11-Jun	18-Jun
Pusa Navrang(PN)	8-Mar	26-Feb	1-Mar	10-Mar	16-Jun	5-Jun	11-Jun	12-Jun
Cardinal (CA)	16-Mar	7-Mar	2-Mar	18-Mar	17-Jun	8-Jun	31-May	12-Jun
Kishmish Beli(KI)	10-Mar	7-Mar	2-Mar	16-Mar	17-Jun	10-Jun	10-Jun	18-Jun
Perlette (PE)	13-Mar	2-Mar	3-Mar	16-Mar	19-Jun	8-Jun	9-Jun	13-Jun
Pusa Seedless(PS)	14-Mar	26-Feb	3-Mar	16-Mar	17-Jun	9-Jun	8-Jun	15-Jun
Gold (GO)	14-Mar	2-Mar	29-Feb	16-Mar	26-Jun	8-Jun	12-Jun	16-Jun
Beauty Seedless(BS)	2-Mar	20-Feb	26-Feb	5-Mar	28-May	30-May	16-May	5-Jun
Flame Seedless(FS)	11-Mar	20-Feb	27-Feb	10-Mar	4-Jun	31-May	4-Jun	14-Jun
New Perlette(NP)	8-Mar	20-Feb	24-Feb	7-Mar	15-Jun	7-Jun	9-Jun	8-Jun
Pusa Urvasi (PU)	11-Mar	26-Feb	27-Feb	16-Mar	16-Jun	6-Jun	17-Jun	14-Jun
BA x Per- 75-32 (BP)	10-Mar	24-Feb	27-Feb	11-Mar	26-Jun	10-Jun	15-Jun	14-Jun
BA x BS-71-50 (BB)	-	-	-	-	-	-	-	-

**Fig. 1. Fruit yield/ vine (a), number of bunches/vine (b) and bunch weight (c) in early ripening grape genotypes****Fig. 2. Mean yield(a), total yield(b) and coefficient of variation(c) in yield pattern of early ripening grape genotypes**

that Flame Seedless and Pusa Navrang were high yielding genotypes and mean yield of these genotypes over 4 years was about 20 kg vine⁻¹ year⁻¹. The total yield of 4 years was also high in Flame Seedless and Pusa Navrang (Fig. 2). This show that yearly yield fluctuation was less in these genotypes as expressed by coefficient of variation (Fig 2c). Genotypes, Delight, Gold, New Perlette had more fluctuation in yield vine⁻¹. The yield data of genotypes, recorded in different years also indicate that total yield of Flame Seedless and Pusa Navrang were not only high but they also recorded phenotypic yield stability and show potential for satisfactory yield and fruit quality under unfavourable conditions. Observations for four years have also shown that damage due to early rains is not apparent on Flame Seedless and Pusa Navrang, while BA x Per-75-32 and New Perlette were highly susceptible to cracking under the influence of light showers also. Genotypes, Cardinal (5.40 - 8.61kg vine⁻¹), Kishmish Charani (4.69 -12.66 kg

Table 2. Variation in berry weight, acidity and TSS of early ripening grape genotypes

Genotype	Berry weight (g)					Acidity (%)					TSS (°Brix)				
	1997	1998	1999	2000	Mean	1997	1998	1999	2000	Mean	1997	1998	1999	2000	Mean
Kishmish Charani	1.41	1.72	1.65	1.60	1.60	0.80	0.80	0.75	0.88	0.81	16.6	15.8	15.4	17.8	16.4
Delight	1.30	0.92	1.43	1.80	1.36	0.50	0.45	0.45	0.57	0.49	17.00	16.80	17.00	18.20	17.25
Pusa Navrang	0.97	1.68	0.64	1.80	1.27	0.65	0.60	0.42	0.56	0.56	16.00	16.40	15.20	16.60	16.05
Cardinal	2.34	3.99	2.11	3.60	3.01	0.60	0.50	0.39	0.48	0.49	15.60	15.20	17.80	18.00	16.65
Kishmish Beli	1.41	1.31	1.36	1.20	1.32	0.45	0.45	0.43	0.45	0.45	21.40	18.00	17.67	18.00	18.77
Perlette	1.53	1.57	1.54	1.43	1.52	0.60	0.63	0.58	0.57	0.60	16.80	17.07	16.67	18.80	17.34
Pusa Seedless	1.95	2.02	1.98	1.50	1.86	0.75	0.58	0.60	0.57	0.63	18.00	17.13	17.13	18.40	17.67
Gold	2.10	1.86	1.92	1.93	1.95	0.50	0.45	0.44	0.56	0.49	21.00	15.40	17.67	18.40	18.12
Beauty Seedless	1.50	2.89	2.14	1.60	2.03	0.60	0.50	0.50	0.66	0.57	16.00	18.20	16.80	18.20	17.30
Flame Seedless	1.49	1.33	1.08	1.50	1.35	0.50	0.50	0.47	0.49	0.49	20.40	17.20	17.00	18.80	18.35
New Perlette	1.56	1.75	0.89	1.30	1.38	0.65	0.65	0.60	0.56	0.62	20.40	17.20	16.60	19.20	18.35
Pusa Urvashi	1.66	1.65	1.54	1.60	1.61	0.60	0.60	0.47	0.57	0.56	15.80	16.27	16.33	15.87	16.07
BA x PER-75-32	1.84	1.88	1.34	1.68	1.69	1.10	0.72	0.38	0.75	0.74	9.00	10.80	9.20	9.53	9.63
BA x BS-71-50	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CD ($p=0.05$)	0.12	0.14	0.13	0.13	0.13	0.17	0.18	0.10	0.17	0.08	0.71	0.57	0.38	0.70	0.30

vine⁻¹), Beauty Seedless (1.13-22.63 kg), Pusa Seedless (5.02 - 7.13 kg vine⁻¹), Gold (1.36 kg - 8.88 kg vine⁻¹) and New Perlette (2.69 kg - 9.84 kg vine⁻¹) recorded medium yield, while Pusa Urvashi (1.20 - 2.89kg vine⁻¹) and Kishmish Beli (1.15 - 3.04 kg vine⁻¹) were observed as poor yielder under Lucknow conditions. These results are in agreement with the findings of Cheema *et al.* (1998) from Ludhiana and Jindal (1998) in Delhi conditions. The results of present investigation are contradictory with the results of Gaurav *et al.* (2000) who received maximum yield with Beauty Seedless under Rahauri conditions whereas under Lucknow conditions it was observed as medium yielder. This variation may be due to difference in agro-climatic conditions. Under Lucknow conditions, hybrid BA x BS-71-50 did not produce fruits throughout the experimental period. Poor yield behaviour of this hybrid has also been reported from Delhi (Singh, 1996). Number of bunches vine⁻¹ was maximum in Pusa Navrang although its bunch weight was minimum (Fig. 1b). The low bunch weight might be due to high number of bunches causing competition among the berries and resulting into smaller size. The results also indicate that in Flame Seedless, number of bunches was significantly higher than other genotypes except Pusa Navrang along with high bunch weight. Although Kishmish Charani, Pusa Seedless and New Perlette had high bunch weight but exhibited less yield under Lucknow conditions (Fig. 1a, 1c). Because of higher yield, Pusa Navrang can be exploited as processing variety for juice making as of it has attractive juice colour. Thus smaller berry size and seededness are not the limiting factor for the cultivation of this genotypes. Flame Seedless was adjudged as suitable genotype for subtropics not only due to high yield and stability in various environments but also its highly attractive flame colour and satisfactory berry and bunch size with sufficient number of bunches vine⁻¹. Highest bunch weight was observed in Pusa Seedless (279.75g) followed by Kishmish Charani (231.17g), Flame Seedless (226.25g) and New Perlette (215.50g). Higher (3.01g) berry weight was recorded in Cardinal as compared to others and it was minimum (1.27g) in Pusa Navrang. Tomar (1990) also recorded the high berry weight in Cardinal under arid irrigated conditions of Punjab. The next higher berry weight was recorded in Beauty Seedless (2.03g), Gold (1.95g) and Pusa Seedless (1.86g). TSS was maximum in Kishmish Beli (18.77° Brix), New Perlette (18.35° Brix), Flame Seedless (18.35° Brix) and Gold (18.4° Brix) were at par in this parameter while it was minimum in hybrid BA x Per 75-32. Minimum acidity (0.44%) was observed in Kishmish Beli followed by Delight, Cardinal, Gold and Flame Seedless whereas, it was maximum (0.75-0.88%) in Kishmish Charani and BA x Per -75-32 (0.74%), respectively. Gaurav *et al.* (2000) also

reported highest TSS and lower acidity in Flame Seedless. Sable and Tambe (1996) have also reported more acidity in the juice of Kishmish Charni.

Results of this investigation indicated that Flame Seedless is most suitable table variety for the commercial cultivation under Lucknow conditions and Pusa Navrang was next suitable variety for the region particularly for juice making.

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