

**RESEARCH PAPER****Performance of grape (*Vitis vinifera* L.) varieties under agro- climatic conditions of Ayodhya, U.P. India**Sanjeev Kumar\*, I.S. Singh<sup>1</sup> and A.S. Yadav<sup>2</sup>

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**Abstract :** Five grape varieties viz. Perlette, Beauty Seedless, Delight, Thompson Seedless and Banqui-Abyad were evaluated at Horticulture Experiment Farm, Acharya Narendra Deva University of Agriculture and Technology, Kumarganj, Ayodhya (U.P.) for their yield, ripening and quality characteristics. Performances of Perlette, Beauty Seedless and Delight varieties were found better in terms of early ripening, bunch and berry quality, productivity as well as physico-chemical constituents. As such these varieties emerged potentially rich for commercial cultivation under Ayodhya conditions in view of their over excellence.

**Key Words :** Attributes, Productivity, Physicochemical, Quality, Ripening, Grape

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**INTRODUCTION**

Grape (*Vitis vinifera* L.) belongs to family 'Vitaceae' and is widely considered as one of the most delicious, nourishing and refreshing fruits ranking first in area and production among all the fruit crops of the world. Globally grapes are cultivated on an area of 18 million acres with 77,518,398 tonnes production. Grapes are grown for several purposes, 71% of it is used for wine, 27% is used for fresh consumption while remaining 2% is being consumed as dried fruit. The edible portion of grape contains a large proportion of sugars and useful minerals. Monsoon rains at the time of fruit maturity causes the berry splitting, cracking and rotting which

ultimately gives invitation to different fungal diseases. As sugars and high temperature in summer provides an ideal conditions for fungal growth and development which affects the fruit quality. In order to resolve the rotten berry issue due to monsoon rains, early ripening grape cultivars should be evaluated in terms of physical and chemical characteristics. The grapes quality depends upon its physical and chemical composition which is greatly affected by biotic and abiotic factors (Akram *et al.*, 2020). Climate has a profound effect on growth, production and fruit quality which greatly affects grapes diversity. Factors include in climate are temperature, precipitation, wind, light and humidity of particular area.

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Among these factors, temperature and rainfall are the foremost factors that contribute to the successful cultivation of grapes. Average range of temperature from 25-30°C is considered ideal for shoot growth and physiological processes (Keller *et al.*, 2022).

Temperature also effects on colour and aroma of grapes (Sener, 2018). Moreover, grapes quality is also affected by rainfall, frost and humidity during the growing season. Rainfall directly contributes in production and vigour of vines however indirectly contributes to sugars, acids and phenolic contents of berry. The climatic conditions of northern India have been considered marginal for grape growing. The period of berry ripening synchronises with the advent of rains which causes cracking and fungus growth on berries (Ji *et al.*, 2021). As such in order to make grape growing, successful and remunerative in north India, it is essential to select early, high quality and prolific bearing varieties. Little information is available pertaining to yield, ripening and quality attributes of these varieties for exploring the possibilities of grape growing in eastern part of Uttar Pradesh. Hence, keeping in view, the economic importance of grapes on commercial scale in Ayodhya region the present research was conducted with objective to manage the problem of berry rotting due to monsoon rains, early maturing varieties of grapes were evaluated for their physicochemical quality characteristics under eastern U.P. climate.

## MATERIAL AND METHODS

Four years old healthy and uniform vines, planted at 3m × 3m, trained on double arm kniffin system were selected for the study of five grape varieties (Perlette, Beauty Seedless, Delight, Thompson Seedless and Banqui-Abyad) at Horticulture Experiment Farm, Acharya Narendra Deva University of Agriculture and Technology, Kumarganj, Ayodhya (U.P.). The vines of each variety considering as a unit, were replicated four times in a Randomized Block Design. The vines received

uniform cultural treatments throughout the experimentation. Data was collected on duration of flowering, fruit setting, ripening and number of bunches per vine. At ripening 20 bunches of each variety were picked up randomly and their size and weight were recorded. Yield per vine was calculated by multiplying the average weight of bunch with average number of bunches per vine. From these bunches total number of berries were counted after removal from cluster and their average were calculated. After counting total number of berries, shot berries were separated, counted and expressed in per cent. Ten berries were randomly picked and their size, weight and number of seeds were recorded and average was calculated. Berry colour was examined visually. Percentage of juice, pomace and seed were obtained in relation with total weight of berries.

A total soluble solid (T.S.S.) was determined with the help of hand refractometer and values corrected at 20°C. The acidity was determined by titrating the juice against N/10 NaOH using phenolphthalein as an indicator and value was expressed as g tartaric acid per 100g of sample. Sugars, ascorbic acid and total minerals were analysed by the procedures as described in A.O.A.C. (1975).

## RESULTS AND DISCUSSION

The experimental findings obtained from the present study have been discussed in following heads :

### Flowering, fruit setting and ripening :

Data presented in Table 1 revealed that flowering started in first week of March in all the varieties. Banqui-Abyad was earliest to flower followed by Beauty Seedless. Duration of flowering varied from 3 to 4 days. Time of fruit set varied from 18<sup>th</sup> March to 20<sup>th</sup> March depending upon the varieties. Berry set was earliest in Banqui-Abyad followed by Parlette, Beauty Seedless, Delight and Thompson Seedless. Ripening period of grape varieties varied from 3<sup>rd</sup> week of May to 1<sup>st</sup> week

**Table 1: Time of flowering, fruit setting and ripening of grape varieties**

Varieties	Flowering time	Setting time	Ripening time	Days taken to ripening (from berry set)
Perlette	March 4 <sup>th</sup> -7 <sup>th</sup>	March 20 <sup>th</sup> -25 <sup>th</sup>	May 25 <sup>th</sup> -30 <sup>th</sup>	66-71
Beauty seedless	March 2 <sup>nd</sup> -6 <sup>th</sup>	March 21 <sup>st</sup> -25 <sup>th</sup>	May 25 <sup>th</sup> -30 <sup>th</sup>	65-70
Delight	March 5 <sup>th</sup> -8 <sup>th</sup>	March 23 <sup>rd</sup> -27 <sup>th</sup>	May 26 <sup>th</sup> -31 <sup>st</sup>	64-69
Thompson seedless	March 5 <sup>th</sup> -9 <sup>th</sup>	March 24 <sup>th</sup> -29 <sup>th</sup>	May 31 <sup>st</sup> -June 5 <sup>th</sup>	68-73
Banqui-Abyad	March 1 <sup>st</sup> -4 <sup>th</sup>	March 18 <sup>th</sup> -21 <sup>st</sup>	May 21 <sup>st</sup> -26 <sup>th</sup>	64-69

of June. Banqui-Abyad ripened earliest among all the varieties *i.e.* from 21<sup>st</sup> May to 26<sup>th</sup> May. Perlette and Beauty Seedless ripened in 4<sup>th</sup> week of May. Thompson Seedless ripened late *i.e.* in 1<sup>st</sup> week of June under Ayodhya conditions, while this variety ripens in middle of June under Hisar (Gupta *et al.*, 2020) and 4<sup>th</sup> week of June to 1<sup>st</sup> week of July under Jammu (Kalbhor *et al.*, 2021) conditions. Earlier ripening of grape varieties under Ayodhya conditions indicates the possibility of growing grapes on commercial scale. Delight and Banqui-Abyad took shortest time *i.e.* 64 to 69 days from berry set to ripening followed by Beauty Seedless, Perlette and Thompson Seedless.

### Bunch characteristics and productivity :

Present findings revealed that average bunch weight varied from 371.60g to 480.05g in different varieties of grape (Table 2). Bunch weight was highest (480.05g) in Delight followed by Perlette (473.80g) and it was lowest (371.60g) in Thompson Seedless. Arora and Singh (1972) observed 275g bunch weight in Delight variety under Hisar conditions, while 208.50g bunch weight of Perlette variety was recorded in Agra (Sharma *et al.*, 1973) conditions. Average bunch weight decides the average total yield of the vines. Differences in average bunch weight of a variety are due to locality, cultural practices and crop load. Average length of bunch was recorded highest (21.73 cm) in Thompson Seedless followed by Beauty Seedless (19.85 cm), while average width of

bunch was highest (8.70 cm) with Banqui-Abyad followed by (8.13 cm) Beauty Seedless (Table 2). Average number of bunches per vine varied from 23.25 (Banqui-Abyad) to 60.75 (Beauty Seedless).

Average yield per vine was highest (22.62 kg) in Beauty Seedless followed by Perlette (18.36 kg). Lowest yield (9.29 kg) was recorded with Banqui-Abyad. A great variability in yield of these varieties was reported by several workers. Singh *et al.* (1972) observed 35.00 kg and Chauhan and Singh (1981) noticed only 11.90 kg yield per vine in Beauty Seedless variety of grape. In Perlette variety yield per vine was 16.50 kg (Singh *et al.*, 1974) and 12.80 kg (Yamdagni *et al.*, 1981) under Hisar conditions when vines were trained on kniffin system. Yield is one of the important parameters for evaluating the performance of varieties under different climatic conditions since it varies with locality to locality and training systems.

### Berry characteristics :

Average berry weight was recorded highest (3.64g) in Banqui-Abyad followed by Perlette (1.92g). Under Hisar conditions also average berry weight of Banqui-Abyad variety was observed 3.60 g (Daulta, 1981) and for Perlette it was 2.33 g (Yamdagni *et al.*, 1981). The variation in berry weight of various regions may possibly be due to differences in cultural practices, climatic conditions and training systems. Average berry length and diameter were found to be the highest with Banqui-

**Table 2 : Bunch characteristics and productivity of grape varieties**

Varieties	Av. wt./bunch (g)	Av. length (cm)	Av. width (cm)	Av. no. of bunch/vine	Av. yield/vine (kg)
Perlette	473.80	19.35	7.13	38.75	18.36
Beauty Seedless	371.93	19.85	8.13	60.75	22.62
Delight	480.05	18.45	7.83	38.00	18.27
Thompson Seedless	371.60	21.73	6.08	30.50	11.32
Banqui-Abyad	399.30	19.13	8.70	23.25	9.29
C.D. (P=0.05)	13.98	0.48	0.14	13.02	0.66

**Table 3 : Berry characteristics of grape varieties**

Varieties	Av. wt./berry (g)	Av. length (cm)	Av. diameter (cm)	Av. no. of berries/bunch	Shot berry (%)	Colour	Av. no. of seed/berry
Perlette	1.92	2.20	2.29	296.00	29.78	Yellowish green	-
Beauty Seedless	1.68	2.09	2.07	222.00	17.01	Bluish black	-
Delight	1.43	2.06	1.99	204.25	8.27	Greenish	-
Thompson Seedless	1.88	2.23	2.01	226.50	10.76	Golden yellow	-
Banqui-Abyad	3.64	2.35	2.41	101.00	6.68	Greenish yellow	3.00
C.D. at 5%	0.05	0.03	0.03	2.95	1.23	-	-

Abyad and lowest with Delight variety in present study (Table 3). The results are in confirmity with Mehta *et al.* (1973) and Daulta (1981).

Colour of grape berries of different varieties varied at ripening (Table 3). Greenish colour was observed in both Delight and Banqui-Abyad varieties. The berry colour in Perlette, Thompson Seedless and Beauty Seedless at ripening was yellowish green, golden yellow and bluish black, respectively. Berry colour is one of the important criteria to judge the maturity. Development of full or uniform colour in grape berries is also useful from marketing point of view. It is, therefore, essential to harvest the grape varieties when they developed bright, attractive or full colour.

Average number of berries per bunch was highest in Perlette (296) and Thompson Seedless (226.50) as compared to those reported by Mishra, 1984 in a bunch of Perlette (142.30) in Garhwal and Bindra and Brar, 1979 in Thompson Seedless (161) under Punjab conditions. The differences in number of berries in a bunch of grape varieties might be due to differences in berry set under different climatic zones. Shot berries were found to be the highest (29.78%) in Perlette followed by Beauty Seedless (17.01%) in present findings, while 27.96 per cent shot berries in Perlette (Sarowa and Bakshi, 1972) and 36.55 per cent in Beauty Seedless (Chauhan and Singh, 1982) was noticed under Hisar conditions. Viable seeds (3) recorded only in Banqui-Abyad variety (Table 3). It was almost in

agreement with the finding of Daulta (1981).

#### Physical composition :

A perusal of data in Table 4 revealed that juice content was highest (75.28%) in Beauty Seedless with lowest (24.72%) pomace. These findings are in consonance with Chadha and Randhawa (1974). Per cent seed was found low (2.40%) in Banqui-Abyad variety as compared to those reported by Mehta *et al.*, 1973 (5%).

#### Chemical composition :

Data furnished in Table 5 revealed that T.S.S. content was found highest (20.15%) in Thompson Seedless followed by Banqui-Abyad (20.13%) and it was lowest (17.63%) in Perlette. T.S.S. content of 19.70 per cent in Thompson Seedless and 17.00 per cent in Perlette variety was noticed by Singh *et al.* (1972), while Daulta (1981) observed 18.00 per cent T.S.S. in Banqui-Abyad variety at Hisar. Acidity was lowest (0.55%) with Delight and highest with Beauty Seedless (0.73%). It was almost in agreement with the findings of Chadha and Randhawa (1974). TSS/acid ratio was recorded maximum (35.50) with Delight and minimum (25.43) with Beauty Seedless variety. Singh and Singh (1972) showed 27.94 and 27.14 TSS/acid ratio in Delight and Beauty Seedless varieties, respectively under Hisar conditions.

Reducing sugar content was recorded highest (12.84

**Table 4 : Physical composition of grape varieties**

Varieties	Juice (%)	Pomace (%)	Seed (%)
Perlette	61.63	38.37	-
Beauty Seedless	75.28	24.72	-
Delight	67.35	32.65	-
Thompson Seedless	70.40	29.60	-
Banqui-Abyad	64.40	33.20	2.40
C.D. (P=0.05)	0.59	0.59	-

**Table 5 : Chemical composition of grape varieties**

Varieties	T.S.S. (%)	Acidity (%)	T.S.S./ acid ratio	Sugars			Ascorbic acid (mg/100g)	Total minerals (%)
				Reducing (%)	Non-reducing (%)	Total (%)		
Perlette	17.63	0.65	27.26	12.84	0.83	13.71	4.74	0.45
Beauty Seedless	18.38	0.73	25.43	11.57	1.41	13.05	3.92	0.60
Delight	19.38	0.55	35.50	12.29	0.90	13.24	4.51	0.33
Thompson Seedless	20.15	0.68	29.97	11.60	1.24	12.91	4.33	0.41
Banqui-Abyad	20.13	0.68	29.94	12.59	1.04	13.68	4.21	0.51
C.D. (P=0.05)	0.66	0.09	4.24	0.08	0.08	0.07	0.04	0.02

%) in juice of Perlette followed by Banqui-Abyad (12.59%) and Delight (12.29%). 13.10 per cent and 14.50 per cent reducing sugars, respectively in Perlette and Delight varieties were observed by Singh *et al.* (1972) under Hisar conditions. Non-reducing sugar was found to be lowest (0.83%) in Perlette (Table 5). Sharma *et al.* (1975) observed 0.78 per cent non-reducing sugars in Perlette under Lucknow conditions which is very close to our finding. Total sugar content was highest (13.71%) in Perlette variety as compared to those reported by Revis *et al.*, 1975 (11.30%) in this variety under Lucknow conditions.

Studies indicated that ascorbic acid content of grape is very low, Perlette recorded highest value (4.74 mg/100g) among all varieties under study (Table 5). Similar results were obtained by Revis *et al.* (1975). Total mineral content of Beauty Seedless variety (0.60%) was found to be highest followed by Banqui-Abyad (0.51 per cent). However, mineral content of grape was reported to vary from 0.20 to 0.60 per cent by other workers too (Singh *et al.*, 1967 and Amerine *et al.*, 1972).

### Conclusion :

Based on the observations reported earlier it can be recommended that grape varieties ripen earlier under Ayodhya conditions than that of other parts of north India. Early ripening avoids rains suited for commercial grape growing in north India. On the basis of yield, ripening and quality attributes Perlette, Beauty Seedless and Delight varieties showed great potentialities for commercial production under Ayodhya, U.P. conditions.

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