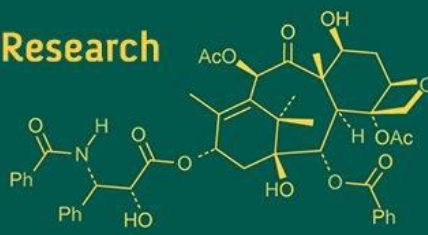


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Performance assessment of onion (*Allium cepa* L.) genotypes based on growth, yield attributes and bulb quality

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Abstract

Thirty onion (*Allium cepa* L.) genotypes were evaluated during *Rabi*, 2022-23 for growth, yield and quality traits to assess the extent of variability among genotypes. The number of leaves per plant ranged from 4.69 (W-063) to 7.00 (W-405) with a grand mean of 6.17, while plant height at harvest varied from 8.40 cm (W-063) to 10.40 cm (W-405) with a mean of 9.60 cm. Equatorial bulb diameter ranged from 26.35 mm (W-085) to 37.25 mm (Bhima Shakti) and polar bulb diameter from 45.15 mm (Arka Swadista) to 64.23 mm (Bhima Dark Red). Average bulb weight varied from 64.64 g (Arka Swadista) to 105.36 g (Bhima Shakti) with a grand mean of 82.17 g, whereas bulb yield per plot ranged from 1.26 kg (W-355) to 2.20 kg (Bhima Shakti) with a mean of 1.73 kg. Harvest index varied from 53.02% (Bhima Light Red) to 77.34% (Bhima Shakti). Total soluble solids ranged from 9.15 °Brix (W-337) to 13.57 °Brix (Bhima Safed), while anthocyanin content ranged from 0.16 mg/100 g (Bhima Safed) to 19.22 mg/100 g (Bhima Dark Red). The wide range observed for all growth, yield and quality parameters indicates substantial variability among the onion genotypes evaluated.

Keywords: *Allium cepa* L., onion genotypes; growth traits, bulb yield, quality parameters, variability

Introduction

Onion (*Allium cepa* L.), a bulbous crop belonging to the family Alliaceae, is one of the most extensively cultivated vegetable-cum-spice crops worldwide and constitutes an indispensable component of human diets owing to its distinctive flavour, aroma, storability and wide culinary applications. It is consumed in fresh, cooked and processed forms and plays a vital role in daily food preparation across cultures. In addition to its culinary importance, onion possesses considerable nutritional and medicinal value, as the bulbs are rich in carbohydrates, vitamins, minerals and sulphur-containing compounds that exhibit antioxidant and health-enhancing properties (Griffiths *et al.*, 2002; Patil *et al.*, 2016) [10, 16]. Owing to its wide adaptability, onion is cultivated across diverse agro-climatic regions ranging from temperate to tropical zones. India is the second largest producer of onion, cultivating the crop over 16-19 lakh hectares with a production ranging from 242.44 to 289 lakh tonnes [Department of Agriculture and Farmers' Welfare (2024)]. The national average productivity ranges between 15 and 20 t ha⁻¹ (NHB, 2023), which remains lower than that of countries such as the Netherlands and the United States, where yields often exceed 40-50 t ha⁻¹ due to the adoption of hybrid cultivars and advanced production technologies (Brewster, 2008; Havey, 2013) [12]. Globally, onion is cultivated on about 5.2 million hectares with an annual production exceeding 100 million tonnes, highlighting its importance as a major vegetable crop (FAO, 2023).

Despite its significance, onion productivity and quality exhibit wide variation due to genetic diversity and environmental influences. Growth traits such as number of leaves and plant height affect photosynthetic efficiency and biomass accumulation, while yield attributes including bulb size, bulb weight and harvest index largely determine economic yield (Havey, 1999; Falconer and Mackay, 1996) [11, 7].

In recent years, quality characteristics such as total soluble solids, sugars, pungency and antioxidant compounds have gained importance owing to changing consumer preferences and increased nutritional awareness (Goldman *et al.*, 1996; Slimstad *et al.*, 2007) [9, 25]. Since these traits are quantitatively inherited and influenced by genotype $\times$ environment interactions, systematic evaluation of onion genotypes is essential. Therefore, the present study was undertaken to assess thirty onion genotypes for growth, bulb yield and quality traits with the objective of identifying superior genotypes suitable for cultivation and future improvement programmes.

Materials and Methods

The experiment was conducted during the Rabi season of 2022-23 at the Vegetable Block, College of Horticulture, Anantharajupeta, situated in the Southern Agro-climatic Zone of Andhra Pradesh, India (13°09' N latitude, 79°32' E longitude) at an elevation of 162 m above mean sea level. The soil of the experimental field was sandy loam, well drained and neutral in reaction (pH 7.2). Thirty onion (*Allium cepa* L.) genotypes comprising white and red bulb types were used in the present study. The genotypes were procured from ICAR-Directorate of Onion and Garlic Research (DOGR), Pune and ICAR-Indian Institute of Horticultural Research (IIHR), Bengaluru. The list of genotypes along with their sources is presented in Table 1. The experiment was laid out in a Randomized Block Design (RBD) with 30 genotypes as treatments and two replications. Each plot measured 1.5 m $\times$ 1.0 m and seedlings were transplanted at a spacing of 30 cm $\times$ 15 cm. Seeds of all genotypes were raised in pro-trays under greenhouse conditions during the third week of November 2022. The seedlings germinated within 10-14 days and were transplanted into the main field during the second week of January 2023. Healthy and uniform seedlings were selected for transplanting. Light irrigation was applied immediately after transplanting to ensure proper establishment. The field was prepared to fine tilth by ploughing and harrowing. Well-decomposed farmyard manure @ 20 t ha⁻¹ was incorporated during final land preparation. A recommended fertilizer dose of 100:50:50 kg N:P₂O₅:K₂O ha⁻¹ was applied, with the full dose of phosphorus and potassium and half of nitrogen as basal and the remaining nitrogen in two equal splits at 30 and 45 days after transplanting. Irrigation was provided at 7-10-day intervals during early growth and 5-6-day intervals during bulb development. Irrigation was stopped 10-12 days before harvest. All intercultural and plant protection practices were followed as per the recommendations. Harvesting was done manually when plants showed yellowing and bending of tops. Bulbs were harvested genotype-wise and replication-wise and cured in the field for 3-4 days. Observations on the growth traits *i.e.*, plant height and the number of leaves were recorded from five randomly selected plants in each replication 60 DAT and at the time of harvest. Yield attributing traits *viz.*, bulb weight (g), equatorial bulb diameter (mm), polar bulb diameter (mm), per cent double/splits, neck thickness (mm), average weight of 10 bulbs (kg), bulb yield per plot (Kg) and harvest index (%) were recorded from five randomly selected bulbs after harvest. Whereas, Quality traits *viz.*, TSS (° Brix), Total sugars (%) using Anthrone method suggested by Ranganna (1986) [20], Ascorbic acid content in bulb (mg 100g⁻¹) using titrimetric method by Srivastava and

Kumar, (2005), Total phenols in bulb (mg 100g⁻¹) by Singleton *et al.* (1999), Anthocyanin content (mg 100g⁻¹) by spectrophotometric method given by Ranganna (1986) [20], Pyruvic acid content (μ moles/gram fresh weight) (Anthon and Barrett (2003) [1]. The data recorded for growth, yield and quality traits were subjected to statistical analysis following the procedures appropriate for a Randomized Block Design (RBD). Analysis of variance (ANOVA) was carried out to test the significance of differences among the onion genotypes. The significance of treatment effects was evaluated at the 5% level of probability. Standard error of mean (SEm) and critical difference (CD) values were computed to compare treatment means wherever the F-test was found significant. All statistical analyses were performed using standard statistical methods.

Table 1: Details of onion genotypes used in the experiment and source of collection

S. No	Genotypes	Source
1	W-043	ICAR-DOGR, Pune
2	W-063	ICAR-DOGR, Pune
3	W-085	ICAR-DOGR, Pune
4	W-172	ICAR-DOGR, Pune
5	W-203	ICAR-DOGR, Pune
6	W-208	ICAR-DOGR, Pune
7	W-337	ICAR-DOGR, Pune
8	W-355	ICAR-DOGR, Pune
9	W-364	ICAR-DOGR, Pune
10	W-396	ICAR-DOGR, Pune
11	W-405	ICAR-DOGR, Pune
12	W-448	ICAR-DOGR, Pune
13	R-1672	ICAR-DOGR, Pune
14	R-1739	ICAR-DOGR, Pune
15	R-1740	ICAR-DOGR, Pune
16	R-1772	ICAR-DOGR, Pune
17	R-1773	ICAR-DOGR, Pune
18	R-1774	ICAR-DOGR, Pune
19	R-1807	ICAR-DOGR, Pune
20	Bhima Shweta	ICAR-DOGR, Pune
21	Bhima Shubhra	ICAR-DOGR, Pune
22	Bhima Safed	ICAR-DOGR, Pune
23	Bhima Dark Red	ICAR-DOGR, Pune
24	Bhima Kiran	ICAR-DOGR, Pune
25	Bhima Light Red	ICAR-DOGR, Pune
26	Bhima Raj	ICAR-DOGR, Pune
27	Bhima Red	ICAR-DOGR, Pune
28	Bhima Shakti	ICAR-DOGR, Pune
29	Arka Swadista	IIHR, Bangalore
30	Arka Vishwas	IIHR, Bangalore

Results and Discussion

The mean performance of genotypes in onion is the average expression of important traits and mean performance of genotypes is a key criterion for selecting high-yielding, good quality and widely adapted varieties, forming the foundation for genetic improvement and variety development. The mean performance of 30 genotypes of onion for various vegetative, yield and quality traits are described under below.

Plant growth traits

The growth parameters, namely number of leaves and plant height at 60 days after transplanting (DAT) and at harvest, exhibited significant variation among the thirty onion genotypes, indicating the presence of considerable genetic variability. The number of leaves at 60 DAT ranged from

4.69 to 7.00, with a general mean of 6.17 leaves per plant. The genotype W-405 recorded the highest number of leaves (7.00) and R-1672, Bhima Safed, R-1772, Arka Swadista, R-1740, Bhima Dark Red and Bhima Shubhra were found statistically at par with it, whereas W-063 recorded the minimum number of leaves (4.69). At harvest, the number of leaves varied from 8.40 to 10.40, with a grand mean of 9.60 leaves per plant. The maximum number of leaves was observed in W-405 (10.40), which was statistically on par with Bhima Safed, R-1672, Bhima Dark Red, Bhima Light Red, Bhima Kiran, Bhima Red, R-1773, R-1774 and R-1740, while W-063 (8.40) recorded the lowest value. Plant height at 60 DAT also differed significantly among

genotypes, ranging from 26.35 cm to 37.25 cm, with a mean of 30.68 cm. The tallest plants were recorded in Bhima Shakti (37.25 cm), which was statistically on par with R-1807, R-1739, Bhima Kiran, W-203 and W-448, whereas W-085 (26.35 cm) exhibited the minimum height. At harvest, plant height ranged from 45.15 cm to 64.23 cm, with an overall mean of 52.88 cm. The genotype Bhima Dark Red recorded the maximum plant height (64.23 cm) and was statistically comparable with Bhima Shakti (63.14 cm), while Arka Swadista (45.15 cm) recorded the minimum height. Behera *et al.* (2017) [3]; Dangi *et al.* (2018) [5] and Prakash *et al.* (2022) [17] noticed the similar results.

Table 2: Mean performance of plant growth parameters in thirty genotypes of onion

Genotypes	NL		PH		EBD (mm)	PBD (mm)	NT (mm)
	60 DAT	At harvest	60 DAT	At harvest			
White Genotypes							
W-043	5.09	8.50	30.25	51.88	52.98	48.33	11.93
W-063	4.69	8.40	29.24	50.08	55.07	46.15	8.40
W-085	5.58	9.30	26.35	49.93	51.99	44.28	8.60
W-172	5.88	9.54	30.50	54.89	54.08	47.47	11.80
W-203	6.47	9.80	33.25	59.91	58.20	51.54	12.03
W-208	5.90	9.10	27.25	53.00	51.24	47.21	11.57
W-337	5.48	8.60	29.50	46.88	46.96	44.23	8.70
W-355	5.78	9.00	26.60	48.24	50.15	45.29	9.44
W-364	6.08	9.50	31.75	56.35	53.88	48.23	12.60
W-396	6.18	9.80	32.20	51.33	45.02	43.31	8.95
W-405	7.00	10.40	29.37	50.37	50.75	46.09	9.28
W-448	6.37	9.50	33.25	55.07	56.71	49.15	11.52
Bhima Shweta	6.27	9.50	30.78	53.87	47.03	41.21	8.40
Bhima Shubra	6.57	9.70	31.50	58.12	60.23	54.45	11.50
Bhima Safed	6.80	10.32	31.75	57.40	58.99	53.37	11.78
Arka Swadista	6.68	9.80	29.25	45.15	48.22	41.36	8.45
Red Genotypes							
R-1672	6.90	10.30	31.47	53.82	59.69	58.72	11.75
R-1739	5.68	9.30	34.50	52.99	49.75	44.27	9.06
R-1740	6.67	9.90	32.70	54.07	56.71	49.40	13.30
R-1772	6.77	9.80	31.30	55.09	65.16	55.46	11.69
R-1773	6.37	9.90	27.10	52.00	47.76	43.40	9.58
R-1774	6.47	9.90	29.40	45.55	52.74	48.49	11.75
R-1807	5.97	9.20	34.60	50.10	46.22	46.20	8.59
Bhima Dark Red	6.58	10.20	29.25	64.23	62.90	55.53	12.02
Bhima Kiran	6.48	10.10	33.47	55.96	56.21	46.26	9.96
Bhima Light Red	6.17	10.10	29.50	46.88	51.20	46.46	9.28
Bhima Raj	6.21	9.80	28.60	50.88	53.09	45.45	9.30
Bhima Red	6.37	10.10	28.14	50.35	56.95	48.23	12.32
Bhima Shakti	5.77	9.40	37.25	63.14	60.89	54.60	12.43
Arka Vishwas	5.77	9.30	30.45	48.99	53.93	47.17	8.02
Grand Mean	6.17	9.60	30.68	52.88	53.82	48.04	10.47
SE(m)±	0.17	0.20	1.52	1.32	1.30	1.99	0.87
CD (P=0.05)	0.50	0.57	4.39	3.81	3.75	5.75	2.52

Yield attributing traits

The bulb and yield traits exhibited significant variation among the thirty onion genotypes, indicating substantial genetic diversity for these characters. Equatorial bulb diameter ranged from 45.02 to 65.16 mm, with a grand mean of 53.82 mm. The genotype R-1772 recorded the maximum equatorial bulb diameter (65.16 mm), followed by Bhima Dark Red (62.90 mm), which was statistically on par with R-1772, while the minimum equatorial diameter was observed in W-396 (45.02 mm). Polar bulb diameter varied from 41.21 to 58.72 mm, with an overall mean of 48.04 mm. The highest polar diameter was recorded in R-1672 (58.72 mm) and Bhima Dark Red (55.53 mm), R-1772

(55.46 mm), Bhima Shakti (54.60 mm), Bhima Shubhra (54.45 mm) and Bhima Safed (53.37 mm) were found statistically on par with R-1672, whereas Bhima Shweta (41.21 mm) recorded the lowest value. Neck thickness ranged from 8.02 to 13.30 mm, with a grand mean of 10.47 mm. The maximum neck thickness was recorded in R-1740 (13.30 mm), followed by W-364 (12.60 mm), Bhima Shakti (12.43 mm), Bhima Red (12.32 mm), W-203 (12.03 mm), Bhima Dark Red (12.02 mm), W-043 (11.93 mm), W-172 (11.80 mm), Bhima Safed (11.78 mm), R-1672 and R-1774 (11.75 mm), R-1772 (11.69 mm), W-208 (11.57 mm), W-448 (11.52 mm) and Bhima Shubhra (11.50 mm), all of which were statistically on par with R-1740. The minimum

neck thickness was observed in Arka Vishwas (8.02 mm). Bulb weight showed wide variation, ranging from 64.64 to 105.36 g, with a grand mean of 82.17 g. The genotype Bhima Shakti recorded the highest bulb weight (105.36 g), which was significantly superior to all other genotypes, while the lowest bulb weight was recorded in Arka Swadista (64.64 g). Bulb yield per plot ranged from 1.26 to 2.20 kg, with an overall mean of 1.73 kg. The highest bulb yield per plot was recorded in Bhima Shakti (2.20 kg) and Bhima Dark Red (2.08 kg), Bhima Kiran (1.97 kg), R-1772 (1.97 kg), Bhima Safed (1.96 kg) and Bhima Red (1.95 kg) were found statistically on par with it, whereas W-355 (1.26 kg) recorded the lowest yield. The yield per plot varied widely, extending from 1.26 kg to 2.20 kg, while the overall mean yield was 1.73 kg. On the higher end, Bhima Shakti emerged as the top yielder with 2.20 kg per plot and Bhima Dark Red (2.08 kg), Bhima Kiran (1.97 kg), R-1772 (1.97 kg), Bhima Safed (1.96 kg) and Bhima Red (1.95 kg) were found statistically on par with Bhima Shakti. In contrast, lower bulb yield per plot was recorded in W-355 (1.26 kg). The harvest index varied from 53.02 to 77.34 per cent, with a grand mean of 67.17 per cent. The highest

harvest index was recorded in Bhima Shakti (77.34%), followed by Bhima Dark Red (74.96%), R-1773 (74.38%), W-448 (73.42%), Bhima Shweta (72.37%), Bhima Kiran (72.14%), Bhima Shubhra (72.06%), R-1672 (71.69%), R-1772 (71.04%), W-364 (70.81%), W-203 (70.57%), Bhima Red (70.52%) and Bhima Safed (70.35%), which were statistically on par with Bhima Shakti. The lowest harvest index was recorded in Bhima Light Red (53.02%). The percentage of double/split bulbs ranged from 0.00 to 12.50 per cent, with a general mean of 2.33 per cent. The highest incidence of double splits (12.50%) was observed in W-043 and R-1672, whereas several genotypes recorded nil double splits (0.00%), indicating superior bulb quality. Genotypes with zero double splits included W-063, W-085, W-172, W-208, W-337, W-355, W-364, W-396, W-405, W-448, Bhima Shweta, Bhima Shubhra, Bhima Safed, R-1740, R-1774, R-1807, Bhima Kiran, Bhima Light Red, Bhima Raj and Bhima Red. The present findings are in corroboration with Lakshmi (2015) ^[19]; Behera *et al.* (2017) ^[3]; Dangi *et al.* (2018) ^[5]; Bal *et al.* (2019) ^[2]; Rahaman *et al.* (2021) ^[18]; Rashid *et al.* (2021) ^[21] and Prakash *et al.* (2022) ^[17], respectively.

Table 3: Mean performance of yield attributing traits in thirty genotypes of onion

Genotypes	BW (g)	BYP (kg)	HI (%)	PDS (%)
White Genotypes				
W-043	80.24	1.34	66.50 ()	12.50 ()
W-063	82.32	1.85	66.23 ()	0.00 ()
W-085	81.34	1.83	68.33 ()	0.00 ()
W-172	85.17	1.93	67.50 ()	0.00 ()
W-203	90.42	1.78	70.57 ()	7.50 ()
W-208	82.35	1.57	64.84 ()	0.00 ()
W-337	67.30	1.41	56.36 ()	0.00 ()
W-355	65.76	1.26	59.44 ()	0.00 ()
W-364	81.16	1.33	70.81 ()	0.00 ()
W-396	79.36	1.71	68.79 ()	0.00 ()
W-405	78.75	1.46	64.71 ()	0.00 ()
W-448	86.60	1.88	73.42 ()	0.00 ()
Bhima Shweta	84.63	1.87	72.37 ()	0.00 ()
Bhima Shubra	92.98	1.88	72.06 ()	0.00 ()
Bhima Safed	91.26	1.96	70.35 ()	0.00 ()
Arka Swadista	64.64	1.59	57.45 ()	7.50 ()
Red Genotypes				
R-1672	89.70	1.64	71.69 ()	12.50 ()
R-1739	80.62	1.55	65.23 ()	10.00 ()
R-1740	84.59	1.80	62.70 ()	0.00 ()
R-1772	92.83	1.97	71.04 ()	2.50 ()
R-1773	83.25	1.72	74.38 ()	2.50 ()
R-1774	71.32	1.75	64.48 ()	0.00 ()
R-1807	79.52	1.70	60.28 ()	0.00 ()
Bhima Dark Red	94.24	2.08	74.96 ()	5.00 ()
Bhima Kiran	88.23	1.97	72.14 ()	0.00 ()
Bhima Light Red	66.72	1.53	53.02 ()	0.00 ()
Bhima Raj	82.66	1.84	69.58 ()	0.00 ()
Bhima Red	85.31	1.95	70.52 ()	0.00 ()
Bhima Shakti	105.36	2.20	77.34 ()	2.50 ()
Arka Vishwas	66.31	1.56	58.00 ()	7.50 ()
Grand Mean	82.17	1.73	67.17	2.33
SE(m)±	1.73	0.08	2.48	0.17
CD (P=0.05)	5.01	0.24	7.16	0.50

Quality parameters

The TSS values ranged from 9.15 to 13.57 °Brix, with a grand mean of 11.74 °Brix. The highest TSS was recorded in Bhima Safed (13.57 °Brix) and Bhima Dark Red (13.27 °Brix), R-1772 (13.23 °Brix), W-043 (13.17 °Brix), Bhima

Shakti (13.10 °Brix), W-172 (13.02 °Brix), R-1672 (13.00 °Brix), R-1739 (12.60 °Brix), Bhima Shubra (12.57 °Brix), W-448 (12.57 °Brix), R-1740 (12.50 °Brix), R-1807 (12.30 °Brix) and Bhima Red (12.27 °Brix) were found statistically on par with Bhima Safed. On the lower end, W-337 (9.15

°Brix) recorded the minimum TSS. The total sugar content of onion bulbs ranged from 4.08 to 6.59 percent, with a grand mean of 5.40 per cent. The highest total sugar content was recorded in Bhima Raj (6.59 %) followed by Bhima Shakti (6.34%) and Bhima Dark Red (6.15%), Bhima Kiran (6.13%) and Bhima Shweta (6.10%). The lowest total sugar content was observed in R-1774 (4.08 %). Ascorbic acid content of onion bulbs ranged from 9.10 to 12.72 mg 100 g⁻¹, with a grand mean of 10.84 mg 100 g⁻¹. The highest ascorbic acid content was recorded in W-043 (12.72 mg 100 g⁻¹) and Bhima Shakti (12.52 mg 100 g⁻¹), Bhima Dark Red (11.98 mg 100 g⁻¹), Bhima Shubhra (11.97 mg 100 g⁻¹) and W-203 (11.93 mg 100 g⁻¹) were found statistically on par with W-043 indicating their superiority in terms of vitamin C content. The lowest ascorbic acid content was observed in R-1740 (9.10 mg 100 g⁻¹). The total phenol content in onion bulbs ranged from 1.62 to 6.40 mg 100 g⁻¹, with a grand mean of 3.47 mg 100 g⁻¹. The highest total phenol content was recorded in Bhima Dark Red (6.40 mg 100 g⁻¹), followed by Bhima Red (5.93 mg 100 g⁻¹) indicating their superior antioxidant potential. The lowest phenol content

was observed in R-1739 (1.62 mg 100 g⁻¹). Anthocyanin content of onion bulbs ranged from 0.16 to 19.22 mg 100 g⁻¹, with a grand mean of 4.70 mg 100 g⁻¹. The genotype Bhima Dark Red recorded the highest anthocyanin content (19.22 mg 100 g⁻¹), followed by Arka Vishwas (15.68 mg 100 g⁻¹) and Bhima Raj (14.37 mg 100 g⁻¹) indicating their strong pigmentation potential. In contrast, very low anthocyanin content was recorded in white and light-coloured genotypes such as Bhima Safed (0.16 mg 100 g⁻¹), Bhima Shweta (0.17 mg 100 g⁻¹) and W-063 (0.17 mg 100 g⁻¹). Pyruvic acid content ranged from 3.02 to 6.52 µ moles g⁻¹, with a grand mean of 4.63 µ moles g⁻¹. The genotype Bhima Dark Red recorded the highest pyruvic acid content (6.52 µ moles g⁻¹), followed by Bhima Red (6.14 µ moles g⁻¹), R-1772 (6.12 µ moles g⁻¹) and Bhima Shakti (6.08 µ moles g⁻¹) indicating their higher pungency levels. The lowest pyruvic acid content was observed in W-364 (3.02 µ moles g⁻¹), followed by W-355 (3.05 µ moles g⁻¹) and W-085 (3.25 µ moles g⁻¹). These present findings are in alignment with the findings of Dangi *et al.* (2018) [5]; Bal, *et al.* (2019) [2] and Islam *et al.* (2019) [22].

Table 4: Mean performance of quality parameters in thirty genotypes of onion

Genotypes	TSS (°Brix)	Total Sugars (%)	Ascorbic Acid (mg/100g)	Pyruvic Acid (µ molesg ⁻¹)	Phenols (mg/100g)	Anthocyanins (mg/100g)
White Genotypes						
W-043	13.17	5.17	12.72	3.78	2.10	0.29
W-063	11.18	4.91	11.29	3.45	2.38	0.17
W-085	12.11	5.16	11.27	3.25	3.39	0.21
W-172	13.02	5.70	11.38	3.74	3.39	0.34
W-203	10.05	6.09	11.93	3.35	2.35	0.36
W-208	11.10	4.67	10.16	3.37	4.16	0.24
W-337	9.15	5.69	11.16	3.56	3.71	0.41
W-355	11.50	4.65	11.30	3.05	4.91	0.27
W-364	10.97	5.46	10.32	3.02	4.23	0.30
W-396	10.67	4.49	10.20	3.38	3.17	0.31
W-405	10.50	4.87	9.10	3.55	4.75	0.27
W-448	12.57	5.89	11.05	3.80	2.72	0.37
Bhima Shweta	11.57	6.10	11.35	4.67	2.61	0.17
Bhima Shubra	12.57	6.00	11.97	4.87	2.82	0.19
Bhima Safed	13.57	5.67	9.45	4.95	2.84	0.16
Arka Swadista	10.23	4.57	10.97	4.94	4.50	0.18
Red Genotypes						
R-1672	13.00	5.25	11.07	5.19	2.84	8.74
R-1739	12.60	4.93	9.63	5.29	1.62	8.69
R-1740	12.50	4.78	9.10	5.17	2.82	9.44
R-1772	13.23	5.96	11.78	6.12	2.61	7.33
R-1773	11.00	5.09	10.21	5.32	2.70	7.23
R-1774	11.03	4.08	10.30	5.61	4.36	9.34
R-1807	12.30	5.37	9.65	5.42	4.45	9.36
Bhima Dark Red	13.27	6.15	11.98	6.52	6.40	19.22
Bhima Kiran	11.83	6.13	11.02	5.37	2.77	4.81
Bhima Light Red	10.74	6.03	10.52	4.95	2.39	6.36
Bhima Raj	10.87	6.59	11.37	5.21	3.81	14.37
Bhima Red	12.27	5.86	10.20	6.14	5.93	8.90
Bhima Shakti	13.10	6.34	12.52	6.08	3.17	7.23
Arka Vishwas	10.56	4.38	10.30	5.73	4.36	15.68
Grand Mean	11.74	5.40	10.84	4.63	3.47	4.70
SE(m)±	0.46	0.06	0.29	0.04	0.08	0.30
CD (P=0.05)	1.33	0.16	0.83	0.12	0.22	0.87

Conclusion

The present study revealed substantial variability among onion genotypes for growth, bulb yield and quality traits. Bhima Shakti and Bhima Dark Red emerged as superior

genotypes for yield and quality attributes, respectively. These genotypes may be recommended for cultivation and can serve as valuable genetic resources for onion improvement programmes.

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