

Evaluation of Onion (*Allium cepa* L.) genotypes for yield and its attributes traits under Bundelkhand region of Uttar Pradesh

Abstract

The present investigation was conducted at the Vegetable Research farm at the College of Horticulture, Banda University of Agriculture and Technology, Banda, Uttar Pradesh, during the *Rabi* season 2019-2020. The experiment was conducted in randomized block design with 20 genotypes of onion. The result obtained shows that the NHRDF Red-4 is performing the best among all genotypes in characters *viz.*, plant height at 75 DAP, number of leaves per plant at 75 DAP, equatorial bulb diameter, 20 bulb weight, average bulb weight, gross yield kg per plot, gross yield q/ha, marketable yield kg/plot and marketable yield q/ha. The Bhima Shweta performed superior regarding most of the traits *viz.*, double (%) on number basis, bolters percentage on number basis, rotten percentage at number basis, days to maturity at 60-70% neck fall, days to harvesting after transplanting, thrips per plant and TSS percentage but the genotype/variety Sukh Sagar ~~taken took~~ minimum duration and mature only in 80 days after transplanting, it is harvested before others genotypes/varieties and also yielded well, so ~~that~~ this variety can be also recommended for cultivation *in* Uttar Pradesh.

1.0 Introduction

Onion (*Allium cepa* L.) is one of the oldest and most extensively used vegetables and is found worldwide. The second-largest monocotyledon in Amaryllidaceae is *Allium*. Onion is native to south western Asia, it is grown worldwide, mostly in temperate zones (Thompson and Kelly, 1957). After China, Netherlands, and Spain, India produces 2362.33 thousand MT of onions per year from 1284.99 thousand hectares at 18.10 MT/ha (Horticulture Statistics Department, 2018-19). It is biannual seed production and herbaceous annual bulb production characterize *the* onion crop growth. Since onions are protandrous, the flowers cannot fertilize themselves because anthers shed pollen before the stigma becomes receptive (Delaplane and Mayer, 2000). Therefore, seed production requires geitonogamy or allogamy. The onion pollen is sticky and moist. Unfortunately, wind cannot mediate their transport, thus insect pollinators are the sole choice. In the Latin language “onion” means “large pearl”. The onion was compared to a

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pearl for its shape (Mehta, 2017). It contains 47mg Ca, 50mg P, and 0.7mg Fe, 11.1% carbs, 1.2% protein, 0.4% dietary fiber, and 0.1% fat per 100 gm (Kumar *et al.*, 2010).

Onions contain phytoncides that destroy harmful bacteria, making them a common cure for flu, angina, suppurative lung inflammation, catarrh, and cough. Onion is anti-carcinogenic. It promotes digestion and eliminates microorganisms in the colon. Onion is healthy, as shown. Onion has more medical benefits than many medications, which have adverse effects. Traditional medicine uses several plant parts. Dental worms and urinary problems are relieved by onion seeds. Tender and mature stages use them (Kumar *et al.*, 2010).

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2.0 Materials and Methods

The present investigation was conducted at Vegetable Research farm of College of Horticulture, Banda University of Agriculture and Technology, Banda, Uttar Pradesh during the Rabi season 2019-2020. The university, which is situated at 24° 53'-25° 55' N latitudes and 80° 07'-81° 34' E longitudes. However, Banda District is bounded by districts of Fatehpur in the north, Chitrakoot in the east, Hamirpur and Mahoba in the west, and Satna, Panna and Chhatarpur (Madhya Pradesh) in the south. The climate of Bundelkhand region is predominantly characterized by semi-arid/ that has dry & warm summer, pleasant monsoon and mildly cold winter. The region receives an average rainfall of 800-910 mm of which more than 88-90% occurs during only three months i.e., August and September however, June and October receive only 7-9% of total rainfall.

Table-1. Experimental details of the experiment.

SN	Particular	Specification
1	Location	VRF-BUAT, Banda
2	Crop	Onion
3.	Design	RBD
4.	Replications	3
5.	Number of treatments	20
6.	Total Plot size	378 m ²
7.	Planting distance	Row x Row
		Plant x Plant
8.	Number of row per plot	20
9.	Number of plant per row	15
10.	Total number of plants per plot	300
11.	Gross area	7.0 m ²

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12.	Net area	4.5 m ²
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The experimental material for the present investigation comprises of 20 genotypes of onion (*Allium cepa* L.) obtained from different institute/organisation and State Agriculture Universities/ research stations. The detailed description of Genotypes symbol and source of different seeds from different institute 1.1.

Table 2. Genotypes symbol and source of different seeds from different institute

SN	Genotype symbol	Name of genotype	Sources of seed
1.	V ₁	Bhima Safed	ICAR-DOGR, Rajgurunagar, Pune, MS
2.	V ₂	Bhima Shweta	ICAR-DOGR, Rajgurunagar, Pune, MS
3.	V ₃	Bhima Subhra	ICAR-DOGR, Rajgurunagar, Pune, MS
4.	V ₄	Phule Suvarna	ICAR-DOGR, Rajgurunagar, Pune, MS
5.	V ₅	Bhima Red	ICAR-DOGR, Rajgurunagar, Pune, MS
6.	V ₆	Bhima Shakti	ICAR-DOGR, Pune
7.	V ₇	Bhima Light Red	ICAR-DOGR, Rajgurunagar, Pune, MS
8.	V ₈	Bhima Kiran	ICAR-DOGR, Rajgurunagar, Pune, MS
9.	V ₉	Bhima Super	ICAR-DOGR, Rajgurunagar, Pune, MS
10.	V ₁₀	N-2-4-1	NIPHAD, Maharashtra
11.	V ₁₁	Early Grano	IARI, New Delhi
12.	V ₁₂	Pusa Madhvi	IARI, New Delhi
13.	V ₁₃	Pusa Ridhi	IARI, New Delhi
14.	V ₁₄	Arka Niketan	IARI, New Delhi
15.	V ₁₅	Sukh sagar	West Bengal
16.	V ₁₆	NHRDF Red	NHRDF, Nashik, Maharashtra
17.	V ₁₇	NHRDF Red 2	NHRDF, Nashik, Maharashtra
18.	V ₁₈	NHRDF Red 3	NHRDF, Nashik, Maharashtra
19.	V ₁₉	NHRDF Red 4	NHRDF, Nashik, Maharashtra
20.	V ₂₀	Agrifound Light Red	NHRDF, Nashik, Maharashtra

3.0 Results and Discussion

The mean performance was calculated using observations for each genotype in three replications for bulb yield and its component traits. The observations were recorded on ten randomly tagged plants from each entry and averaged. The mean performance and grand mean of 20 onion genotypes/varieties for various attributes are presented in Table 3 and 4. The following are the details of the characters that were recorded during the research period.

3.1 Plant stand at maturity

The minimum plant stand at maturity was exhibited by Arka Niketan (280.66), while variety N-2-4-1 having maximum plant stand at maturity (293). The general mean for plant stands at maturity is 286.68.

3.2 Plant height at 75 DAP

Plant height can be used to determine the growth rate of distinct genotypes/varieties. The maximum plant height at 75 days after transplanting (62.66 cm) was exhibited by check variety NHRDF Red-4, while, variety Pusa Madhvi (53.00 cm) noted minimum plant height at 75 days after transplanting. The general mean for plant height at 75 DAT is 57.82 cm.

3.3 Maximum number of leaves per plant at 75 DAP

In the table, maximum number of leaves per plant at 75 days after transplanting is exhibited by NHRDF Red 4 (8.00), while the genotype Bhima Red (4.66) having the minimum number of leaves. The general mean for numbers of leaves per plant at 75 days after transplanting is 6.25 leaves per plant.

3.4 Neck thickness

The data predicted that the maximum neck thickness at 75 days after harvesting was exhibited by Early Grano (1.26 cm) while, genotype Sukh Sagar (1.03 cm) having minimum neck thickness at 75 days after transplanting. The general mean for neck thickness after curing is 1.18 cm.

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3.5 Equatorial bulb diameter

The data indicated that the check variety NHRDF Red 4 (5.96 cm) observed maximum equatorial bulb diameter while, genotype N-2-4-1 (5.26 cm) having the minimum equatorial bulb diameter. The general mean for equatorial bulb diameter is 5.64 cm.

3.6 Polar bulb diameter

The maximum polar bulb diameter is exhibited by Early Grano (4.74 cm) while genotype N-2-4-1 (4.10 cm) having the minimum polar bulb diameter. The general mean for polar bulb diameter is 4.40 cm.

3.7 P:E ratio

The maximum P:-E ratio was exhibited by Phule Suvarna (0.84 cm) while genotype NHRDF Red (0.73 cm) having the minimum P:-E ratio. The general mean for P:-E ratio is 0.78 cm.

3.8 20 Bulb weight

The data presented in table showed that maximum 20 bulbs weight in kg was exhibited by check variety NHRDF Red 4 (1.50 kg) while, genotype Bhima Safed (1.14 kg) having the minimum 20 bulb weight in kg. The general mean for 20 bulb weight is 1.29 kg.

3.9 Average bulb weight

The maximum average bulb weight was exhibit by check variety NHRDF Red 4 (75.16 g) while genotype/variety Bhima Safed (57.16 g) having the minimum average bulb weight in gram. The general mean for average bulb weight is 64.55g.

3.10 Double (%) on number basis

The maximum double (%) on number basis is exhibited by Bhima red (3.34 %) while genotype Bhima Shweta (1.04 %) having the minimum double (%) on number basis. The general mean for double (%) on number basis is 2.18 %.

3.11 Bolter percentage on number basis

The maximum bolter percentage on number basis is exhibited by Bhima Super (1.84 %) while genotype Bhima Shweta (0.64 %) having the minimum bolter percentage on number basis. The general mean for bolter percentage on number basis is 1.18%.

3.12 Rotten percentage at number basis

The maximum rotten percentage on number basis was exhibited by Phule Suvarna (0.32 %) while genotype Bhima Shweta, Bhima Super, Pusa Madhvi, Pusa Ridhi, NHRDF Red 3, NHRDF Red 4 (0.00 %) having no rotten percentage on number basis. The general mean for rotten percentage on number basis is 0.13%.

3.13 Days to maturity at 60-70% neck fall

The maximum days to maturity at 60-70% neck fall is exhibited by NHRDF Red-3 (118.33 days) while genotype Sukh Sagar (76 days) having the minimum days to maturity at 60-70% neck fall. The general mean for days to maturity at 60-70% neck fall is 112.69 days.

3.14 Days to harvesting after transplanting

The maximum days to harvesting after transplanting is exhibited by NHRDF Red 3 (122.66 days) while genotype Sukh Sagar (80.66 days) having the minimum days to harvesting after transplanting. The general mean for days to harvesting after transplanting is 117.29 days.

3.15 Thrips per plant

The maximum thrips per plant is exhibited by Bhima ~~R~~red (8 thrips/plant) while genotype Sukh Sagar (4.33 Thrips/plant) having the minimum thrips per plant. The general mean for thrips per plant is 5.86 thrips/ plant.

3.16 Stemphylium blight (Intensity %)

The maximum stemphylium blight (Intensity %) is exhibited by Phule Suvarna (6.0 %) while genotype Bhima Light Red (3.0 %) having the minimum stemphylium blight (Intensity %). The general mean for stemphylium blight (Intensity %) is 4.40%.

3.17 TSS (percentage)

The maximum total soluble solids % is exhibited by Bhima Shweta, Bhima Light Red (13.33 %) while genotype Early Grano (10.33 %) having the minimum total soluble solids %. The general mean for TSS % is 12.60%.

3.18 Gross yield (kg/plot)

The data indicated that ~~the~~ maximum gross yield (kg/plot) is exhibited by check NHRDF Red 4 (16.60 kg/plot) while genotype Bhima super (12.86 kg/plot) having the minimum gross yield. The general mean for gross yield (kg/plot) is 14.46 kg/plot.

3.19 Gross yield (q/ha)

The check variety NHRDF Red 4 showed maximum gross yield (368.88 q/ha), while genotype Bhima super (285.92 q/ha) having the minimum gross yield (q/ha). The general mean for gross yield (q/ha) is 321.40 q/ha.

3.20 Marketable yield (kg/plot)

The maximum marketable yield (kg/plot) is exhibited by check variety NHRDF Red 4 (16.20 kg/plot) while, genotype Bhima Super (12.60 kg/plot) having the minimum marketable yield (kg/plot). The general mean for marketable yield (kg/plot) is 14.18 kg/plot.

3.21 Marketable yield (q/ha)

The maximum marketable yield (q/ha) is exhibited by NHRDF Red 4 (360.00 q/ha) while genotype Bhima Super (280.00 q/ha) having the minimum marketable yield (q/ha). The general mean for marketable yield (q/ha) is 315.25 q/ha.

The genotypes Bhima Shubhra, N-2-4-1 and NHRDF Red 3, exhibited maximum plant stands at maturity and minimum plant stand at maturity recorded in genotypes such as Arka Niketan and Pusa Ridhi. Plant height can be used to determine the growth rate of distinct genotypes. The plant height at 75 days after transplanting was recorded maximum in variety/genotype NHRDF Red 4 and was at par with varieties Bhima Red, Bhima Shweta, Bhima Shubhra, Bhima Kiran, Early Grano, NHRDF Red-3 and Agrifound Light Red. While the lowest plant height at 75 days after transplanting was recorded in Pusa Madhvi. Number of leaves per plant at 75 days after transplanting was recorded maximum for the check variety/genotype NHRDF Red 4 and was at par with NHRDF Red 3, Bhima Light Red and Bhima Shweta, the lowest number of leaves recorded at 75 days after transplanting in genotype Bhima Red and was at par with Phule Swarna, Bhima Super, N-2-4-1, Pusa Madhvi, Pusa Riddhi and Sukh Sagar. The neck thickness at 75 days after transplanting was found to be minimum in variety Sukh Sagar and was at par with N-2-4-1, however, maximum neck thickness at 75 days after transplanting was noted for genotype Early Grano and it was at par with Bhima Safed, Bhima Shubhra, Bhima Kiran, Arka Niketan, NHRDF Red, NHRDF Red 3, NHRDF Red 4 and Agrifound Light Red.

Equatorial bulb diameter (cm) was found to be maximum for check variety NHRDF Red 4 and was at par with NHRDF Red 3 and Bhima Shweta, while, equatorial bulb diameter was

recorded minimum for the genotype N-2-4-1. Polar bulb diameter (cm) exhibited maximum for the genotype Early Grano and was at par with Phule Swarna, NHRDF Red 3 and NHRDF Red 4, however it was found to be minimum for N-2-4-1 and was at par with Bhima Safed, Bhima Red, Bhima Kiran, and NHRDF Red. Polar and Equatorial ratio was found ~~to be~~ maximum for the genotype of Phule Suvarna and was at par with Early Grano, however, lowest P: E ratio was recorded in the genotype NHRDF Red. The result was also reported by Singh *et al.* (2011) and Singh *et al.* (2013).

The trait 20 bulbs weight (kg) was recorded maximum for the check variety NHRDF Red 4 and was highest among ~~the~~ all the treatments. Lowest 20 bulb weight was recorded in genotype Bhima Safed and was at par with Bhima Shubhra, Bhima Light Red, and Arka Niketan. A significantly wide variation was found among the onion genotypes for average weight of bulb. The average bulb weight (gm) was found to be maximum and significant in check variety NHRDF Red 4, however, recorded minimum for the genotypes Bhima Safed. Similar results are reported by Singh and Gupta (2016). The above genotypes can be further exploited in breeding programme for increasing production of onion.

The lowest double (%) on number basis was recorded in genotype Bhima Shweta and was found at par with Bhima Safed, Phule Suvarna, Early Grano, Pusa Ridhi and NHRDF Red 3 while, double (%) on number basis was found to maximum in genotype Bhima Red and was at par with Bhima Kiran, N-2-4-1, Arka Niketan and Agrifound Light Red. Lowest bolters (%) on number basis was observed for the genotype Bhima Shweta and was at par with Bhima Safed, Phule Suvarna, Early Grano, Pusa Ridhi, Sukh Sagar, NHRDF Red 2, NHRDF Red 4 and NHRDF Red 3. Bolters (%) on number basis found ~~to be~~ maximum for the genotype Bhima Super and at par with Bhima Red, Bhima Shakti, Bhima Kiran, N-2-4-1, NHRDF Red and Agrifound Light Red. No rotten (%) on number basis was noted in genotype NHRDF Red 4, NHRDF Red 3, Bhima Super, Pusa Madhvi, Pusa Ridhi and Bhima Shweta. Rotten percent (%) on number basis was recorded maximum for the genotypes Phule Swarna and at par with Bhima Red, Agrifound Light Red and N-2-4-1. Bhonde *et al.* (1991) also recorded similar range of bolting in their study of different varieties. The varieties/genotypes recorded minimum double, bolters and rotten percent can be utilized for development of excellent quality variety of onion for higher production.

Early maturing of bulbs can ensure quick economic return on early harvest and may escape market gluts and give high returns. Days to maturity at 60-70% neck fall was recorded maximum for the genotypes NHRDF Red 3 and at par with Bhima Safed, Bhima Shakti and NHRDF Red 4, while, it was recorded minimum for the genotype Sukh Sagar. Days to harvesting after transplanting was recorded maximum for the genotypes NHRDF Red 3 and at par with Bhima Safed, NHRDF Red 4, Bhima Red, N-2-4-1, Early Grano, NHRDF Red 2 and Bhima Shakti, however, minimum days to harvesting after transplanting was recorded for genotype Sukh Sagar. It is suggested that the genotype/variety Sukh Sagar can be utilized by the breeder for development of early onion variety for *rabi* season as it takes minimum duration and yielded also well also.

Thrips/plant was recorded minimum for the genotypes Sukh Sagar and was at par with Bhima Shubhra, Bhima Shakti, Bhima Light Red, Bhima Super, Early Grano, Pusa Madhvi, Pusa Ridhi, Arka Niketan, NHRDF Red and Agrifound Light Red, while, maximum thrips/plant was recorded in variety Bhima Red, and was at par with Bhima Safed, Bhima Kiran, NHRDF Red 3 and NHRDF Red 4. The minimum stemphylium blight (Intensity %) was recorded in genotype Bhima Light Red and was at par with Bhima Shweta, Bhima Shakti, Bhima Kiran, Bhima Super, Pusa Madhvi, Pusa Ridhi, Arka Niketan, Sukh Sagar, NHRDF Red 2 and Agrifound Light Red, however, maximum recorded for the genotype Phule Swarna and at par with Bhima Safed, Bhima Shubhra, N-2-4-1, Early Grano, NHRDF Red 4, NHRDF Red 3 and Bhima Red.

The total soluble solids have a direct impact on onion and is a crucial biochemical feature for the processing industry. Total soluble solids (%) was recorded maximum for the genotypes Bhima Light Red and Bhima Shweta and was at par with Bhima Safed, Bhima Shubhra, Phule Swarna, Bhima Red, Bhima Shakti, Bhima Super, Pusa Madhvi, Pusa Ridhi, Arka Niketan, Sukh Sagar, NHRDF Red 2, NHRDF Red, NHRDF Red 4, and NHRDF Red 3, however, the minimum total soluble solids (%) was recorded in variety Early Grano.

One of the most important traits receiving more attention in breeding programmes is yield per plot. The highest gross yield (kg/plot) was recorded in check variety NHRDF Red 4, and was significantly highest among all treatments, however, it was recorded minimum for the genotype Bhima Super and was at par with Bhima Shubhra, Bhima Red, Bhima Shakti, Bhima Kiran, N-2-4-1, Arka Niketan and NHRDF Red. The gross yield (q/ha) was also recorded

maximum for the variety/genotypes NHRDF Red 4, and it was highest among all genotypes/varieties, while, minimum noted for genotypes Bhima Super. Marketable yield (kg/plot) and (q/ha) were recorded maximum in check variety NHRDF Red 4, however, minimum for the genotypes Bhima Super. Similar findings were reported by Singh *et al.* (2020) and Singh *et al.* (2020)

4.0 Conclusion

Based on the mean data it is suggested that the variety NHRDF Red-4, NHRDF Red-3, Bhima Shweta performed superior regarding most of the traits, but the genotype/variety Sukh Sagar ~~taken took~~ minimum duration and mature only in 80 days after transplanting, it harvested approximately 30-40 days before if compared to others genotypes/varieties and also yielded well, so ~~that~~ this variety can also be ~~also~~ recommended for cultivation in Uttar Pradesh. The above genotypes/ varieties/advance lines can be used in crop improvement programme for development of good quality onion varieties.

Table 3 Range and mean performance of onion (*Allium cepa* L.) genotypes for different characters

Genotypes	Plant stands at maturity	Plant height at 75 DAT	Number of leaves per plant at 75 DAT	Neck thickness (cm) 75 DAT	Equatorial bulb diameter (cm)	Polar bulb diameter (cm)	P: E ratio	20 bulbs weight (kg)	Average bulb weight (g)	Double (%) on number basis	Bolter (%) on number basis
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Genotypes	Root rot (%) on number basis	Days to maturity	Days to harvest	Thrips/plant	Stemphyllium blight (Intensity %)	TSS (%)	Gross yield (kg/plot)	Gross yield (t/ha)	Marketable yield (kg/plot)	Marketable yield (t/ha)				
Bhima Safed	289.66	59.26	6.33	1.21	5.61	4.20	0.74	1.14	57.16	1.72	0.80			
Bhima Shweta	285.33	60.33	7.33	1.17	5.84	4.45	0.76	1.40	70.00	1.04	0.64			
Bhima Shubhra	291.00	59.33	6.66	1.20	5.68	4.44	0.78	1.16	58.00	2.06	1.26			
Phule Swarna	287.00	58.66	5.66	1.16	5.61	4.72	0.84	1.37	68.83	1.50	1.05			
Bhima Red	288.66	58.53	6.00	1.18	5.51	4.42	0.76	1.25	62.50	2.24	1.61			
Bhima Shakti	288.66	58.53	6.00	1.23	5.61	4.27	0.78	1.20	60.33	2.53	1.14			
Bhima Light Red	289.66	55.66	7.00	1.23	5.71	4.27	0.74	1.20	60.33	2.53	1.14			
Bhima Safed	282.00	59.46	16.38	120.38	7.00	5.58	5.16	4.23	3.26	75	14.428	320.00	1248#3	315#07
Bhima Shweta	288.33	56.33	14.35	118.66	6.00	5.60	4.00	4.39	3.39	78	15.805	352.70	1300	348#70
Bhima Shubhra	293.00	54.00	14.00	119.00	4.66	5.26	5.33	4.10	2.63	78	13.765	363.00	1320	362#22
Early Giant	282.00	60.20	10.32	113.66	6.33	5.68	6.00	4.74	2.33	83	14.70	331.11	147	324#44
Phule Swarna	290.66	53.66	5.66	1.11	5.64	4.50	0.79	1.29	64.50	2.18	1.15			
Pusa Madhvi	282.00	56.80	5.66	1.17	5.69	4.51	0.79	1.37	68.83	1.29	1.05			
Pusa Ridhi	282.00	56.80	5.66	1.17	5.69	4.51	0.79	1.37	68.83	1.29	1.05			
Arka Niketan	280.66	56.00	6.00	1.19	5.52	4.32	0.78	1.16	58.00	2.84	1.18			
Sukh Sagar	285.66	54.66	5.33	1.03	5.53	4.43	0.80	1.31	65.50	2.22	0.93			
NHRDF Red	284.00	54.66	6.00	1.19	5.59	4.12	0.73	1.21	60.66	2.58	1.63			
NHRDF-Red-2	283.33	56.33	6.33	1.18	5.62	4.28	0.76	1.34	67.33	2.33	0.82			
NHRDF Red 3	292.66	59.49	7.66	1.24	5.88	4.59	0.78	1.41	70.83	1.36	0.79			
NHRDF Red-4©	285.00	62.66	8.00	1.24	5.96	4.62	0.77	1.50	75.16	1.75	0.69			
ALR ©	284.66	60.20	6.66	1.19	5.72	4.55	0.79	1.35	67.83	2.70	1.40			
Mean	286.68	57.82	6.25	1.18	5.64	4.40	0.78	1.29	64.55	2.18	1.18			
C.V.	2.13	3.55	9.79	3.70	1.76	2.15	3.02	3.13	3.13	19.16	23.88			
S.E.	3.52	1.18	0.35	0.02	0.057	0.05	0.01	0.02	1.16	0.24	0.16			
C.D. 5%	-	3.39	1.01	0.07	0.16	0.15	0.03	0.06	3.34	0.69	0.46			
C.D. 1%	-	4.54	1.35	0.09	0.22	0.21	0.05	0.08	4.47	0.92	0.62			
Range Lowest	280.66	53.00	4.66	1.03	5.26	4.10	0.73	1.14	57.16	1.04	0.64			
Range Highest	293.00	62.66	8.00	1.26	5.96	4.74	0.84	1.50	75.16	3.34	1.84			

Table 4 Range and mean performance of onion (*Allium cepa* L.) genotypes for different characters

Bhima Red	0.24	115.66	120.33	8.00	5.00	12.96	13.40	297.77	13.10	291.11
Bhima Shakti	0.14	118.00	121.00	4.66	3.33	13.00	13.93	309.62	13.70	304.44
Bhima Light Red	0.11	114.00	118.33	5.66	3.00	13.33	14.23	316.29	13.96	310.37
Bhima Kiran	0.16	114.00	118.33	7.00	3.33	12.00	13.76	305.92	13.53	300.74
Bhima Super	0.00	113.66	118.66	5.00	4.00	12.33	12.86	285.92	12.60	280.00
N-2-4-1	0.24	114.66	121.00	6.00	4.83	11.66	13.20	293.33	12.96	288.14
Early Grano	0.13	114.33	120.33	5.33	5.00	10.33	14.93	331.85	14.60	324.44
Pusa Madhvi	0.00	115.00	119.33	5.66	4.00	12.60	14.56	323.70	14.30	317.77
Pusa Ridhi	0.00	115.00	119.66	5.66	4.00	12.56	15.60	346.66	15.26	339.25
Arka Niketan	0.12	111.66	116.33	5.66	4.33	12.46	13.46	299.25	13.13	291.85
Sukh Sagar	0.17	76.00	80.66	4.33	3.33	12.66	14.13	314.07	13.93	309.62
NHRDF Red	0.12	114.33	119.00	5.00	5.00	13.00	13.60	302.22	13.40	297.77
NHRDF-Red-2	0.14	114.00	120.66	6.00	4.33	12.66	14.70	326.66	14.40	320.00
NHRDF Red-3	0.00	118.33	122.66	7.00	4.66	13.00	16.20	360.00	15.90	353.33
NHRDF Red-4 ©	0.00	117.33	121.33	7.00	5.33	12.94	16.60	368.88	16.20	360.00
ALR ©	0.29	113.00	116.66	5.33	4.00	12.93	15.16	337.03	14.93	331.85
Mean	0.13	112.69	117.29	5.86	4.40	12.60	14.46	321.40	14.18	315.25
C.V.	38.72	1.35	1.52	15.40	19.70	5.40	0.96	0.96	0.93	0.93
F ratio	12.85	60.61	50.32	3.36	2.60	3.03	161.14	161.14	170.38	170.39
F Prob.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
S.E.	0.02	0.88	1.03	0.52	0.50	0.39	0.08	1.79	0.07	1.69
C.D. 5%	0.08	2.53	2.96	1.49	1.43	1.12	0.23	5.15	0.21	4.84
C.D. 1%	0.11	3.39	3.96	2.00	1.91	1.50	0.31	6.89	0.29	6.49
Range Lowest	0.00	76.00	80.66	4.33	3.00	10.33	12.86	285.92	12.60	280.00
Range Highest	0.32	118.33	122.66	8.00	6.00	13.33	16.60	368.88	16.20	360.00

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Comment [N4]: Mentioned as Horticulture Statistics Department in the manuscript.