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Evaluation of white onion (*Allium cepa* L.) genotypes for yield and storage under central dry zone of Karnataka

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ABSTRACT

Abstract: The present investigation entitled "Evaluation of White Onion (*Allium cepa* L.) Genotypes for Yield and storage under Central Dry Zone of Karnataka" was conducted during the rabi season of 2025–26 at the Zonal Agricultural and Horticultural Research Station, Babbur Farm, Hiriya, Chitradurga district, Karnataka, to evaluate fifteen white onion genotypes for yield and storage attributes under the central dry zone of Karnataka. The experiment was laid out in a Randomized Complete Block Design (RCBD) with three replications. Significant differences were observed among the genotypes for all the characters studied, indicating the existence of considerable genetic variability. Among the genotypes, *Bhima Shubhra* recorded the maximum plant height (73.52 cm), leaf length (62.03 cm), number of leaves (13.03), collar thickness (1.47 cm), neck thickness after curing (1.17 cm), polar diameter (6.52 cm), equatorial diameter (6.94 cm), average bulb weight (89.37 g), total bulb yield per plot (12.00 kg), total bulb yield per hectare (37.04 t), marketable bulb yield (92.46%), A grade bulb yield (45.23%) and C grade bulb yield (11.20%), besides recording the minimum bolting (0.65%), double bulb formation (1.58%), physiological loss in weight after one (2.91%) and two months (2.48%) of storage and rotten bulbs (2.15%). *Bhima Shubhra* also matured earlier (90 days) and required the least number of days to harvest (100 days). Based on the overall performance, *Bhima Shubhra* was identified as the most promising genotype for higher bulb yield, earliness and storage quality. This genotype is recommended for commercial cultivation under the central dry zone of Karnataka.

Keywords: *Allium cepa* L., White onion genotypes, Bulb yield, Storage quality, Central Dry Zone of Karnataka

Introduction

Onion (*Allium cepa* L.) is one of the oldest cultivated bulbous vegetable crops and is popularly known as the "Queen of the Kitchen" because of its indispensable role in daily cooking. It is believed to have originated in Central Asia and the Mediterranean region (McCollum, 1976) [1]. Onion belongs to the family Alliaceae, sub-family Allioideae and order Asparagales, with a chromosome number of $2n(2x) = 16$. It is valued not only for its culinary uses but also for its nutritional and medicinal properties.

According to the USDA National Nutrient Database (USDA, 2007) [2], onion is rich in carbohydrates, dietary fibre, potassium, calcium and selenium while being low in fat and calories. The characteristic pungency of onion is due to allyl-propyl disulphide, whereas quercetin is responsible for the bulb skin colour. Onion possesses antioxidant, hypocholesterolemic, thrombolytic and anticancer properties, making it an important functional food (Augusti, 1996; Block et al., 1997) [3, 4].

Onion is cultivated extensively throughout the world, with India being the second-largest producer after China. During 2022–23, onion occupied 1.79 million hectares with a production of 31.01 million tonnes and an average productivity of 17.3 t ha⁻¹ in India (Anon., 2022). Karnataka is one of the major onion-producing states. Despite its economic importance, onion productivity in India is lower than that of many leading onion-producing countries, highlighting the need to identify high-yielding, region-specific onion genotypes. Bulb yield is a complex quantitative trait influenced by several growth and yield-contributing characters. Since onion varieties differ considerably in their performance under different agro-climatic conditions, systematic evaluation of genotypes is essential to identify suitable cultivars for a specific region (Raghuwanshi et al., 2016) [5]. Understanding the relationship among yield and its component traits through correlation and path coefficient analysis also facilitates effective selection of superior genotypes (Chattoo et al., 2015) [6].

Post-harvest losses due to physiological loss in weight, sprouting and rotting remain a major challenge in onion production. Therefore, identification of high-yielding genotypes with good storage quality is essential for reducing post-harvest losses, increasing marketable yield and improving farmers' profitability.

Keeping these aspects in view, the present investigation entitled "Evaluation of White Onion (*Allium cepa* L.) Genotypes for Yield and Storage under Central Dry Zone of Karnataka" was undertaken to evaluate white onion genotypes for growth, yield, yield attributes and storage quality under the central dry zone of Karnataka.

2. Materials and Methods

The present investigation entitled “Evaluation of White Onion (*Allium cepa* L.) Genotypes for Yield under Central Dry Zone of Karnataka” was conducted during the rabi season of 2025–26 at the Zonal Agricultural and Horticultural Research Station (ZAHRS), Babbur Farm, Hiriya, Chitradurga district, Karnataka, India. The experimental site is situated in the Central Dry Zone (Zone-4) of Karnataka at 13°57'32" N latitude, 76°37'38" E longitude and an altitude of 606 m above mean sea level.

The experiment was laid out in a Randomized Complete Block Design (RCBD) with 15 white onion genotypes and three replications. The genotypes included WAVT-II-25-1, WAVT-II-25-2, WAVT-II-25-3, WAVT-II-25-4, WAVT-II-25-5, WAVT-II-25-6, WAVT-II-25-7, WAVT-II-25-8, Vijayapura Local, *Bhima* Shubhra, Akola Safed, Panchaganga Safed No-16, *Bhima* Safed, *Bhima* Shwetha and Arka Yogith. Fifty-day-old healthy seedlings raised in nursery beds were transplanted at a spacing of 15 × 10 cm in plots measuring 1.8 × 1.8 m, accommodating 45 plants per plot. Recommended package of practices, including nutrient management, irrigation, intercultural operations and plant protection measures, were followed uniformly throughout the crop growth period.

Observations were recorded from five randomly selected plants in each treatment for growth, yield, quality and storage parameters. Growth observations included plant height, leaf length and number of leaves at 30, 60 and 90 days after transplanting (DAT), collar thickness and bolting percentage. Yield and quality parameters comprised neck thickness after curing, polar and equatorial bulb diameter, average bulb weight, days to maturity, days to harvest, bulb yield per plot and hectare, marketable bulb yield, A, B and C grade bulb yield and double bulb formation. Storage studies included physiological loss in weight, sprouting and rotting percentage under ambient storage conditions.

The experimental data were subjected to analysis of variance (ANOVA) following the procedures of Panse *et al.* (1957) [7]. Genetic parameters, including genotypic and phenotypic coefficients of variation (GCV and PCV), heritability and genetic advance, were estimated using standard biometrical methods. Genotypic and phenotypic correlation coefficients were computed following Al-Jibouri *et al.* (1958) [8], while path coefficient analysis was carried out according to Wright (1921) [9] and Dewey *et al.* (1959) [10] to determine the direct and indirect effects of component characters on bulb yield.

3. Results and Discussion

3.1 Plant height

The genotype *Bhima* Shubhra recorded the maximum plant height (73.52 cm), followed by Panchaganga Safed No-16 (72.81 cm) and WAVT-II-25-3 (71.69 cm), whereas the minimum plant height was observed in WAVT-II-25-7 (62.48 cm). The variation in plant height among the genotypes could be attributed to their genetic makeup and differential adaptability to the prevailing agro-climatic conditions, which influence cell division, cell elongation and efficient utilization of nutrients. Similar genotypic differences in plant height were reported by Ram *et al.* (2018) [11], Gosai *et al.* (2018) [12], Lakshmipathi *et al.* (2017) [13], Santra *et al.* (2017) [14] and Dewagan and Sahu (2014) [15].

3.2 Bolting percentage

The variety *Bhima* Shubhra recorded the minimum bolting percentage (0.65%), whereas the maximum bolting percentage was observed in WAVT-II-25-6 (6.87%). The variation in bolting among the genotypes

could be attributed to genetic differences and their response to environmental conditions, particularly exposure to low temperatures, which induce premature flowering. Similar variations in bolting percentage among onion genotypes were reported by Yadav *et al.* (2009) [16] and Trivedi *et al.* (2010) [17].

3.3 Collar thickness

The variety *Bhima* Shubhra recorded the maximum collar thickness (1.47 cm), whereas the minimum collar thickness was observed in WAVT-II-25-7 (1.22 cm). The variation in collar thickness among the genotypes could be attributed to differences in genetic constitution, efficient nutrient uptake and greater assimilate accumulation, resulting in vigorous vegetative growth. Similar variations in collar thickness among onion genotypes were reported by Ram *et al.* (2018) [11], Umamaheswarappa *et al.* (2018) [18], Lakshmipathi *et al.* (2017) [13] and Tripathy *et al.* (2013) [19].

3.4 Days to harvest

The variety *Bhima* Shubhra required the minimum number of days to harvest (100 days), whereas WAVT-II-25-7 required the maximum (130 days). The variation in days to harvest among the genotypes could be attributed to differences in their genetic makeup and adaptability to the prevailing agro-climatic conditions. Similar variations in maturity and harvesting period among onion genotypes were reported by Basha *et al.* (2018) [20], Kushal *et al.* (2015) [21], Tarai *et al.* (2015) [22], Devi *et al.* (2014) [23] and Singh *et al.* (2011) [24].

3.5 Polar and equatorial bulb diameter

The variety *Bhima* Shubhra recorded the maximum polar diameter (6.52 cm) and equatorial diameter (6.94 cm), whereas the minimum polar diameter (4.28 cm) and equatorial diameter (4.93 cm) were observed in WAVT-II-25-7. The variation in bulb size among the genotypes could be attributed to differences in genetic potential, vegetative vigour and efficient accumulation of photosynthates in the developing bulbs. Similar findings were reported by Hussien *et al.* (2019) [25], Umamaheswarappa *et al.* (2018) [18], Dewagan and Sahu (2014) [15] and Sharma (2009) [26].

3.6 Average bulb weight, total bulb yield per plot and bulb yield per hectare

The variety *Bhima* Shubhra recorded the highest average bulb weight (89.37 g), total bulb yield per plot (12.00 kg) and bulb yield per hectare (37.04 t), whereas the lowest values were recorded in WAVT-II-25-7 (46.19 g, 5.94 kg plot⁻¹ and 18.33 t ha⁻¹, respectively). The superior yield performance of *Bhima* Shubhra could be attributed to its vigorous vegetative growth, efficient photosynthate accumulation and better source–sink relationship. Similar findings were reported by Hirave *et al.* (2015) [27], Devi *et al.* (2014) [23], Tripathy *et al.* (2013) [19] and Ram *et al.* (2011) [28]. (Fig 1)

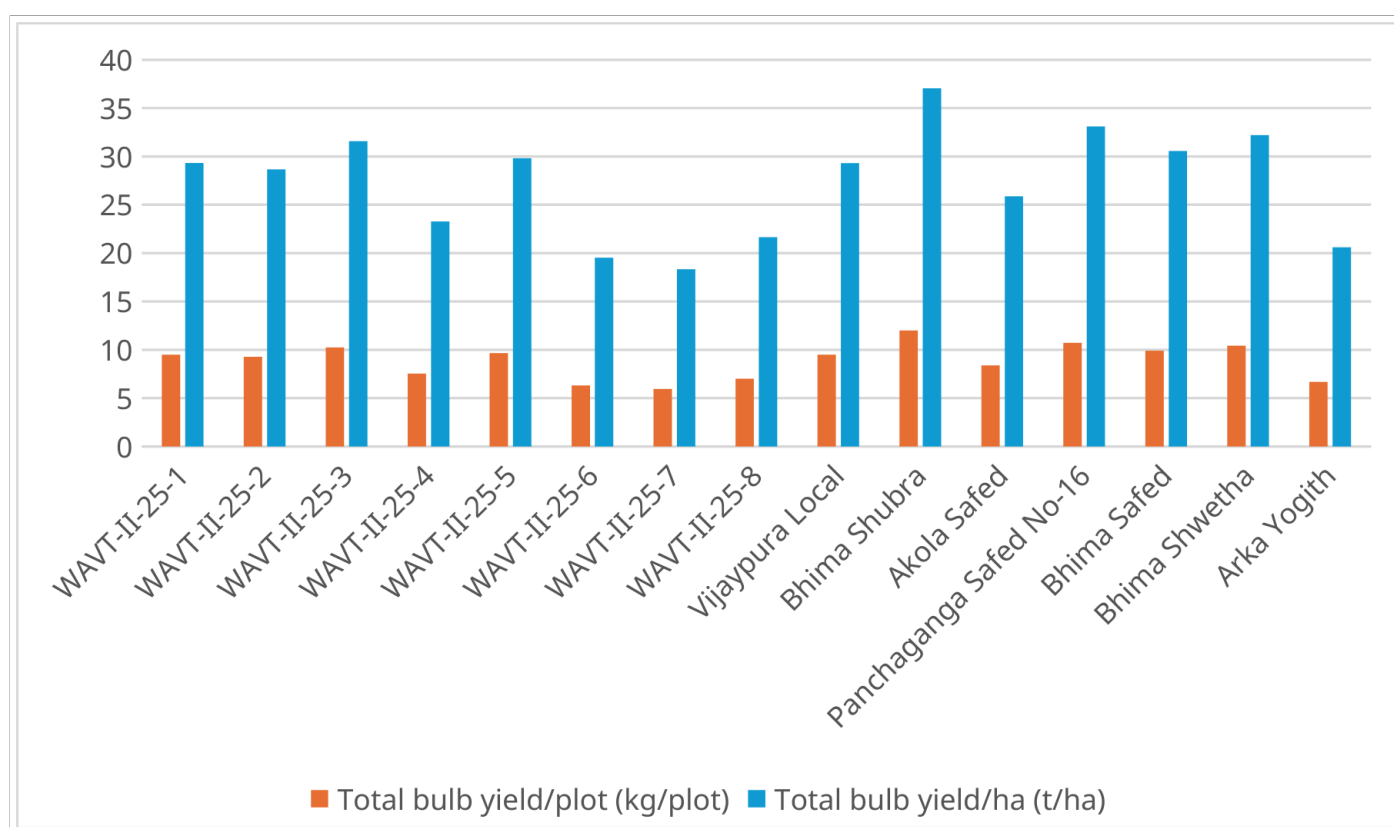
3.7 Marketable bulb yield

The variety *Bhima* Shubhra recorded the highest marketable bulb yield (92.46%), whereas the lowest was observed in WAVT-II-25-7 (54.56%). The higher marketable bulb yield in *Bhima* Shubhra could be attributed to its superior vegetative growth, larger bulb size and higher bulb weight, resulting in a greater proportion of marketable bulbs. Similar findings were reported by Dhar *et al.* (2019) [29], Gosai *et al.* (2018) [12], Kumar *et al.* (2015) [30], Sarkar *et al.* (2015) [31], Pashok *et al.* (2013) [32] and Tripathy *et al.* (2013) [19].

Mean performance of different onion Cultivars for average bulb weight, total bulb yield per plot, total bulb yield per hectare, marketable bulb yield and grade wise yield are presented in table 1.

Table 1. Mean performance of different onion Cultivars for average bulb weight, total bulb yield per plot, total bulb yield per hectare and marketable bulb yield.

Sl. No.	Cultivars	Average bulb weight (g)	Total bulb yield/plot (kg/plot)	Total bulb yield/ha (t/ha)	Marketable bulb yield t/ha and (%)		Grade wise yield (%)		
							A	B	C
1	WAVT-II-25-1	77.14	9.5	29.32	22.95	78.27	38.55	33.3	6.42
2	WAVT-II-25-2	76.34	9.28	28.64	21.46	74.94	36.97	32	5.97
3	WAVT-II-25-3	84.32	10.23	31.57	25.65	81.24	39.61	34.07	7.56
4	WAVT-II-25-4	66.41	7.54	23.27	16.77	72.07	34.98	31.53	5.56
5	WAVT-II-25-5	78.47	9.66	29.81	23.56	79.04	38.66	33.9	6.48
6	WAVT-II-25-6	58.35	6.32	19.51	11.43	58.61	26.84	27.15	4.62
7	WAVT-II-25-7	46.19	5.94	18.33	10	54.56	24.73	25.88	3.95
8	WAVT-II-25-8	65.14	7.01	21.64	14.72	68	32.37	30.53	5.1
9	Vijayapura Local	77.08	9.49	29.29	22.57	77.04	38.2	32.57	6.27
10	Bhima Shubra	89.37	12	37.04	34.25	92.46	45.23	36.03	11.2
11	Akola Safed	69.38	8.38	25.86	18.86	72.93	35.42	31.93	5.58
12	Panchaganga Safed No-16	86.91	10.72	33.09	28.79	87	43.2	34.57	9.23
13	Bhima Safed	79.27	9.9	30.56	24.62	80.55	39.57	33.98	7
14	Bhima Shwetha	84.54	10.43	32.19	26.56	82.51	40.87	34.07	7.57
15	Arka Yogith	62.58	6.67	20.59	12.87	62.51	28.61	28.97	4.93
	S Em±	3.54	0.44	1.36	2.72	3.58	1.67	1.56	0.27
	C.D @ 5%	10.27	1.27	3.94	7.9	10.39	4.84	4.54	0.79

**Figure 1.** Total bulb yield per plot and hectare of different onion cultivars

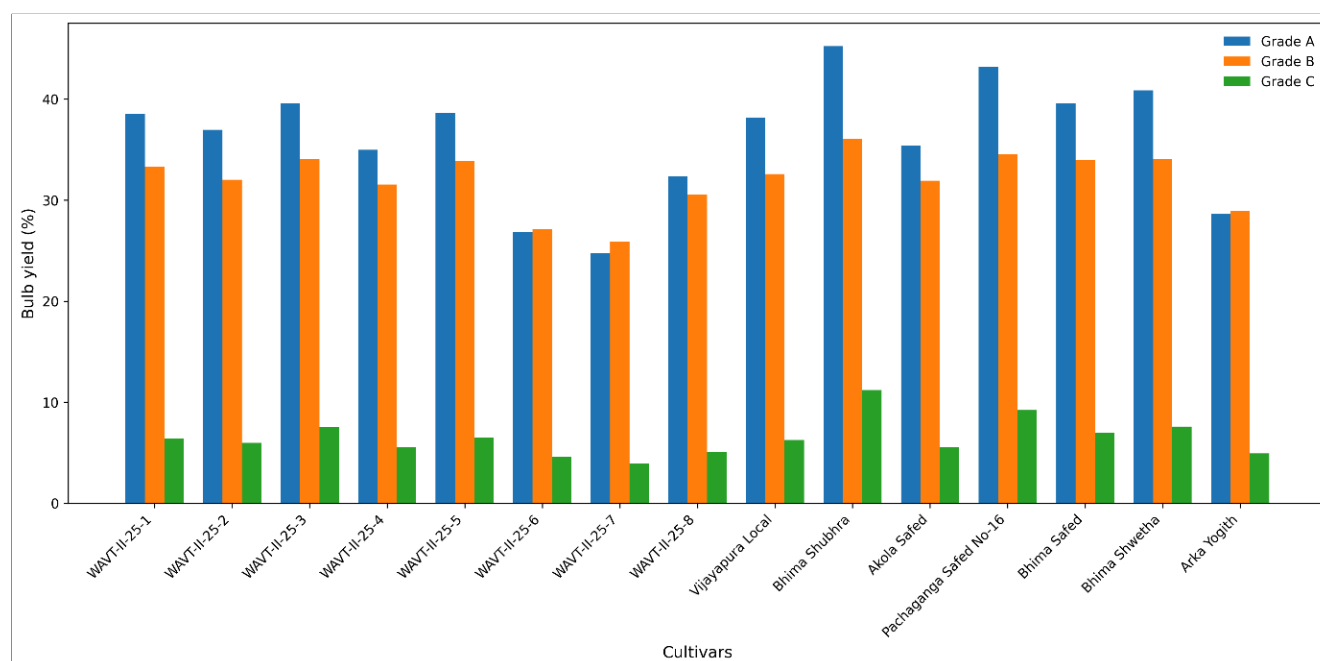


Figure 2. Grade-wise bulb yield (%) of different onion cultivars

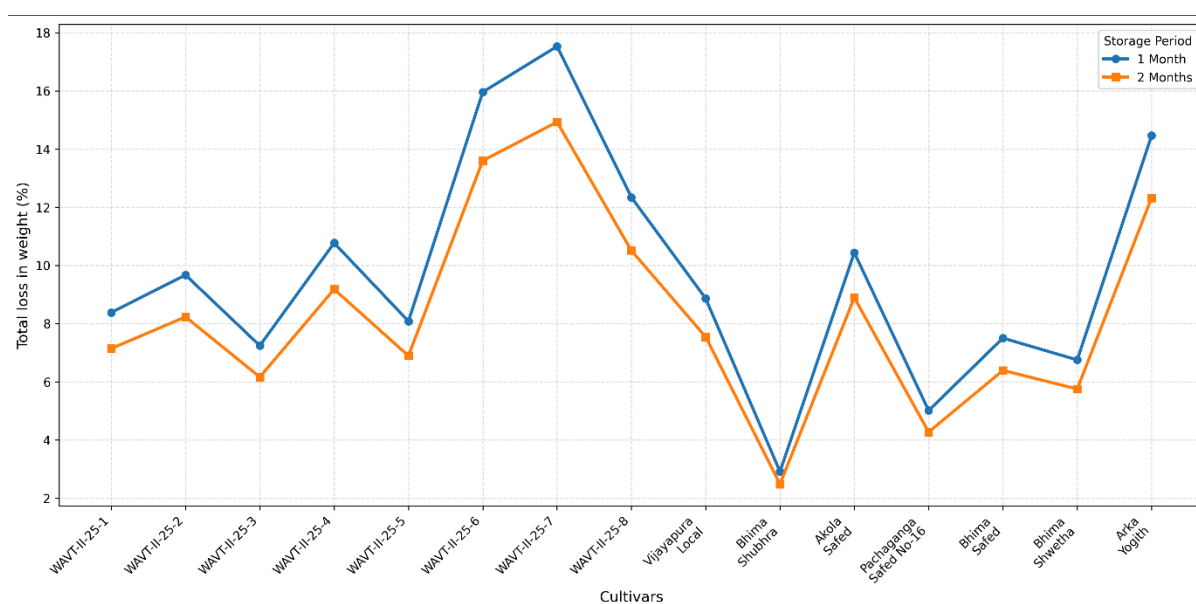


Figure 3. Performance of onion cultivars for total loss in weight (%) after one and two months of storage.

3.8 Rotten bulbs

The variety *Bhima Shubhra* recorded the minimum rotten bulbs after storage (2.15%), whereas the maximum was observed in WAVT-II-25-7 (12.98%). The variation in rotting among the genotypes could be attributed to differences in their genetic makeup, bulb quality and storage behaviour. Genotypes with superior storage quality exhibited lower rotting losses during storage. Similar findings were reported by Shanmugasundaram (2000) [33] and Trivedi *et al.* (2010) [17].

3.9 Physiological loss in weight

The variety *Bhima Shubhra* recorded the minimum physiological loss in weight after one month (2.91%) and two months (2.48%) of storage, whereas the maximum loss was observed in WAVT-II-25-7 (17.53% and 14.93%, respectively). The variation in physiological loss in weight among the genotypes could be attributed to differences in bulb dry matter content, total soluble solids and moisture loss during storage. Similar findings were reported by Shanmugasundaram (2000) [33], Trivedi *et al.* (2010) [17] and Jamali *et al.* (2012). (Fig. 3)

Conclusion

The present investigation revealed significant genetic variability among the fifteen white onion genotypes evaluated for yield and storage attributes under the central dry zone of *Karnataka*. Among the genotypes, *Bhima Shubhra* exhibited superior performance for growth, bulb yield, marketable yield and storage quality. High heritability coupled with high genetic advance for bulb yield and storage traits indicated the predominance of additive gene action, suggesting the effectiveness of direct selection for crop improvement. Correlation and path coefficient analyses identified leaf length, neck thickness, polar diameter and total bulb yield as important contributors to marketable bulb yield. Overall, *Bhima Shubhra* is recommended for commercial cultivation owing to its superior yield and storage performance under the central dry zone of *Karnataka*.

Future prospects

The promising genotype *Bhima Shubhra* identified in the present study can be further evaluated across different agro-climatic regions and seasons to confirm its stability and wider adaptability. This genotype may also be utilized in breeding programmes for the develop

ment of high-yielding cultivars with superior storage quality. In addition, future research should focus on improving post-harvest storage technologies and storage conditions to minimize losses and enhance bulb quality during storage. Molecular characterization of elite genotypes could further facilitate the development of improved varieties for commercial cultivation

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