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Research Article

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Study the Morphological of Different Onion Varieties for Crop Improvement Purposes

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ABSTRACT

Study of Research Farm of Department of Horticulture, College of Agriculture, Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya, Indore, (M.P.). Significantly highest plant height was recorded in genotypes Agrifound white and Mahasuper red and which were at par with each other. Therefore, it was observed lowest in genotype Bhima shakti at all the growth stages. Genotypes Agrifound white, Mahasuper red, and N-2-4-1 were recorded in significantly maximum leaves per plant at 30, 60, 90 and 120 DAT and which were at par with each other. However, it was observed lowest in genotype Bhima shakti for the same. At 30, 60, 90 and 120 DAT, the significantly maximum leaf length was recorded under the genotypes Agrifound white followed by Mahasuper red, N-2-4-1 and Bhima sweta and which were at par with each other. While, minimum leaf length was recorded in genotype Bhima shakti. In case of 30, 60, 90 and 120 DAT, the dry weight per plant was significantly increased by the different genotypes. The Agrifound white was found significantly superior as compared to other genotypes. Highest dry weight per plant was recorded in genotype Agrifound white, followed by Mahasuper red and N-2-4-1. However, lowest dry weight per plant was noted under the genotype Bhima shakti at 30, 60, 90 and 120 DAT. Significantly lowest 0.42 bolting per cent were observed in genotype Agrifound white followed by Mahasuper red (0.96%) and N-2-4-1 (1.04%) as compared to other genotypes. Therefore, it was noted maximum 5.88 bolting per cent under the genotype Bhima shakti. The Bhima shakti was noted early matureing genotype and recorded significantly minimum 203.0 day for mature followed by Bhima raj (204.67 days) and Akshda mahasuper (205.33 days). However, the genotype Agrifound white was required maximum (210.0) days for maturity. It is obvious from the data that the leaf area per plant was significantly influenced by the different genotypes of onion. Agrifound white was observed highest leaf area per plant which was followed by Mahasuper red and N-2-4-1 at 30, 60, 90 and 120DAT and which were at par with each other at 60, 90 and 120 DAT. The lowest leaf area per plant was recorded in Bhima shakti for the same.

Key words: *Genotypes, Allium cepa, Calcium, Vitamins*

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INTRODUCTION

The common bulb onion, *Allium cepa* L. (2n=2x=16).Its belongs to family Alliaceae, an important group of crops worldwide[4]. It is one of the oldest bulb vegetables in continuous cultivation dating back to at least 4000 BC[3,7]. It is probably native of South Asia or Mediterranean region. It is considerably important in the daily Ethiopian diet[14]. All the plant parts are edible, but the bulbs and the lower stems sections are the most popular as seasonings or as vegetables in stews.

India is next to china in area and production of onion. Among the different states Maharastra is leading state in terms of area and production. Other major onion states are Gujrat, Karnataka, Orisa, Uttar Pradesh, Andhra Pradesh, Tamilnadu and Rajasthan. The area of onion in Madhya Pradesh is 96.88 thousand-hectare, total production is 2153.0 thousand million tonnes and productivity is about 22.22 tonnes per hectare[1]. Onion accounts for 70 per cent of our total foreign exchange earnings from the export of fresh vegetables. Government of India has declared onion as an essential commodity. Looking to its importance for domestic consumption as well as export greater attention is needed for its improvement.

Onions are rich in antioxidants, mainly quercetin and its glycosides, and are a major source of dietary flavonoids[13]. In addition, flavonoids are responsible for the yellow or red color of onions[5]. Although these health-promoting compounds are ubiquitous in onion bulbs, a detailed chemical profile is required for identification, as the content of specific compounds can vary among Allium species or cultivars[6,13,5].

Onion has recently received considerable attention for its high medicinal value.It is recently introduced crop and rapidly becoming popular among producers and consumers. It is widely produced by small farmers and commercial growers throughout the year for local use and export market[9]. Onion is valued for its distinct pungency and from essential ingredients for flavoring varieties of dishes, sauces, soup, sandwiches, snacks as onion rings etc. The crop nutritional composition includes 2.0 g protein, 70 mg calcium and 53 mg phosphorus[2]. It also contains the vitamins thiamine, riboflavin and niacin and is used for its medicinal value especially in the case of heart problems[11]. They also contain a phytochemical called quercetin, which is effective in reducing the risk of cardiovascular disease, an anticancer, and has promise to be an antioxidant[15]. It is popular over the local shallot because of its high yield potential per unit area, availability of desirable cultivars for various uses, ease of propagation by seed, high domestic(bulb and seed) and export(bulb, cut flowers) markets in fresh and processed forms[10].

In this study, shallot accessions collected along the Croatian coast and hinterland were evaluated for their morphological properties. Furthermore, chemical composition of these accessions was compared with that of local landraces of common onions and market-available shallot and common onion cultivars. The diversity observed for the tested traits may be useful for preservation of genetic variability in future breeding programs and to protect local agronomic production systems by means of agricultural, biological, and chemical multidisciplinary approach[8,12,5].

MATERIAL AND METHODS

The present experiment was laid out in the field of the Research Farm, Department of Horticulture, College of Agriculture, Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya, Indore during Kharif season, 2013-14. The land topography of the experimental site was almost uniform with an adequate surface drainage. The internal drainage of the experimental site is medium.

Indore is situated in Malwa plateau region in the Western part of the state of Madhya Pradesh at an altitude of 555.5 meters above mean sea level (MSL). It is located at latitude 22.43o N and longitude of 75.66o E. It has subtropical climate having a temperature range of 21o C to 45o C and 6o C to 31o C in summer and winter seasons, respectively. The rainfall in the region has been mostly inadequate and erratic in most of the recent past seasons. Late commencement, early withdrawal of monsoon and occurrence of two to three dry spells during the rainy season are the common features. The mean annual average rainfall is 964 mm. The meteorological data during crop growth period from the first week of 25th June, 2013 to last week of January, 2014

The data indicate that the total rainfall received during crop growth period was 1389.6 mm. There were no rains during SMW 42 to 47 and 49 – 04. The minimum and maximum temperature during crop growth period varied 6.50C to 23.00C and from 20.40C to 34.00C, with season's average values of 16.000C and 27.170 C respectively. The relative humidity and wind speed ranged between 70.0 to 86.9 % and 1.4 to 10.0 km hrs-1 with season's average of 80.60% and 4.17 km hrs-1 respectively. The experiment was laid out in Completely Randomized Block Design (CRBD) with three replications. Each replication consists of 12 genotypes. All the genotypes were randomized separately in each replication.

2.1 Bulb/green top ratio (%)

Weight of bulb and green top 20 days before harvesting and ratio between both was calculate with the following formula and expressed in percentage.

$$\text{Bulb/green top ratio} = \frac{\text{Weight of bulb}}{\text{Weight of green top}} \times 100$$

RESULTS AND DISCUSSION

3.1. Plant height (cm)

The mean plant height of onion plant as influence by different genotypes is given in Table 1. Plant height was recorded at 30, 60, 90 and 120 days after transplanting.

At 30 days after transplanting, the significantly highest 35.63 and 33.40 cm plant height were recorded in genotypes Agrifound white and Mahasuper red, respectively and which were at par with each other and it was observed lowest in genotype Bhima shakti (26.87 cm).

At 60 days after transplanting, the significantly maximum 53.34 cm plant height was recorded under the genotypes Agrifound white followed by Mahasuper red (50.56 cm), N-2-4-1 (50.0 cm) and Bhima sweta (49.56 cm) as compared to other genotypes. While, minimum plant height (45.67 cm) was recorded in genotype Bhima shakti.

As regards to 90 DAT, genotypes Agrifound white, Mahasuper red, N-2-4-1, Bhima sweta and Bhima kiran were recorded in significantly maximum 58.44, 57.78, 57.67, 56.45 and 56.44 cm plant height, respectively and which were at par with each other. However, it was observed lowest in genotype Bhima shakti (50.67 cm).

Table 1: Plant height (cm) as influenced by different genotypes of onion at 30, 60, 90 and 120 DAT

S. No.	Genotypes	Plant height (cm) at			
		30 DAT	60 DAT	90 DAT	120DAT
1	Bhima shakti	26.87	45.67	50.67	59.78
2	Bhima sweta	31.70	49.56	56.45	65.66
3	Agrifound white	35.63	53.34	58.44	68.67
4	Bhima kiran	31.73	49.56	56.44	65.45
5	L 355	31.53	49.21	55.00	65.33
6	Bhima super	30.67	48.78	54.44	65.11
7	N-2-4-1	32.90	50.00	57.56	66.78
8	Bhima shubhra	29.70	48.22	53.22	65.11
9	Bhima red	27.70	47.22	52.67	64.44
10	Bhima raj	27.60	46.77	51.78	64.44
11	Akshda mahasuper	27.57	46.56	51.00	62.78
12	Mahasuper red	33.40	50.56	57.78	67.67
SEm±		0.87	0.73	1.12	1.36
C.D. at 5% level		2.56	2.14	3.30	4.00

As regards to 120 DAT, genotypes Agrifound white, Mahasuper red, N-2-4-1, Bhima sweta, Bhima kiran, Bhima super and Bhima shubhra were recorded in significantly maximum 68.67, 67.67, 66.78, 65.66, 65.33, 65.11 and 65.11 cm plant height, respectively and which were at par with each other. However, it was observed lowest in genotype Bhima shakti (59.78 cm).

3.2. Number of leaves per plant

The mean number of leaves per plant of different genotypes is given in Table 2. Number of leaves per plant was recorded at 30, 60, 90 and 120 days after transplanting.

Table 2: Number of leaves per plant as affected by various genotypes of onion at 30, 60, 90 and 120 DAT

S. No.	Genotypes	Number of leaves per plant at			
		30 DAT	60 DAT	90 DAT	120DAT
1	Bhima shakti	4.27	4.33	8.67	9.78
2	Bhima sweta	5.29	7.49	9.56	10.56
3	Agrifound white	5.42	7.71	10.33	11.67
4	Bhima kiran	5.22	7.34	9.55	10.56
5	L 355	5.15	7.28	9.44	10.55
6	Bhima super	5.02	7.02	8.89	10.23
7	N-2-4-1	5.29	7.56	9.89	11.55
8	Bhima shubhra	5.03	7.12	9.11	10.44
9	Bhima red	5.07	7.23	9.44	10.45
10	Bhima raj	4.61	5.45	8.67	9.78
11	Akshda mahasuper	4.88	5.51	8.78	10.00
12	Mahasuper red	5.36	7.68	10.22	11.67
SEm±		0.09	0.16	0.30	0.23
C.D. at 5% level		0.26	0.49	0.88	0.68

At 30 days after transplanting, genotypes Agrifound white, Mahasuper red, N-2-4-1, Bhima sweta and Bhima kiran were recorded in significantly maximum 5.42, 5.36, 5.29, 5.29 and 5.22 leaves per plant respectively and which were at par with each other. However, it was observed lowest in genotype Bhima shakti (4.27). The significantly maximum 7.71, 7.68, 7.56, 7.49, 7.34, 7.28 and 7.23 leaves per plant were recorded under the genotypes Agrifound white, Mahasuper red, N-2-4-1, Bhima sweta, Bhima kiran, L 355 and Bhima red, respectively and which were at par with each other. While, minimum number of leaves per plant (4.33) was recorded in genotype Bhima shakti at 60 days after transplanting.

In case of 90 days after transplanting, the significantly maximum 10.33, 10.22, 9.89, 9.56 and 9.55 leaves per plant was recorded in genotypes Agrifound white, Mahasuper red, N-2-4-1, Bhima sweta and Bhima kiran, respectively and which were at par with each other. Therefore, it was observed minimum in genotype Bhima shakti (8.67).

Genotypes Agrifound white, Mahasuper red, and N-2-4-1 were recorded in significantly maximum 11.67, 11.67 11.55 leaves per plant at 120 DAT and which were at par with each other. However, it was observed lowest in genotype Bhima shakti (9.78 and 12.60) at 120 DAT.

3.3. Leaf length (cm)

The leaf length was recorded and has been presented in Table 3. At 30 days after transplanting, the significantly maximum 32.93 and 32.03 cm leaf length were recorded under the genotypes Agrifound white and Mahasuper red, respectively and which were at par with each other. While, minimum leaf length (26.33) was recorded in genotype Bhima shakti.

At 60 days after transplanting, the significantly maximum 46.55 cm leaf length was recorded under the genotypes Agrifound white followed by Mahasuper red (45.10 cm), N-2-4-1 (44.46 cm) and Bhima sweta (44.11 cm) as compared to other genotypes. While, minimum leaf length (40.33 cm) was recorded in genotype Bhima shakti.

Table 3: Leaf length (cm) as affected by various genotypes of onion at 30, 60, 90 and 120 DAT

S. No.	Genotypes	Leaf length (cm) at			
		30 DAT	60 DAT	90 DAT	120DAT
1	Bhima shakti	26.33	40.33	45.55	55.67
2	Bhima sweta	30.43	44.11	51.22	59.90
3	Agrifound white	32.93	46.55	52.89	61.67
4	Bhima kiran	29.73	43.89	50.67	59.56
5	L 355	27.67	41.89	46.66	58.11
6	Bhima super	28.87	43.44	49.11	59.33
7	N-2-4-1	31.13	44.46	52.11	60.88
8	Bhima shubhra	28.73	42.66	47.78	59.22
9	Bhima red	29.20	43.56	49.22	59.55
10	Bhima raj	26.40	41.11	45.66	57.78
11	Akshda mahasuper	27.07	41.22	46.11	57.90
12	Mahasuper red	32.03	45.10	52.22	60.89
SEm±		0.58	0.48	1.09	0.32
C.D. at 5% level		1.71	1.41	3.22	0.93

In case of 90 days after transplanting, the significantly maximum 52.89, 52.22, 52.11, 51.22 and 50.67 cm leaf length was recorded in genotypes Agrifound white, Mahasuper red, N-2-4-1, Bhima sweta and Bhima kiran, respectively and which were at par with each other. Therefore, it was observed minimum in genotype Bhima shakti (45.55 cm).

In case of 120 days after transplanting, the significantly maximum 61.67, 60.89 and 60.88 cm leaf length was recorded in genotypes Agrifound white, Mahasuper red, and N-2-4-1, respectively and which were at par with each other. Therefore, it was observed minimum in genotype Bhima shakti (55.67 cm).

3.4. Dry weight per plant (g)

The average dry weight per plant of different genotypes is given in Table 4. Dry weight per plant was recorded at 30, 60, 90, 120 days after transplanting.

Table 4: Dry weight per plant (g) as affected by various genotypes of onion at 30, 60, 90 and 120 DAT

S. No.	Genotypes	Dry weight of per plant (g) at			
		30 DAT	60 DAT	90 DAT	120DAT
1	Bhima shakti	1.80	2.85	4.46	5.79
2	Bhima sweta	2.15	3.64	5.16	7.03
3	Agrifound white	2.47	3.76	5.37	7.26
4	Bhima kiran	2.12	3.62	5.00	6.86
5	L 355	1.91	3.43	4.89	6.52
6	Bhima super	2.00	3.57	4.96	6.72
7	N-2-4-1	2.28	3.67	5.19	7.04
8	Bhima shubhra	1.98	3.47	4.94	6.72
9	Bhima red	2.03	3.58	4.96	6.76
10	Bhima raj	1.84	3.42	4.82	6.41
11	Akshda mahasuper	1.84	3.42	4.89	6.47
12	Mahasuper red	2.30	3.72	5.27	7.19
SEm±		0.005	0.031	0.006	0.132
C.D. at 5% level		0.015	0.093	0.018	0.390

In case of 30, 60, 90 and 120 DAT, the dry weight per plant was significantly increased by the different genotypes. The Agrifound white was found significantly superior as compared to other genotypes. Highest 2.47, 3.76, 5.37 and 7.26 g dry weight per plant were recorded in genotype Agrifound white, followed by Mahasuper red which recorded 2.30, 3.72, 5.27 and 7.19 g and N-2-4-1exhibited 2.28, 3.67, 5.19 and 7.04 g dry weight per plant at 30, 60, 90 and 120 DAT respectively. However, lowest 1.80, 2.85, 4.46 and 5.79g dry weight per plant was noted under the genotype Bhima shakti at 30, 60, 90 and 120 DAT, respectively.

3.5. Neck thickness of bulb (cm)

The average neck thickness was recorded and has been presented in Table 5. The neck thickness was significantly influenced by various genotypes. The significantly minimum 0.43 cm and 0.45 cm neck thickness were recorded in genotypes Agrifound white and Mahasuper red, respectively and which were at par with each other. While, the highest 1.10 cm neck thickness was recorded in the Bhima shakti.

3.6. Bolting percentage

The bolting percentage has been presented in Table 5. The Significantly lowest 0.42 bolting per cent were observed in genotype Agrifound white followed by Mahasuper red (0.96%) and N-2-4-1 (1.04%) as compared to other genotypes. Therefore, it was noted maximum 5.88 bolting per cent under the genotype Bhima shakti.

3.7. Bulb/green top ratio (%)

The bulb and green top ratio percentage has been presented in Table 5. The bulb and green top ratio percentage was significantly influenced by various genotypes. The significantly maximum 87.65 and 85.58 % bulb and green top ratio were recorded in genotypes Agrifound white and Mahasuper red, respectively and which were at par with each other. While, the lowest 66.58% bulb and green top ratio was recorded in the Bhima shakti.

Table 5: Neck thickness (cm), bolting (%), bulb/green top ratio (%) and duration of the crop as influenced by different genotypes of onion

S. No.	Genotypes	Neck thickness (cm)	Bolting (%)	Bulb/green top ratio (%)	Duration of the crop (No. of days (since showing))
1	Bhima shakti	1.10	5.88	66.58	203.00
2	Bhima sweta	0.56	1.13	82.99	208.33
3	Agrifound white	0.43	0.42	87.65	210.00
4	Bhima kiran	0.57	1.25	80.75	207.67
5	L 355	0.76	3.54	70.43	205.67
6	Bhima super	0.66	2.83	75.93	206.67
7	N-2-4-1	0.53	1.04	83.10	209.33
8	Bhima shubhra	0.71	3.21	73.33	206.33
9	Bhima red	0.59	2.79	78.09	207.33
10	Bhima raj	1.01	5.29	68.88	204.67
11	Akshda mahasuper	1.04	4.08	68.90	205.33
12	Mahasuper red	0.45	0.96	85.58	209.67
SEm±		0.008	0.06	1.48	0.23
C.D. at 5% level		0.02	0.17	4.35	0.67

3.8. Duration of the crop

Duration of the crop of different onion genotypes is given in Table 5. The Bhima shakti was noted early maturing genotype and recorded significantly minimum 203.0 day for maturity followed by Bhima raj (204.67 days) and Akshda mahasuper (205.33 days). However, the genotype Agrifound white was required maximum (210.0) days for maturity.

Effect of different genotypes of onion on morphological parameters

Among morphological parameters, the plant height, number of leaves per plant , leaf length, dry weight per plant, neck thickness, bolting per cent, bulb and green top ratio and duration of the crop were studies in kharif onion.

Significantly highest plant height was recorded in genotypes Agrifound white and Mahasuper red and which were at par with each other and it was observed lowest in genotype Bhima shakti at all the growth stages. This may be due to genetical makeup of the genotypes and application of major and minor nutrients, increased the photosynthetic activity, chlorophyll formation, nitrogen metabolism and auxin contents in the plants which ultimately improving the plant height. Similar results have been reported by Soni *et al*., Bal and Sidhu, Thamburaj *et al*., Mohanty, Mohanty, Mohanty, Singh *et al*., Singh *et al*., Jogdande *et al*., Channagoudar and Janawade, Khar *et al*., Yaso, Sharma, and Khandwe, Hosamani *et al*., Singh *et al*., and Jogdande *et al*.,

Genotypes Agrifound white, Mahasuper red, and N-2-4-1 were recorded in significantly maximum leaves per plant at 30, 60, 90 and 120 DAT and which were at par with each other. However, it was observed lowest in genotype Bhima shakti for the same. Probable reasons for enhanced more number of leaves, may be due to primitive effects of macro and micronutrients on vegetative growth which ultimately lead to more photosynthetic activities. These findings are in agreement with the findings of Soni *et al*., Thamburaj *et al*., Shrivastava *et al*., Mohanty, Mohanty, Mohanty, Singh *et al*., Singh *et al*., Jansi Rani and Thangaraj, Jogdande *et al*., Channagoudar and Janawade, Khar *et al*., Yaso, Hosamani *et al*., and Jogdande *et al*.,

At 30, 60, 90 and 120 DAT the significantly maximum leaf length was recorded under the genotypes Agrifound white followed by Mahasuper red, N-2-4-1 and Bhima sweta and which were at par with each other. While, minimum leaf length was recorded in genotype Bhima shakti. Probable reasons for enhanced more number of leaves, may be due to primitive effects of macro and micronutrients on vegetative growth which ultimately lead to more photosynthetic activities. These findings are in agreement with the findings of Soni *et al*., and Jansi Rani and Thangaraj.

In case of 30, 60, 90 and 120 DAT, the dry weight per plant was significantly increased by the different genotypes. The Agrifound white was found significantly superior as compared to other genotypes. Highest dry weight per plant was recorded in genotype Agrifound white, followed by Mahasuper red and N-2-4-1. However, lowest dry weight per plant was noted under the genotype Bhima shakti at 30, 60, 90 and 120 DAT. This may be due to application of major and minor nutrients, increased the photosynthetic activity, chlorophyll formation, nitrogen metabolism and auxin contents in the plants which ultimately improving the plant growth ultimately dry weight of plant. Results are in agreement with the finding reported by Shrivastava *et al*., Ushakumari *et al*., Singh *et al*., Channagoudar and Janawade, Mahanthesh *et al*., and Hosamani *et al*.,

The neck thickness was significantly influenced by various genotypes. The significantly minimum neck thickness was recorded in genotypes Agrifound white and Mahasuper red and which were at par with each other. While, the highest neck thickness was recorded in the Bhima shakti. Variation in neck thickness was due to the inherent genetic makeup of the genotypes, which is some way influenced by quantity of irrigation water such as more irrigation at the growth period leads to increased neck thickness of the bulb. The findings is also in agreement with the findings of Bal and Sidhu, Singh *et al*., Singh and Singh, Mohanty, Mohanty, Singh *et al*., Singh *et al*., Khar *et al*., Patil *et al*., Supe *et al*., and Hosamani *et al*.,

Significantly lowest 0.42 bolting per cent were observed in genotype Agrifound white followed by Mahasuper red (0.96%) and N-2-4-1 (1.04%) as compared to other genotypes. Therefore, it was noted maximum 5.88 bolting per cent under the genotype Bhima shakti. This may be due to the inherent genetic makeup of the genotypes. These findings are in agreement with the findings of Bal and Sidhu, Singh *et al*., Bosch Serra and Domingo Olive they found that the upper temperature limit for flower induction was 17 degrees C and that low irradiance impairs flower production. To control bolting while maintaining yield requires high levels of soil N availability during growth and a leaf area index less than 3.5.

The bulb and green top ratio percentage was significantly influenced by various genotypes. The significantly maximum bulb and green top ratio were recorded in genotypes Agrifound white and Mahasuper red and which were at par with each other. While, the lowest bulb and green top ratio was recorded in the Bhima shakti.

The Bhima shakti was noted early maturing genotype and recorded significantly minimum 203.0 day for mature followed by Bhima raj (204.67 days) and Akshda mahasuper (205.33 days). However, the genotype Agrifound white was required maximum (210.0) days for maturity. Probable reasons due to the inherent genetic makeup of the genotypes. Nitrogen in plants increased cell division and cell differentiation. Thus, plant remained in vegetative phase and resulted in imbalance between C: N ration thus delayed maturity at higher nutrient level.

CONCLUSION

On the basis of present investigation, it is concluded that the onion genotype Agrifound white responded well in terms of growth, growth analytical, yield and quality parameters and suitable for commercial production in Malwa condition in kharif season. Genotypes Agrifound white was observed best for growth (i.e. significantly maximum plant height, number of leaves per plant, leaf length, dry weight per plant, bulb and green top ratio and minimum neck thickness, bolting per cent, duration of the crop), yield parameters (fresh weight of bulb, polar diameter of bulb, equatorial diameter of bulb, bulb yield per hectare and long crop duration and lowest percentage of doubles bulb,) was recorded maximum in this genotypes. It was also observed best quality. Higher money value and less cost of cultivation are desirable traits for getting higher returns. Hence economics of the treatments was work out. It is revealed form the date obtained that a significantly maximum bulb yield of 338.67q per ha was obtained in onion genotype Agrifound white with net return of Rs 2,87,656 per ha and cost benefit ratio 1:6.64 as compared to other genotypes.

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