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## Evaluation of *rabi* onion genotypes for morphological and yield characters

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**Abstract**

A field experiment entitled, "Evaluation of *rabi* onion genotypes for morphological, characters" was conducted during *rabi* season, 2017-18 at "Scheme for Research on Onion Storage", Department of Horticulture, Mahatma Phule Krishi Vidyapeeth, Rahuri, Dist. Ahmednagar (Maharashtra), India. Evaluation of *rabi* onion genotypes for morphological characters for higher yield was also one of the important objective for study,

The experiment was carried out in Randomized Block Design with seventeen genotypes and one check variety i.e. N-2-4-1 treatments replicated three times.

The results indicated that the treatment T<sub>7</sub> (RHROR-7), T<sub>10</sub> (RHROR-10) and T<sub>11</sub> (RHROR-11) significantly enhanced the morphological characters viz., plant height, polar diameter and equatorial diameter of bulb. The result also shows that, the important yield parameters like average bulb weight total bulb yield and total marketable yield in onion crop was recorded highest in genotypes T<sub>11</sub> (23.61 kg/plot & 39.34 t/ha) followed by genotype T<sub>7</sub> (23.51 kg/plot & 39.18 t/ha) and T<sub>10</sub> (23.06 kg/plot & 38.43 t/ha).

Considering the above results, it could be concluded that, among the seventeen genotypes T<sub>7</sub> (RHROR-7), T<sub>10</sub> (RHROR-10) and T<sub>11</sub> (RHROR-11) found promising for further evaluation.

**Keywords:** Polar diameter of bulb, equatorial diameter of bulb, marketable bulb yield, total bulb yield

**Introduction**

Onion (*Allium cepa* L.) is most important bulbous vegetable crop. It belongs to family Alliaceae order Asparagales composed of 795 species in genera. Its chromosome number 2n=16. It is an important vegetable crop grown in India. India exports 12 per cent of total world export of onion. It is more than 75 per cent of foreign exchange that comes from export of fresh vegetables. The onion plant has a flattern fan shaped hollow, bluish-green leaves and its bulb at the base of the plant begins to swell, when a certain day-length is reached. The bulbs are composed of shortened, compressed, underground stems surrounded by fleshy modified scales (leaves) that envelope a central bud at the tip of the stem. It is originated from Central Asia.

The demand for onion is worldwide. Onions are found in most marketable of the world throughout the year and can be grown under wide range of Agro-climatic conditions. Irrespective of prices, the demand remains almost constant in the market as it is primarily, used as seasoning for a wide variety of dishes in many homes almost. Among the different states, Maharashtra is leading state in terms of area and production. Other major onion growing states are Gujarat, Karnataka, Odessa, Uttar Pradesh, Andhra Pradesh, Tamil Nadu and Rajasthan.

It is a biennial plant, but is usually grown as an annual shallow rooted crop. It is basically long day plant for bulb production. *Rabi* is the most favorable and ideal season for onion crop and it accounts for 50-60 per cent of total area under cultivation For good vegetative growth, lower temperatures, (daily mean 13-21 °C) and short photoperiod are required while for bulb development high temperatures (daily mean 15-25 °C) and long photoperiod are required and these conditions are fulfils in *rabi* season. Cole *et al.* (1996) [5] reported that highest commercial bulb yield was reported at higher planting density. While the highest proportion of large bulb and average bulb weight were examined at lower planting density.

The important contents like allucin, allin and sulphites etc. are present in onion. These compounds are helps to fighting cancer, high blood cholesterol and sugar, liver problems and intestinal problems. It has diuretic and stimulant property.

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The antifungal property of onion is due to presence of catechol a phenolic compound. Onion is used for treating problems including loss of appetite. Upset stomach and gall bladder disorder for treating heart and blood vessel problems including chest pain (angina) and high blood pressure and for preventing hardening of the arteries atherosclerosis. It is used in processed form i.e. flakes powder is used for making pickles. (Bhagchandani *et al.*, 1980) [1].

Basically, onion is *rabi* season crop. But only few varieties have been useful for *rabi* plantation. Amongst them, N-2-4-1, AFLR, Arka Niketan and Pusa Red, etc are the major. Cultivation of white onion is also undertaken in *rabi* season with cultivars *viz.* N-257-9-1, Phule Safed, Pusa White Flat, Pusa White Round, etc. But these varieties become older. Hence it is essential to develop a new cultivar for better yield and storability. In this context the germplasm available with Scheme for Research on Onion Storage will be screened for evaluations to fulfill the following objectives.

## Material and Methods

The present field investigation was carried out during *rabi* season at, "Scheme for Research on Onion Storage", Department of Horticulture, Mahatma Phule Krishi Vidyapeeth (MPKV), Rahuri Maharashtra in 2017 – 18. The experiment was laid out in Randomized Block Design with three replications having seventeen genotypes and one check variety i.e. N-2-4-1,

The MPKV, Rahuri is situated between 19° 47' and 19° 57' North latitude and 74° 19' and 74° 42' East longitudes with elevation of 525 m above the mean sea level.

The plots selected for same planting date had a uniform soil depth and fertility. The soil was medium black, calcareous and well drained.

**Treatment details:** Seventeen genotypes and one check variety i.e. N-2-4-1 available at "Scheme for Research on Onion Storage" was utilized for the experimentation.

**Table 1:** Treatment details

Treatment No.	Genotype	Treatment No.	Genotype
T <sub>1</sub>	RHROR-1	T <sub>10</sub>	RHROR-10
T <sub>2</sub>	RHROR-2	T <sub>11</sub>	RHROR-11
T <sub>3</sub>	RHROR-3	T <sub>12</sub>	OPS-1
T <sub>4</sub>	RHROR-4	T <sub>13</sub>	OPS-2
T <sub>5</sub>	RHROR-5	T <sub>14</sub>	OPS-3
T <sub>6</sub>	RHROR-6	T <sub>15</sub>	OPS-4
T <sub>7</sub>	RHROR-7	T <sub>16</sub>	OPS-5
T <sub>8</sub>	RHROR-8	T <sub>17</sub>	OPS-6
T <sub>9</sub>	RHROR-9	Check variety	N-2-4-1

## Observations to be recorded

### Morphological character

#### Plant height (cm)

The plant height was recorded in centimeters for randomly selected ten plants from each treatment at harvesting of crop. The height was measured from ground level to the tip of the lastly emerged leaves.

#### Number of leaves per plant

Numbers of leaves per plants were counted and average was taken for the same plants selected for plant height before 15 days to harvest.

#### Polar diameter of bulb (cm)

Polar diameter of bulb was measured by using vernier caliper in cm from the base of root plate to the neck of the bulb from the same ten bulbs, which were used for recording equatorial diameter. The mean polar diameter of bulb was worked out.

#### Equatorial diameter of bulb (cm)

Equatorial diameter of bulb is the diameter of the bulb when it is kept upright in natural position. The distance was measured from North to South direction horizontally. It was measured by vernier caliper from the randomly selected ten bulbs at harvesting time. The mean equatorial diameter was worked out.

## Yield Characters

### Average bulb weight (g)

After harvesting, bulb weight of randomly selected ten bulbs were recorded and then mean weight of bulb was worked out for each replication of all treatments and expressed in gram.

### Total bulb yield (t/ha)

The weight of total harvested bulbs including marketable and non-marketable bulbs such as premature bolters, twin bulbs and rotten bulbs in t/ha was recorded.

### Marketable bulb yield (t/ha)

The weight of total harvested 'A', 'B' and 'C' grade bulbs was included as a marketable bulb yield in t/ha was recorded.

## Statistical Analysis

The data recorded in respect of various observations were subjected to the statistical analysis as per procedure given by Panse and Sukhatme (1989) [9].

## Results and Discussion

The results obtained from the statistical analysis of generated data in present investigation were presented under appropriate headings and subheadings.

### Morphological characters

#### Plant height (cm)

The data from Table 2. Shows that, the maximum plant height was found in the genotype T<sub>11</sub> (66.43 cm). It was followed by genotypes *viz.* T<sub>7</sub> (65.53 cm), T<sub>10</sub> (64.82 cm) and T<sub>8</sub> (64.37 cm). Whereas, the minimum plant height was found in the genotype T<sub>17</sub> (54.43 cm).

Khan *et al.* (2007) [7] observed that the nitrogen and zinc levels both significantly affected the plant height. The results revealed that maximum plant height (50.15 cm) was noted in plots applied with nitrogen at the rate of 100 kg per hectare while minimum plant height-(45.82) was recorded in plots received no nitrogen (control).

**Number of leaves per plant**

It is evident from Table 2. that, non-significant differences were recorded in number of leaves per plant by onion genotypes. The maximum number of leaves per plant was found in the genotype T<sub>11</sub> (11.37) and T<sub>6</sub> (11.37) whereas the minimum number of leaves per plant was found in the genotype T<sub>5</sub> (9.58)

Shrivastav *et al.* (2017) [11] observed that at 90 DAT the maximum number of leaves was recorded in Pusa Madhavi (12.00) followed by Bhima Sweta (11.73) and maximum number of leaves was noticed in genotype Arka Niketan (9.40) and followed by Bhima Super (9.66) and Bhima Kiran (10.13).

**Polar diameter of bulb (cm):** Significant differences were

recorded (Table 2.) in polar diameter of bulb by the genotypes. The maximum polar diameter of bulb was recorded in genotypes T<sub>11</sub> (5.70 cm). It was followed by genotypes *viz.* T<sub>7</sub> (5.53 cm), T<sub>10</sub> and T<sub>3</sub> (5.52 cm). The minimum polar diameter of bulb was recorded in genotype T<sub>17</sub> (4.80 cm).

Sharma (2009) [10] screened five onion varieties and recorded the highest polar diameter of bulb in Baswant-780 (5.72 cm) and lowest polar diameter of bulb in Arka Kalyan (4.88 cm).

Yadav *et al.* (2009) [14] evaluated eight varieties of onion for performance under Konkan agro-climatic conditions of Maharashtra and recorded the maximum polar diameter of bulb was observed in Sindhudurg Local (6.42 cm) followed by Phule Samarth (5.86 cm) and least in the variety Phule Swarna (5.10 cm).

**Table 2:** Plant height (cm), number of leaves per plant & polar diameter of bulb (cm)

Treatments	Genotypes	Plant height (cm)	Number of leaves per plant	Polar diameter of bulb (cm)
T <sub>1</sub>	RHROR-1	61.77	10.57	5.49
T <sub>2</sub>	RHROR-2	60.50	10.63	4.95
T <sub>3</sub>	RHROR-3	60.20	10.23	5.33
T <sub>4</sub>	RHROR-4	60.40	10.87	5.52
T <sub>5</sub>	RHROR-5	61.50	9.58	5.13
T <sub>6</sub>	RHROR-6	61.20	11.37	5.47
T <sub>7</sub>	RHROR-7	65.53	11.33	5.53
T <sub>8</sub>	RHROR-8	64.37	10.63	5.51
T <sub>9</sub>	RHROR-9	61.70	10.27	5.41
T <sub>10</sub>	RHROR-10	64.82	11.13	5.52
T <sub>11</sub>	RHROR-11	66.43	11.37	5.70
T <sub>12</sub>	OPS-1	55.80	10.33	5.19
T <sub>13</sub>	OPS-2	58.33	10.63	4.85
T <sub>14</sub>	OPS-3	57.43	9.87	4.83
T <sub>15</sub>	OPS-4	57.07	9.60	4.89
T <sub>16</sub>	OPS-5	56.83	10.03	5.08
T <sub>17</sub>	OPS-6	54.43	10.40	4.80
Check variety	N-2-4-1	56.80	10.13	5.41
SE (+)		1.47	0.44	0.08
CD @ 5%		4.22	NS	0.24

**Equatorial diameter of bulb (cm)**

The significant differences were recorded in equatorial diameter of bulb by all genotypes (Table 3.). The maximum equatorial diameter of bulb was recorded in genotype T<sub>11</sub> (5.86 cm) followed by genotypes *viz.* T<sub>7</sub> and T<sub>9</sub> (5.74 cm) and T<sub>3</sub> (5.73 cm). The minimum equatorial diameter was recorded in genotype T<sub>16</sub> (4.83 cm).

Yadav *et al.* (2009) [14] characterized eight varieties under Konkan agro-climatic conditions of Maharashtra and reported

the maximum equatorial diameter of bulb in Sindhudurg Local (6.23 cm) followed by N-2-4-1 (5.81 cm). But, least marked in the variety Phule Suvarna (4.72 cm). Hosamani *et al.* (2010) [6] observed the maximum equatorial diameter of bulb in Sel. 283 (6.20 cm) which was followed by NRCW02 (5.57 cm) and Arka Niketan (5.03 cm). However, lowest equatorial diameter of bulb was observed in L-28 (3.27 cm).

**Yield characters**

**Table 3:** Equatorial diameter of bulb (cm), average bulb weight (g), total bulb yield (t/ha) and Marketable bulb yield (t/ha)

Treatments	Genotype	Equatorial diameter of bulb (cm)	Av. bulb weight (g)	Total bulb yield (t/ha)	Marketable bulb yield (t/ha)
T <sub>1</sub>	RHROR-1	5.51	68.13	32.02	25.74
T <sub>2</sub>	RHROR-2	5.09	72.07	32.93	26.59
T <sub>3</sub>	RHROR-3	5.73	68.53	34.46	29.05
T <sub>4</sub>	RHROR-4	5.56	77.87	34.01	28.76
T <sub>5</sub>	RHROR-5	5.19	77.13	33.81	29.49
T <sub>6</sub>	RHROR-6	5.49	77.80	34.31	29.90
T <sub>7</sub>	RHROR-7	5.74	82.67	39.18	32.17
T <sub>8</sub>	RHROR-8	5.46	69.20	32.88	25.54
T <sub>9</sub>	RHROR-9	5.43	76.40	32.50	27.16
T <sub>10</sub>	RHROR-10	5.74	81.13	38.43	30.47
T <sub>11</sub>	RHROR-11	5.86	83.10	39.34	35.48
T <sub>12</sub>	OPS-1	5.35	80.53	33.30	23.43
T <sub>13</sub>	OPS-2	5.05	63.00	32.55	24.83
T <sub>14</sub>	OPS-3	5.05	62.80	33.71	25.07
T <sub>15</sub>	OPS-4	4.88	70.07	34.60	22.43

T <sub>16</sub>	OPS-5	4.83	66.40	26.89	20.92
T <sub>17</sub>	OPS-6	5.01	66.33	31.81	25.25
Check variety	N-2-4-1	5.58	77.73	34.04	27.85
SE (+)		0.16	1.39	1.97	2.10
CD @ 5%		0.47	4.00	5.66	6.04

### Average bulb weight (g)

All onion genotypes under study (Table 3) shown significant results. The average bulb weight of onion genotypes ranged between 62.80 to 83.10g. The genotype T<sub>11</sub> recorded highest average bulb weight of 83.10g followed by the genotypes viz. T<sub>7</sub> (82.67 g) and T<sub>10</sub> (81.13 g). The genotype T<sub>14</sub> recorded the lowest average bulb weight of 62.80 g (Table 3).

Hosamani *et al.* (2010) [6] showed that onion genotype PKV selection noticed the maximum bulb weight of 84.00 g followed by the variety Arka Niketan (77.33 g). However, Agrifound White recorded the minimum bulb weight of 30.67 g.

Trivedi and Dhumal (2010) [12] revealed that, among eighteen onion genotypes and four varieties evaluated during kharif season at NRCOG, Pune. The genotype Hy-3667 had recorded maximum bulb weight of 94.19 g, which was on par with Baswant-780 (93.29 g) followed by NRCOG-5749040 g). However, NRCOG-581 had registered minimum bulb weight of 46.62 g.

### Total bulb yield (t/ha)

It is evident from Table 3. that, significant differences were recorded in total bulb yield by onion genotypes. The maximum total bulb yield was recorded in genotype T<sub>11</sub> (39.34t/ha). It was at par genotype T<sub>7</sub> (39.18t/ha) and T<sub>10</sub> (38.43t/ha). The minimum total bulb yield was recorded in genotype T<sub>16</sub> (26.89t/ha).

Bhonde *et al.* (1988-89) [2] recorded maximum yield in Arka Kalyan followed by L-102-1 during late kharif season. They further reported that significantly highest gross yield was recorded in No. 780 followed by Agrifound Dark Red during 1989. Marketable yield was found maximum in Arka Kalyan followed by AFDR, AFLR, Arka Niketan and Nasik Red varieties also yielded at par (Bhonde *et al.*, 1990-91) [3].

### Marketable bulb yield (t/ha)

Significant differences (Table 3) were recorded in marketable bulb yield by onion genotypes under study. The maximum marketable bulb yield was recorded in genotype T<sub>11</sub> (35.48 t/ha). It was at par genotype T<sub>7</sub> (32.17 t/ha) and T<sub>10</sub> (30.47 t/ha). The minimum marketable bulb yield was recorded in genotype T<sub>16</sub> (20.92 t/ha).

Warade *et al.* (1996) [13] recorded maximum yield in cultivar AFDR (334.1 q/ha) followed by cultivar N-2.4-1 (324.6 q/ha) However, the differences were non-significant during late kharif season. Kher *et al.* (1999) [8] reported maximum marketable yield in Baswant 780 followed by Arka Niketan and Agrifound Light Red was superior over other varieties under Pune conditions during late kharif season.

### Conclusion

Majority of the onion crop (50-60%) is produced in *Rabi* season which has good storage quality. Development of high yielding and better storage quality variety for *rabi* is today's prime need. For this purpose the experiment was conducted on evaluation of light red, red, dark red and pink varieties available at "Scheme for Research on Onion Storage", Department of Horticulture, MPKV, Rahuri, Maharashtra. Seventeen genotypes were evaluated along with check variety

N 2-4-1. Among different genotypes, highest plant height (66.43 cm), number of leaves (11.37), Av. bulb weight (83.10 g) was recorded by genotype T<sub>11</sub> (RHROR-11) closely followed by genotypes T<sub>7</sub> (RHROR-7) and T<sub>10</sub> (RHROR-10). Maximum polar and equatorial diameter were recorded by the genotypes T<sub>7</sub> (RHROR-7), T<sub>11</sub> (RHROR-11) and T<sub>10</sub> (RHROR-10). Maximum marketable yield (t/ha) and total bulb yield (t/ha) was recorded by the genotypes T<sub>11</sub> (RHROR-11) (39.34 t/ha) followed by genotype T<sub>7</sub> (RHROR-7) (39.18 t/ha) and T<sub>10</sub> (RHROR-10) (23.06 38.43 t/ha).

Among seventeen genotypes T<sub>7</sub> (RHROR-7), T<sub>10</sub> (RHROR-10) and T<sub>11</sub> (RHROR-11) found promising for further evaluation.

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