



ISSN (E): 2277- 7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2022; 11(3): 1873-1878
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www.thepharmajournal.com

Received: 13-12-2021

Accepted: 21-01-2022

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Assessment of onion (*Allium cepa* L.) varieties for growth and yield attributing characters for rabi season under Telangana

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Abstract

A Field experiment was conducted at Vegetable Research Station, SKLTSHU, Hyderabad during Rabi 2018-19 with 21 varieties supplied by Directorate of Onion and Garlic Research (ICAR), Rajgurunagar, Maharashtra. Six week old seedlings of 21 varieties were transplanted in flat beds at a spacing of 15 x 10 cm in a plot of 3 x 2 meter size in randomized block design with three replications to identify suitable onion variety for Rabi season. The results revealed that Maximum average weight of single bulb was recorded in L-355 (C) (NHRDF Red-2) (131.13 g) is on par with Bhima Shakthi (C) (129.63 g) followed by Bhima Kiran (c) (109.47 g), DOGR-WHY-2 (MS 100 X W-361) (108.59 g) which are on par with each other and minimum was recorded in DOGR Hy-8 (38.27 g). Highest Marketable yield/ha was observed in L-355 (C) (NHRDF Red-2) (419.62 q) is on par with Bhima Shakthi (C) (414.80 q) followed by Bhima Kiran (c) (350.29 q), DOGR-WHY-2 (MS 100 X W-361) (347.48 q). The Probable reason for increased fresh weight of bulb per plant due to humus substances could have mobilized the reserve food materials to the sink through increased activity of hydrolyzing and oxidizing enzymes.

Keywords: *Allium cepa* L., varieties, thrips, uniformity of the bulb, purple blotch, average weight of the bulb, marketable yield

Introduction

Onion is an important export oriented vegetable among the cultivated alliums in India. It is used as spices, condiments and vegetables almost daily in every kitchen as seasoning for wide varieties of dishes. The genus *Allium* includes around 750 species out of which over 20 other *Allium* species have been consumed by humans excluding the most important edible *Alliums* i.e. onion, Japanese onion, leek and garlic. It ranks second in value after tomatoes on the list of cultivated vegetable crops worldwide. It is an important bulb crop throughout the world and is commercially cultivated in more than hundred countries. In India it is cultivated in an area of 12.03 lakh ha and production of 194.01 lakh MT in the world with an average productivity of 17.01 t/ha (FAO Stat. 2014) [2] and in Telangana it is cultivated in an area of 15.25 ('000 ha) with a production of 270.38 ('000 MT) and an average productivity of 18.97 t/ha. (Telangana Dept. of Horticulture 2018-19) [8].

In India, onion is predominantly cultivated during *rabi* season. Hence, average productivity of Indian onion depends on the *rabi* onion. In general, productivity could be determined by selection of season suitable varieties, balanced nutrition, optimum water management as well as need based plant protection measures. Therefore, identification of specific cultivars suitable for specific season is an indispensable step towards increase in production and productivity of onion. Keeping this in view, the present investigation was attempted to evaluate the suitable onion varieties for Rabi season for their growth and yield under Telangana state.

Materials and Methods

The present investigation was carried out at Vegetable Research Station, SKLTSHU, Hyderabad under All India Network Research Project on Onion and Garlic during Rabi 2018-19. For this experiment, received 21 varieties from Directorate of Onion and Garlic Research (ICAR), Rajgurunagar, Maharashtra. Six week old seedlings of each variety were transplanted in flat beds at a spacing of 15 cm row to row and 10 cm plant to plant with a plot size of 3 m x 2 m.

The trial was laid in randomized block design with 21 treatments and three replications (Fig 1.). The treatment comprised of twenty one varieties such as were Jindal Riva, Indam-4 F1, DOGR KH M-3, DOGR KH M-4, BSS 262 White Hybrid (c), Jindal Pune Fursungi Advanced, Bhima Kiran (c), Bhima Shakthi (c), Bhima Shwetha (c), L-355 (c) (NHRDF Red -2), DOGR Hy-8, L-883, Orient (Hy) (BSS-133) (C), L-849, Pune Red (Hy) (BSS-441) (C), PKV WHITE (C), L-857, DOGR-344, DOGR-361, DOGR WHY-1 (MS 100 X B. SHUBRA) and DOGR-WHY-2 (MS 100 X W-361). The standard recommended packages of practices of DOGR were followed for raising the successful crop. Randomly ten plants from each plot were selected to record the observations on following parameters such as uniformity in bulb size, shape of the bulb, % double bulbs, % bolters, % rotting, Average weight of single Bulb (g), weight of the bulbs (g), Marketable yield (q/ha). The data for different characters were statistically analyzed in ANOVA and presented in tables. Data on purple blotch was recorded following the scale mentioned below (Table 1.)

Disease scale

Rating scale Description of symptom

1. No disease symptom
2. A few spots towards the tip covering 10 per cent leaf area
3. Several purplish brown patches covering up to 20 percent of leaf area
4. Several patches with paler outer zone covering up to 40 percent leaf area
5. Leaf streaks covering up to 75 percent leaf area or breaking of the leaves from centre
6. Complete drying of the leaves or breaking of leaves from centre

The per cent disease index was calculated by the following formula given by Wheeler (1969) [9].

$$PDI = \frac{\text{Total sum of numerical ratings}}{\text{Number of observations} \times \text{Maximum disease rating}} \times 100$$

Further, the varieties were categorized based on disease severity scale as given by Pathak *et al.* (1986) [4].

Table 1: Scale was adopted to indicate degree of resistance against purple blotch of onion.

S. No	Disease severity	Category	Reaction
1	<5	0	Immune
2	5-10	1	Resistant
3	11-20	2	Moderately resistant
4	21-40	3	Moderately susceptible
5	41-60	4	Susceptible
6	>61	5	Highly susceptible

Thrips data was also recorded on the basis of number of thrips per plant. Five plants were selected randomly in each plot and absolute population of thrips was recorded by examining the plant. The observations were taken at weekly interval from third week after transplanting till to the harvest of the crop. Mean pest population was worked out and the data, thus obtained were transformed in to square root transformation and then statistical analysis done for assessing the relative susceptibility to *Thrips tabaci*.

Categorization of varieties

The onion varieties were also grouped into four categories viz., highly resistant, resistant, susceptible and highly susceptible based on number of thrips per plant.



Fig 1: General view of the experimental field

Results and Discussions

The results obtained from the present investigation on the evaluation of onion (*Allium cepa* L.) varieties for growth and yield traits under Telangana state during Rabi season of 2018-19 are discussed and presented below.

Uniformity in Bulb size

Uniformity in bulb size was measured in a range of > 80% = High, 80-50% = Average, <50% = Low by physical appearance. It is evident from the experiment that the varieties Bhima Kiran (C), Bhima Shakthi (C), L-355 (C) (NHRDF Red-2), DOGR-344, DOGR-361, DOGR-WHY-2 (MS 100 X W-361) exhibited High (>80%) uniformity in bulb size and appearance followed DOGR WHY-1 (MS 100 X B. SHUBRA), L-857, PKV WHITE (C), Pune Red (Hy) (BSS-441) (C), L-849, Orient (Hy) (BSS-133) (C), DOGR Hy-8, Jindal Riva, Indam-4 F1, DOGR KH-M-3, DOGR KH-M-4, BSS 262 White Hybrid (C), Jindal Pune Fursungi Advanced and Bhima Shwetha (C) were Average (50-80%) uniformity and less/low (< 50%) uniformity was observed in L-883.

Predominant colour of the Bulb after curing

The Varieties Indam-4 F1, Jindal Pune Fursungi Advanced, Bhima Shakthi (C), Pune Red (Hy) (BSS-441) (C), L-849 and Orient (Hy) (BSS-133) (C) are Red in Colour followed by L-355 (C) (NHRDF Red-2), L-883, DOGR KH-M-3, DOGR KH-M-4 and Bhima Kiran (C) are Light red coloured bulbs whereas Jindal Reva, DOGR Hy-8 is a Dark red in colour and remaining BSS 262 White Hybrid (C), Bhima Shwetha (C), Pune Red (Hy) (BSS-441) (C), L-857, DOGR -344, DOGR -361, DOGR-WHY-1 (MS 100 X B. Shubhra) and DOGR-WHY-2 (MS 100 X W-361) are white coloured bulbs (Table 2.).

Predominant Shape of the Bulb

Shape of the bulbs was recorded in the form of Round, Oval and Flat based on the visual observations. The varieties BSS 262 White Hybrid (C), Bhima Kiran (C), L-355 (C) (NHRDF Red-2), DOGR Hy-8, L-883, Orient (Hy) (BSS-133) (C), L-849, Pune Red (Hy) (BSS-441) (C), PKV White (C), L-857, DOGR -344 and DOGR -361 are appeared as oval in shape of the bulb and remaining DOGR-WHY-1 (MS 100 X B. Shubhra), DOGR-WHY-2 (MS 100 X W-361), Bhima Shakthi (C), Bhima Shwetha (C), Jindal Pune Fursungi Advanced, DOGR KH-M-3 and DOGR KH-M-4 are round shaped bulbs (Table 2.).

Double Bulb

The significantly No or Zero doubles was recorded under DOGR KH M-4, Bhima Shakthi (C), Bhima Shwetha (C), Orient (Hy) (BSS-133) (C), L-849 while the varieties Jindal Riva, Indam - 4 F1, BSS 262 White Hybrid (C), Pune Red (Hy) (BSS-441) (C), PKV White (C), DOGR -344 and DOGR -361 has maximum number of double bulbs (Table 2.). This doubling of the bulbs is mainly due to Delayed application of Fertilizers and also inherent genetical makeup of the variety.

These results are in conformity with the findings of Dubey *et al.* (2019) [5].

Bolting percentage

The bolting percentage was calculated by counting selected tagged plants as well as total plants in plot per replication before harvesting. Significantly No/Zero bolting percentage of bulb was recorded for the varieties Bhima Shwetha (C), L-355 (C) (NHRDF Red-2), DOGR Hy-8, L-849 and DOGR -361 whereas the maximum percentage of Bolters was observed in the varieties Indam-4 F1, PKV White (C) and DOGR-WHY-2 (MS 100 X W-361) (Table 2.). This may be due to the inherent genetic makeup of the varieties and also depends on the cultural practices adopted during bulb initiation and development period. These results are in agreement with the results of Supe *et al.* (2008) [7] who found that to control bolting while maintaining yield requires high levels of soil N availability during growth periods of Onion. Supe *et al.* (2008) [7] and Dubey *et al.* (2019) [5].

Average weight of Single marketable bulb and Marketable yield (q/ha.)

Average fresh weight of the bulb, bulb yield per plot and per hectare as affected by different varieties is worked out at the time of harvesting and results shows that Maximum average weight of single bulb was recorded in L-355 (C) (NHRDF Red-2) (131.13 g) is on par with Bhima Shakthi (C) (129.63 g) followed by Bhima Kiran (c) (109.47 g), DOGR-WHY-2 (MS 100 X W-361) (108.59 g) which are on par with each other and minimum was recorded in DOGR Hy-8 (38.27 g). Highest bulb yield/plot was recorded in L-355 (C) (NHRDF Red-2) (26.23 kg) followed by Bhima Shakthi (C) (25.93 kg), Bhima Kiran (c) (21.89 kg) and DOGR-WHY-2 (MS 100 X W-361) (21.72 kg) and minimum was recorded in DOGR Hy-8 (7.65 kg). Highest Marketable yield/ha was observed in L-355 (C) (NHRDF Red-2) (419.62 q) is on par with Bhima Shakthi (C) (414.80 q) followed by Bhima Kiran (c) (350.29 q), DOGR-WHY-2 (MS 100 X W-361) (347.48 q) which are on par with each other (Fig: 2) and minimum was recorded in DOGR Hy-8 (122.46 q) (Table 2.).

The Probable reason for increased fresh weight of bulb per plant due to humus substances could have mobilized the reserve food materials to the sink through increased activity of hydrolyzing and oxidizing enzymes. Similar results have been reported by Bindu and Bindu (2015) [1] and also by Singh *et al.* (2011) [6] while the probable reason for enhanced bulb yield may be due to inherent genetic makeup of the varieties and effects of nutrients (macro and micro) on vegetative growth which ultimately lead to more photosynthetic activities enhance carbohydrate and nitrogen metabolism of peptic substances, as well as improve the water metabolism and water relation in the plants and also plant height, number of leaves, leaf area and management practices are also responsible for increasing the bulb weight. Similar results were noticed in Naik *et al.* (2012), Dubey *et al.* (2019) [5].

Table 2: Evaluation of Onion Varieties for growth and yield for Rabi Season under Telangana Conditions.

S. No	List of the Varieties	Uniformity in bulb size	Predominant colour of the bulb after curing	Predominant Shape of the bulb	% double bulbs	% Bolters	% Rotting	Average weight of marketable bulbs (g)	weight of the bulbs in kg/plot	Marketable yield (q/ha) (Includes bulb size above 2.5 cm diameter)
1	Jindal Riva	Average	Dark red	Flat	0.72	0.18	0.00	58.96	11.79	188.67
2	Indam-4 F1	Average	Red	Round	0.55	0.42	0.00	47.54	9.51	152.12
3	DOGR KH-M-3	Average	Light red	Round	0.19	0.14	0.00	79.19	15.84	253.39
4	DOGR KH-M-4	Average	Light red	Round	0.00	0.25	0.00	89.07	17.81	285.02
5	BSS 262 White Hybrid (c)	Average	White	Oval	0.56	0.24	0.00	63.99	12.80	204.77
6	Jindal Pune Fursungi Advanced	Average	Red	Round	0.25	0.28	0.00	62.57	12.51	200.21
7	Bhima Kiran (c)	High	Light red	Oval	0.29	0.30	0.00	109.47	21.89	350.29
8	Bhima Shakthi (c)	High	Red	Round	0.00	0.17	0.00	129.63	25.93	414.80
9	Bhima Shwetha (c)	Average	White	Round	0.00	0.00	0.00	63.22	12.64	202.29
10	L-355 (c) (NHRDF Red-2)	High	Light red	Oval	0.36	0.00	0.00	131.13	26.23	419.62
11	DOGR Hy-8	Average	Dark red	Oval	0.21	0.00	0.00	38.27	7.65	122.46
12	L-883	Low	Light red	Oval	0.09	0.30	0.00	68.27	13.65	218.46
13	Orient (Hy)(BSS-133) (C)	Average	Red	Oval	0.00	0.10	0.00	64.02	12.80	204.87
14	L-849	Average	Red	Oval	0.00	0.00	0.00	99.94	19.99	319.79
15	Pune Red (Hy) (BSS-441)(c)	Average	Red	Oval	0.66	0.10	0.00	80.27	16.05	256.86
16	PKV White (C)	Average	White	Oval	1.24	0.46	0.00	87.22	17.44	279.10
17	L-857	Average	White	Oval	0.34	0.13	0.00	58.71	11.74	187.87
18	DOGR-344	High	White	Oval	0.79	0.38	0.00	49.14	9.83	157.23
19	DOGR-361	High	White	Oval	0.09	0.00	0.00	91.17	18.23	291.76
20	DOGR-WHY_1) MS 100 x B. Shubhra)	Average	White	Round	0.27	0.11	0.00	77.69	15.54	248.60
21	DOGR -WHY-2 (MS 100 x W-361)	High	White	Round	0.72	0.93	0.00	108.59	21.72	347.48
	C.D.(5%)				0.09	0.10		2.21	0.44	7.08
	S.Em.				0.03	0.04		0.77	0.16	2.48



Fig 2: Photos of different high yielding varieties of Onion

Pest and Disease reaction

Minimum purple blotch incidence was recorded in Pune Red (Hy) (BSS-441) (c) (16.00%) is on par with Indam-4 F1 (16.93%), Bhima Kiran (c) (17.20%), Jindal Riva (17.60%) and L-857 (17.60%) showed medium resistance and medium susceptible where maximum purple blotch incidence was

recorded in Jindal Pune fursungi Advanced (57.87%) which is susceptible to purple blotch (Table 3.).

Thrips incidence was minimum recorded in Orient (Hy) (BSS-133) (c) (9.40), DOGR-WHY-2 (MS 100 X W-361) (9.40) and DOGR KH-M-4 (9.48) and maximum was recorded in DOGR-WHY-1 (MS 100 X B. Shubhra).

Table 3: Performance of Onion Varieties on reaction to Thrips and Purple Blotch incidence for Rabi season under Telangana condition.

S. No	List of the Varieties	Thrips Population	Score	Purple Blotch PDI (%)
1	Jindal Riva	10.23 (3.20)	2	17.60 (24.78)
2	Indam-4 F1	10.15 (3.19)	2	16.93 (24.25)
3	DOGR KH-M-3	10.24 (3.20)	2	22.93 (28.59)
4	DOGR KH-M-4	9.48(3.08)	1	23.73(29.13)
5	BSS 262 White Hybrid (c)	10.20(3.19)	2	20.53(26.92)
6	Jindal Pune Fursungi Advanced	12.06(3.47)	2	57.87(49.52)
7	Bhima Kiran (c)	11.30(3.36)	2	17.20(24.48)
8	Bhima Shakthi (c)	10.71(3.27)	2	21.33(27.47)
9	Bhima Shwetha (c)	10.23(3.20)	2	31.20(33.91)
10	L-355 (c) (NHRDF Red-2)	10.06(3.17)	2	23.73(29.14)
11	DOGR Hy-8	10.81(3.29)	2	24.00(29.30)
12	L-883	13.98(3.74)	2	20.00(26.55)
13	Orient (Hy)(BSS-133) (C)	9.40(3.07)	1	20.00(26.54)
14	L-849	10.94(3.31)	2	30.40(33.42)
15	Pune Red (Hy) (BSS-441)(c)	10.75(3.28)	2	16.00(23.55)
16	PKV White (C)	10.15(3.19)	2	19.47(26.14)
17	L-857	10.89(3.30)	2	17.60(24.74)
18	DOGR-344	10.20(3.19)	2	19.47(26.10)
19	DOGR-361	10.31(3.21)	2	22.93(28.45)
20	DOGR-WHY_1) MS 100 x B. Shubhra)	17.87(4.23)	3	30.80(33.69)
21	DOGR -WHY-2 (MS 100 x W-361)	9.40(3.07)	1	36.93(37.38)
	C.D.(5%)	2.06		3.36
	S.Em.	11.42		6.93

Conclusion

Based on the results of the study it is concluded that among all the varieties L-355 (C) (NHRDF Red-2) (419.62 q), Bhima Shakthi (C) (414.80 q) and Bhima Kiran (c) (350.29 q) (Fig: 2) were adopted well to Telangana condition by exhibiting maximum yield during Rabi season. Hence, these varieties can be recommended in place of local varieties for increasing production of Onion crop.

Acknowledgement

We gratefully acknowledge to the Director of Research, Sri Konda Laxman Telangana State Horticultural University, Hyderabad, India for the research facilities provided and also to the Director, Directorate of Onion and Garlic Research (ICAR), Rajgurunagar, Pune, India for providing the financial and other facilities to carry out this study under AINRP on Onion and Garlic at Vegetable Research Station, Rajendranagar, Hyderabad.

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