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Performance of Red Onion varieties during late *kharif* in Telangana

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Abstract
A field experiment was conducted at Vegetable Research Station, SKLTSHU, Hyderabad, Telangana State, India during August, 2020 - January, 2021 to study the performance of red onion varieties under late *kharif* conditions in Southern Telangana. Experiment was conducted with five entries Bhima Super, Bhima Shakti, Bhima Red, DOGR-1669 and DOGR-1657. The experiment was laid out in Randomized Block Design replicated four times. All the five varieties were round in shape, predominant bulb colour of DOGR-1657 and Bhima Shakti was red, DOGR-1669, Bhima Super and Bhima Red were light red. Among the five entries tested, DOGR-1669 recorded the maximum mean bulb weight (90.85 g) which was significantly superior over other entries but was at par with Bhima Super (88.45 g). DOGR-1669 recorded the highest total yield (45.43 t ha^{-1}) and marketable yield (43.82 t ha^{-1}) compared to other entries followed by Bhima Super and Bhima Shakti. Highest TSS (10.20 ^{0}Brix) was observed in the variety DOGR-1669 followed by DOGR-1657. Bolter bulbs were not noticed in DOGR-1669 and Bhima Super and rotten bulbs were not noticed in DOGR-1669 and DOGR-1657. Maximum bolter bulbs were noticed in DOGR-1657, maximum rotten bulbs were noticed in Bhima Super. Least incidence of thrips was noticed in Bhima Shakti followed by DOGR-1669 and least incidence of purple blotch in DOGR-1657 followed by DOGR-1669. Maximum thrips incidence and maximum purple blotch was observed in Bhima Super followed by Bhima Red.

Keywords: Late *kharif*, purple blotch, thrips tolerance, yield

Introduction
Onion belongs to the genus *Allium* of the family Amaryllidaceae (Welbaum, 2015) [24]. Onion is an important bulb crop throughout the world and is commercially cultivated in more than hundred countries (Umamaheswarappa *et al*., 2018) [22]. Onions are the oldest cultivated vegetables, and are second only after tomatoes, both of which are extensively used not only for culinary purposes all over the world (Benitez *et al*., 2011) [5]. It is also called as "Queen of Kitchen" (Selviraj, 1976) [18]. Onion is a multi-use vegetable that is consumed fresh as salad as well as in the form of a number of processed products (Manohar *et al*. 2017) [15]. Regular consumption of onions has been shown to reduce the risk of cancer, cataract, DNA damage, vascular and heart diseases (Arung *et al*., 2011; Jimenez *et al*., 2011; Hamauzu *et al*., 2011) [4, 10, 9]. It can be consumed raw, cooked, fried, dried or roasted. Onions are primarily consumed for their unique flavour or for their ability to enhance the flavour of other foods (Ketter and Randle, 1998) [12]. Besides being used as food, onions have a variety of medicinal properties. The medicinal value of onion has been described in the ancient Indian literature Charaka Samhita and Shusruta as medicine for diuretic, good for digestion, heart, eyes and joints problem (Singh *et al*., 2017) [19]. India ranks first in area of cultivation and second in production after China and third in export after Netherland and Spain (Karuppaiah *et al*., 2017) [11]. Onion production in India is around 26.91 million MT from an area of 16.28 million hectares as per (Anonymous, 2021) [3]. On average, India consumes an estimated 13 lakh tons of onion every month, and to meet this demand, the crop is grown in three seasons - *Kharif* (planted between July-August and harvested in October December); late *Kharif* (planted between October-November and harvested in January March); and *Rabi* (planted between December-January and harvested in March-May). Among the total production about 71% is used for domestic consumption, 20% goes waste during post harvest handling, 5% is being exported, 3% for processing and 1% is used for seed production. Telangana is a newly formed state gaining importance in all aspects in India.

In Telangana, onion is majorly grown in Gadwal, Sangareddy, Vikarabad, Nizamabad, Wanaparthy and Narayankhed areas in an area of 45,577 ha with a production of 4.5 lakh metric tons and a productivity of 9.8 tha^{-1} (Anonymous, 2022-23) [2]. In onions the red onion is predominantly produced in southern Telanagana while white onion in northern Telangana. The color of red onions is primarily due to anthocyanins present in the epidermal cells of the scale leaves of the bulb, and their main anthocyanin pigment is reported to be cyanidin 3-glucoside (Fossen *et al*. 1996; Fossen and Andersen 2003; Lee *et al*., 2015) [7, 6, 14]. The national productivity of onion in late *kharif* and *rabi* is around 25 tha^{-1}, where as it is only 8-10 tha^{-1} in *kharif* (Singh *et al*., 2017) [19]. *Kharif* production is highly vulnerable due to erratic monsoon, cloudy weather, continuous drizzling and rabi season high incidence of thrips aggravates the problem of purple blotch and *Stemphyllum* blight. Thrips is the key pest of onion causing 30-45% yield loss, besides it acts as vector for various plant viral diseases (Soumia *et al*., 2017) [20]. Purple blotch is an important fungal disease which result in necrosis or death of plant, delayed bulb formation and maturation, complete drying and decay of bulb scales and is more prominent in *kharif* and late *kharif* (Vanitha *et al*., 2017) [23]. Onion is produced in surplus in *rabi* which leads to fall in price and the onion produced in *kharif* and late *kharif* is less but has premium price in the market. Hence the farmers are showing interest to grow onion in late *kharif*. In order to increase the production of onion in late *kharif*, it is essential to replace the low productive varieties with high yielding varieties with least thrips and purple blotch disease incidence, least bolter and rot bulbs. Thus a trial was conducted with five onion varieties procured from DOGR, Rajgurunagar, Pune at Vegetable Research Station, Rajendranagar, Hyderabad of Telangana State.

Materials and Methods

A field trail was carried out during late *kharif* (August, 2020 – January, 2021) conducted with five entries Bhima Super, Bhima Red, Bhima Shakti, DOGR-1657 and DOGR-1669 at Vegetable Research Station, Rajendranagar, Hyderabad, Telangana State, India which is at an altitude of 545m above mean sea level and at 78º 39'93" E longitude and 17º32'27" N latitude. The experimental soil was clay loam in texture, neutral in reaction, low in available nitrogen and phosphorous, high in potassium and belongs to the order Alfisol of shallow to medium depth. The experiment was laid out in randomized block design (RBD) replicated four times. The seedlings were transplanted on to a raised bed i.e. broad bed and furrow with a plot size of 4.8 sq. m (4.0m x 1.2m) replicated four times. For thrips and purple blotch screening 1.0 sq.m area was allotted. A plant spacing of 15cm x 10cm was adopted. The crop was fertilized with recommended dose of 100:50:50:40 kg NPKS and 5 kg zinc per hectare as recommended by ICAR-Directorate of Onion and Garlic Research, Rajgurunagar, Pune. 50% N and 100% P2O5, K2O, S and ZnSO4 were added as basal dose and remaining 50% N in two equal splits at an interval of 30 and 45 days after transplanting. Recommended cultural practices were followed to raise the crops successfully.

At physiological maturity when 70% of neck fall or yellowing symptoms were noticed plants were harvested and used for determining yield attributes and yield. Average weight of marketable bulbs is calculated by dividing the total weight of marketable bulbs by total number of marketable bulbs. Bulbs less than 2.5 cm diameter are graded as under sized and bulbs more than 2.5cm diameter are taken into consideration for calculation of marketable yield. The total yield includes marketable and under sized bulbs. The TSS was calculated using Hand refractometer according to AOAC, 1975[1]. The thrips incidence was recorded on 1-5 scale and purple blotch severity was recorded with 0-9 scale. The PDI for purple blotch was determined by using the formula

$$(\text{PDI} = \frac{\text{Sum of numerical ratings}}{\text{Number of leaves observed x Maximum disease scale}} \times 100) \ldots\ldots..(1)$$

The data was analyzed statistically using *F*-test following Gomez and Gomez (1984) [8] LSD values at *P*=0.05 were used to determined the significance of difference between treatment means.

Table 1: Morphological bulb characteristics of red onion varieties tested during late *kharif* at Vegetable Research Station, Rajendranagar, Hyderabad.

Variety	Predominant Bulb Colour	Bulb Shape	Uniformity in Bulb Size
DOGR-1657	Red	Round	Average
DOGR-1669	Light Red	Round	High
Bhima Super	Light Red	Round	High
Bhima Red	Light Red	Round	High
Bhima Shakti	Red	Round	High

Table 2: Performance of Red onion varieties during late *kharif* at Vegetable Research Station, Rajendranagar, Hyderabad (Southern Telangana)

Variety	Average Bulb Weight (g)	Total Yield (tha^{-1})	Marketable Yield (tha^{-1})	TSS (^{0}Brix)	Bolter Bulbs (%)	Rot Bulbs (%)	Thrips Incidence *	PDI (%) Purple Blotch **
DOGR-1657	64.54	32.27	30.85	10.18	3.42	0.0	13.00 (3.71)	16.67 (24.04)
DOGR-1669	90.85	45.43	43.82	10.20	0.0	0.0	12.68 (3.69)	21.33 (27.44)
Bhima Super	88.45	44.25	42.92	9.61	0.0	3.51	16.25 (4.14)	32.00 (34.42)
Bhima Red	60.93	30.46	28.33	9.80	1.27	0.68	15.12 (4.01)	24.67 (29.76)
Bhima Shakti	86.62	43.31	41.92	9.25	0.98	1.62	9.25 (3.18)	30.00 (33.19)
S.Em+	1.29	2.64	2.94	0.35			0.14	0.94
C.D (*P*=0.05)	4.03	8.22	9.15	1.06			0.42	2.80

* Figures in parenthesis are square root transformed values

** Figures in parenthesis are angular transformed values

Results and Discussion

The predominant bulb colour of varieties Bhima Super, Bhima Red and DOGR-1669 were light red where as it was Red in the case of Bhima Shakti and DOGR-1657. The bulb shape of all the varieties was round. Average uniformity in bulb size was observed in DOGR-1657 and high amount of uniformity was noticed in rest of the varieties DOGR-1669, Bhima Super, Bhima Red and Bhima Shakti (Table-1). Among the five entries tested, DOGR-1669 recorded significantly higher mean bulb weight (90.85 g) over other

entries but was at par with Bhima Super. DOGR-1669 recorded significantly higher marketable yield (43.82 t ha^{-1}) over other entries but was at par with Bhima Super. DOGR-1669 recorded significantly higher total yield (45.43 t ha^{-1}) over other entries Bhima Red, DOGR-1657, Bhima Shakti and Bhima Super. Out of the five entries tested the least mean bulb weight, marketable and total yield was recorded by Bhima Red. Maximum TSS was noticed in DOGR-1669 (10.2º Brix) followed by DOGR-1657. Bolter bulbs were not noticed in DOGR-1669 and Bhima Super and no rotten bulbs were noticed in DOGR-1669 and DOGR-1657. Least incidence of thrips (9.25) was observed in Bhima Shakti followed by DOGR-1669. Least Percent Disease Index of purple blotch (16.67) was observed in DOGR-1657 followed by DOGR-1669 (Table-2).

The differences in morphological characters, yield attributes and yield may be due to genetic makeup of variety and suitability under different climatic and soil condition. The present results are in accordance with the findings of Mohanty (2001) [16], Tripathy *et al*. (2013) [21], Kushal *et al*. (2015) [13] and Sarkar *et al*. (2015) [17] in onion.

Conclusion

Among the five varieties tested, DOGR-1669, a round onion variety with light red predominant bulb colour which recorded maximum mean bulb weight, total yield, marketable yield, High TSS and with no bolter bulbs and rotten bulbs can be recommended for Southern Telangna Zone in Telanagna during late kharif conditions followed by Bhima Super. DOGR-1657 and DOGR-1669 are more tolerant to purple blotch and Bhima Shakti and DOGR -1669 are more tolerant to thrips.

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