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Performance of red onion varieties during *kharif* in Southern Telangana zone

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Abstract
A field experiment was conducted at Vegetable Research Station, SKLTSHU, Hyderabad, Telangana, India during *kharif* season (July-December, 2020) to study the performance of red onion varieties under short day conditions in Southern Telangana Zone. Experiment was conducted with five varieties Bhima Dark Red, Bhima Super, Bhima Red, DOGR-1625 and DOGR-1626. The varieties were replicated four times laid in Randomized Block Design. The predominant bulb colour of Bhima Red and DOGR-1626 was light red, Bhima Dark Red, Bhima Super and DOGR-1625 was Red. The bulb shape of Bhima Red was round and the rest were oval. The uniformity of bulb size was high in Bhima Dark Red, Bhima Super and DOGR-1625 and average in case of Bhima Red and DOGR-1626. Among the five entries tested, Bhima Dark Red recorded significantly superior mean bulb weight (71.35 g), total yield (35.64 t ha^{-1}) and marketable yield (34.38 t ha^{-1}) over other varieties but was at par with DOGR-1625 and DOGR-1626. The Highest TSS of 13.30^0Brix was observed in the variety DOGR-1625. Least percent of double bulbs were noticed in Bhima Dark Red. Least percent of bolter bulbs was noticed in DOGR-1626 (0.82%) followed by Bhima Dark Red (0.96%) and least percent of rotten bulbs was noticed in Bhima Dark Red (6.01%) followed by DOGR-1625 (9.68). Least incidence of thrips (1.75) and purple blotch (19.35%) was noticed in Bhima Dark Red.

Keywords: Bulb, *kharif*, high yielding varieties, red onion, TSS

Introduction
Onion belongs to the genus *Allium* of the family Amaryllidaceae (Welbaum, 2015) [27]. Onion is an important bulb crop throughout the world and is commercially cultivated in more than hundred countries. 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) [22]. 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) [18]. 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, 13, 12]. 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) [15]. 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) [14]. Onion production in India is around 26.91 million MT from an area of 16.28 million hectares (Anonymous, 2021) [2]. On average, India consumes an estimated 13 lakh tonnes 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). India contributes 8.9% of global production. 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 tonnes and a productivity of 9.8 tha^{-1}(Anonymous, 2022-2023) [3]. 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) [9, 8, 17]. The national productivity of onion in late kharif and *rabi* is around 25 tha^{-1}, whereas it is only 8-10 tha^{-1} in *kharif* (Singh *et al*., 2017) [23].

Among the various foliar diseases affecting leaves and bulbs, purple blotch incited by *Alternaria porri*, while thrips (*Thrips tabaci* L.) are among the insects that are most devastating and prevalent in many parts of India (Gupta *et al*., 2011) [11]. *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 (Saluke *et al*., 2017) [21]. 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) [24]. 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* (Vanitha *et al*., 2017) [25]. Hence the farmers are showing little interest to grow onion in *kharif*. Cultivation of resistant or tolerant varieties against thrips and purple blotch as a control measure is more economical but also environmentally safer than rest of the chemical control measures. *Kharif* onion is an off-season cultivation of the crop for which standardization of varieties is of immense utility. Hence, the present study was therefore conducted to identify the variety or advanced lines resistant or tolerant to onion thrips and purple blotch disease with high yield potential during *kharif* under field conditions.

Materials and Methods

A field experiment was carried out during *kharif* (July-December, 2020) with five entries Bhima Dark Red, Bhima Super, Bhima Red, DOGR-1625 and DOGR-1626 at Vegetable Research Station, Rajendranagar, Hyderabad, Telangana State, India which is at an altitude of 494 meters 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 m^2 (4.0 m X 1.2 m) replicated four times. For thrips and purple blotch screening 1.0 m^2 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 the morphological characteristics of bulb (Predominant bulb colour, shape, uniformity) yield attributes and yield. When more than 80% of the bulbs are uniform in size it is taken as high, 50 - 80% average and less than 50% as low. 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 refracto meter according to AOAC (1975) [1]. The thrips incidence was recorded on 1–5 scale and purple blotch severity was recorded with 0–9scale. The PDI for purple blotch was determined by using the formula

$$\text{PDI} = \frac{\text{Sum of numerical ratings}}{\text{Number of leaves observed} \times \text{Maximum disease scale}} \times 10 \quad (1)$$

The data was analyzed statistically using *F*-test following Gomez and Gomez (1984) [10], LSD values at *P*=0.05 were used to determined the significance of difference between treatment means.

Table 1: Morphological Bulb characteristics of Onion varieties tested during *kharif* at Vegetable Research Station, Rajendranagar, Hyderabad (Southern Telangana Zone)

Variety	Predominant bulb colour	Predominant bulb shape	Uniformity in bulb size
Bhima Dark Red	Red	Oval	High
Bhima Super	Red	Oval	High
Bhima Red	Light Red	Round	Average
DOGR-1625	Red	Oval	High
DOGR-1626	Light Red	Oval	Average

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

Variety	Average Bulb Weight (g)	Total Yield (t ha^{-1})	Marketable Yield (t ha^{-1})	TSS (^{0}Brix)	Double bulbs (%)	Bolter Bulbs (%)	Rot Bulbs (%)	Thrips incidence *	PDI (%) Purple Blotch **
Bhima Dark Red	71.35	35.64	34.38	8.67	2.51	0.96	6.01	1.75 (1.65)	19.35 (26.35)
Bhima Super	58.54	29.28	27.30	12.85	5.21	3.71	15.90	3.75 (2.17)	32.70 (34.69)
Bhima Red	64.66	32.33	30.95	10.10	4.68	2.62	12.29	6.00 (2.63)	34.75 (33.64)
DOGR-1625	70.75	35.38	34.30	13.30	4.31	2.49	9.68	3.25 (2.05)	27.33 (31.27)
DOGR-1626	68.07	34.04	32.95	12.83	2.89	0.82	15.84	2.75 (1.86)	22.75 (29.51)
S.Em ±	1.39	0.52	0.58	0.26	0.35	0.26	1.30	0.19	0.67
CD (*p*=0.05)	4.33	1.62	1.77	0.79	1.10	0.80	4.06	0.56	2.01

* Figures in parenthesis are square root transformed values

** Figures in parenthesis are angular transformed values

Results and Discussion

The present investigation revealed that there is significant variation among the five red onion varieties in *kharif* season under Southern Telangana zone conditions, which indicated the presence of significant genetic variability for all the traits. Among the five varieties the predominant colour of bulb is light red in Bhima Red and DOGR-1626 and red in Bhima Dark Red, Bhima Super and DOGR-1625. Bulbs of all the

varieties observed are oval except Bhima Red which is round. High amount of uniformity in bulb size was noticed in Bhima Dark Red, Bhima Super and DOGR-1625 (Table-1).

Among the five entries tested, Bhima Dark Red recorded significantly higher mean bulb weight (71.35 g) over other entries but was at par with DOGR-1625 and DOGR-1626. Bhima Dark Red recorded significantly higher marketable yield (34.38 t ha^{-1}) and total yield (35.64 t ha^{-1}) over Bhima Super and Bhima Red but was at par with DOGR-1625 and DOGR-1626. Out of the five entries tested the least mean bulb weight, marketable and total yield was recorded by Bhima Super. Maximum TSS was noticed in DOGR-1625 (13.3° Brix) followed by Bhima Super and DOGR-1626. Least percent of double bulbs were noticed in Bhima Dark red followed by DOGR-1626, highest percent of double bulbs were observed in Bhima Super. Least percent of bolter bulbs were noticed in DOGR-1626 (0.82%) followed by Bhima Super and least percent of rotten bulbs were noticed in Bhima Dark Red (Table-2). These results are in conformity with the findings of Warade *et al*. (1996) [26] and Khar Anil *et al*. (2007) [16]. Least incidence of thrips (1.75) and least Percent Disease Index of purple blotch (19.35) were noticed in Bhima Dark Red followed by DOGR-1626 and DOGR-1625 (Table-2). Similar results were reported by Mohanty *et al*. (2002) [19], Sarada *et al*. (2009) [20], Yadav *et al*. (2010) [28] Dewangan *et al*. (2012) [6] and Dwivedi *et al*. (2012) [7] under different climatic conditions with different varieties.

Conclusion

Bhima Dark Red a red onion variety, oval in shape, high uniformity in bulb size, which recorded the highest average bulb weight, marketable and total yield, less percent of bolter bulbs, least percent of rotten bulbs, least attack of thrips and least incidence of purple blotch can be recommended for Southern Telangana Zone during *kharif*. DOGR-1625 and DOGR-1626 which recorded on par yields with Bhima Dark Red and higher TSS values can also be recommended for the zone.

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