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Performance of High TSS Onion Varieties in Telangana

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ABSTRACT

Field experiments were conducted at Vegetable Research Station, Hyderabad, India during *rabi* seasons (October–March) of 2019–20, 2020–21 and 2021–22 to study the performance of high TSS varieties of onion in initial evaluation trial, advanced varietal trial-I and advanced varietal trial-II as part of All India Network Research Project on Onion and Garlic. The entries tested were DOGR-HT-1, DOGR-HT-2, DOGR-HT-3, DOGR-HT-4, Agrifound White, PKV White and Bhima Shweta. The predominant colour of all the entries was white and the predominant shape of the bulbs was oval. High amount of uniformity in bulb size was reported by Bhima Shweta and PKV white, while the rest of the entries DOGR-HT-1, 2, 3, 4 and Agrifound White reported average uniformity in bulb size. Among the seven entries tested DOGR-HT-2 reported the highest TSS value (17.77 °Brix) followed by DOGR-HT-3 (15.30 °Brix) and the least TSS value was reported by DOGR-HT-1. Maximum mean bulb weight (100.73 g), marketable yield (49.03 tha^{-1}) and total yield (50.48 t ha^{-1}) was reported by Bhima Shweta and it was followed by PKV White (100.26 g, 48.99 t ha^{-1} and 50.28 t ha^{-1}). The least average bulb yield (84.31 g), marketable yield (41.09 t ha^{-1}) and total yield (42.34 t ha^{-1}) was reported by DOGR-HT-2 but was at par with DOGR-HT-3 and DOGR-HT-4. Minimum incidence of thrips and purple blotch were noticed in DOGR-HT-4.

KEYWORDS: Onion, high TSS, qualitative and quantitative characters

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1. INTRODUCTION

Onion is an essential commodity of commerce, owing to a special pungency it is more valuable than any other vegetable (Dutt, 2017). Onion commonly known as "Queen of the kitchen" (Selvaraj, 1976; Griffiths et al., 2002) contains vitamin B, vitamin C and also traces of iron and calcium. As a culinary ingredient it adds to the taste and flavor in a wide range of food preparations and it is also used as a salad (Anonymous, 2022) and steroidal saponins (Carotenuto et al., 1999), which prevent absorption of cholesterol in the intestine (Ahmed et al., 2020) and also provide important nutrients and health promoting phyto chemicals. Regular consumption of onion has 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). Thus there is a steady increase in demand for onion across the world. In India, onion is predominantly cultivated during *rabi* (60%) followed by 20% each in *kharif* and late *kharif* season (Tripathy et al., 2013a). India ranks first in area of cultivation, second in production after China and third in export of onion after Netherland and Spain (Karuppaiah et al., 2017). Its productivity is low compared to world's productivity (Gupta et al., 2017). India is a major supplier of onion with a production of 260 lakh metric tons and contributes 8.9% of global production (Anonymous, 2021). The three major onion growing seasons in India are *kharif*, late *kharif* and *rabi*; however, 60–70% cultivation is mostly done in *rabi* season (Ghodke et al., 2017). Thrips and foliar diseases play the key role in reducing the bulb yield and quality of produce (Tripathy et al., 2013b). Among the various foliar diseases affecting leaves and bulbs, purple blotch incited by *Alternaria porri* Ell (Ciferri), while thrips (*Thrips tabaci* L.) among the insects are the most devastating and prevalent in many parts of India (Gupta et al., 2011), The price of onions is lower during these months due to greater supply. Among the total production about 71% is used for domestic consumption, 20% goes waste during post harvest handling and storage, 5% is being exported and 3% for processing and 1% are used for seed production. Processing of onion into various ready-to-eat or ready to use forms would increase consumption. Processing of onion into various products like dehydrated flakes, powder, onion oil, minimally processed onion, onion paste etc. will allow the effective utilization of onion waste. White colour onion is preferred for dehydration due to their appearance and preference in the market. Onions with high TSS (18–26%) are most vital attribute for processing. High TSS bulbs have less moisture for dehydration, requires less energy and needs less dehydration time, give white products, give higher product yield, at lower cost of processing. High pungent varieties are preferred for dehydration for better flavor retention after dehydration. Good quality onion with low diseases, moulds and insects both in the field and during storage increases the acceptability of an onion cultivar for processing. Hence a study was designed in All India Network Research Project on Onion and Garlic and the study was initiated to know the performance of different varieties with high TSS values and also identify a variety with high TSS value suitable for Telangana.

2. MATERIALS AND METHODS

2.1. Study site

Field experiments were conducted at Vegetable Research Station, Hyderabad, Sri Konda Laxman Telangana State Horticultural University, Telangana State, India, which is at an altitude of 494 meters above mean sea level and at 78°39'93"E longitude and 17°32'27" 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 during *rabi* seasons (October–March) of 2019–20, 2020–21 and 2021–22 to study the performance of high TSS varieties of onion in initial evaluation trial, advanced varietal trial-I and advanced varietal trial-II as part of All India Network Research Project on Onion and Garlic. The varieties tested were DOGR-HT-1, DOGR-HT-2, DOGR-HT-3, DOGR-HT-4, Agrifound White, PKV White and Bhima Shweta.

2.2. Method of data collection

The seedlings were transplanted on to a raised bed i.e. broad bed and furrow with a plot size of 4.8 m^2 (4.0×1.2 m^2) replicated thrice. For thrips and purple blotch screening 1.0 m^2 area was allotted. A plant spacing of 15×10 cm^2 was adopted. The crop was fertilized with recommended dose of 100:50:50:40 kg NPKS and 5 kg zinc ha^{-1} as recommended by ICAR-Directorate of Onion and Garlic Research, Rajgurunagar, Pune. About 50% N and 100% P_2O_5, K_2O, S and $ZnSO_4$ were added as basal dose and remaining 50% N in two equal splits at 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 2.5 cm 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 Anonymous, 1975. The thrips incidence was recorded on 1–5 scale. The damage rating for thrips was 1-1-20% foliage damage, 2-21-40% foliage damage, 3-41-60% foliage damage, 4-61-80% foliage damage and 5-81-100% foliage damage. The purple blotch severity was recorded with 0–5 scale. The disease rating for purple blotch was (0-No disease, 1-1-10%, 2-11-20%, 3-21-30%, 4-31-50% and 5-51-100%). The PDI for purple blotch was determined by using the formula

PDI =Sum of numerical ratings/(Number of leaves observed ×Maximum disease scale)×100

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

3. RESULTS AND DISCUSSION

The pooled results of three seasons revealed that there is significant variation among the seven varieties tested during *rabi* seasons of 2019–20, 2020–21 and 2021–22 in Telangana, indicating the presence of significant genetic variability for various traits.

3.1. Qualitative characters

The predominant colour of all the varieties was white and all the entries were oval in shape. Bhima Shwetha and PKV White showed high amount of uniformity in bulb size (>80% of the bulbs of the same size) and rest of the varieties were average (50–80% bulbs are of same size) in uniformity with respect to size.

3.2. Quantitative characters

3.2.1. Average bulb weight

The mean values of three years of study reveal that the average/mean bulb weight of the varieties ranged from 84.31 to 100.73 g. Maximum mean bulb weight was reported by Bhima Shweta (100.73 g) and it was at par with PKV White (100.26 g) and DOGR-HT-4 (98.49 g). DOGR-HT-2 reported the least mean bulb weight (84.31 g) (Table 1). These results are in conformity with the findings of Warade et al. (1996) and Khar et al. (2007) who have reported wide variation in the average bulb weight among the cultivars which might be due to different genetic make up.

3.2.2. Marketable yield and total yield

The mean values of three years of study reveal that the marketable yields of the varieties ranged from 41.09 to 49.03t ha^{-1} and the total bulb yields ranged between 42.34 to 50.48 t ha^{-1}. The maximum marketable yield (49.03 t ha^{-1}) and total yield (50.48 q ha^{-1}) was reported by Bhima Shweta and it was at par with PKV White (48.99 t ha^{-1} and 50.28 t ha^{-1}) and DOGR-HT-4 (47.81 t ha^{-1} and 49.72 t ha^{-1}). The least marketable yield and total yield were reported by DOGR-HT-2 (41.09 t ha^{-1} and 42.34 t ha^{-1}) (Table 1).

3.2.3. Thrips incidence

Three years of study revealed that the low thrips incidence was noticed in all the varieties tested with a rating of 1 on a scale of 1–5 and ranged between 6.97 to 9.14%. Minimum

Table 1: Performance of different high TSS varieties of onion for qualitative and quantitative characters at vegetable research station, Hyderabad, Telangana

Variety	Predominant bulb colour	Predominant bulb shape	Uniformity in bulb size	Avg. bulb weight (g)	Marketable yield (t ha^{-1})	Total yield (t ha^{-1})	Purple blotch PDI (%)	Purple blotch (scale 0–5)	Thrips incidence (%)	Thrips incidence (scale 1–5)
DOGR-HT-1	White	Oval	Average	90.85	43.84	45.83	22.95	3	7.40	1
DOGR-HT-2	White	Oval	Average	84.31	41.09	42.34	23.14	3	7.36	1
DOGR-HT-3	White	Oval	Average	84.87	41.32	42.78	24.64	3	9.14	1
DOGR-HT-4	White	Oval	Average	98.49	47.81	49.72	21.81	3	6.97	1
Agrifound white (C)	White	Oval	Average	93.49	45.16	47.15	24.50	3	7.16	1
Bhima Shweta (C)	White	Oval	High	100.73	49.03	50.48	24.50	3	7.05	1
PKV white (C)	White	Oval	High	100.26	48.99	50.28	29.20	3	7.52	1
SEm±				1.66	0.79	0.71	0.99		0.18	
CD (p<0.05)				5.11	2.42	2.19	3.02		0.55	

The values are pooled means of rabi, 2019–20, 2020–21 and 2021–22

incidence of thrips (6.97%) was observed in DOGR-HT-4 and it was followed by Bhima Shweta (7.05%). Maximum incidence of thrips was noticed in DOGR HT-3 (Table 1).

3.2.4. PDI purple blotch

Three years of study revealed that there was moderate incidence of purple blotch with a rating of 3 on a scale of 0–5 in all the varieties tested. Least incidence of purple blotch was observed in DOGR-HT-4 (21.81%) and it was followed by DOGR-HT-1 (22.95%) and DOGR-HT-2 (23.14%).

3.2.5. TSS

The study revealed that the pooled mean values of TSS of the varieties ranged between 13.31 to 17.77°Brix (Figure 1). Among the seven varieties tested maximum TSS value (17.77°Brix) was reported by DOGR-HT-2 (Figure 2) and was followed by DOGR-HT-3 (15.30°Brix) and the least TSS value was reported by DOGR-HT-1 (Figure 1). Similar results of wide variation in TSS were reported by Mohanty et al. (2002), Sarada et al. (2009), Yadav et al. (2010), Dewangan et al. (2012) and Dwivedi et al. (2012) under different climatic conditions with different varieties which might be due to variations in their genetic make up.

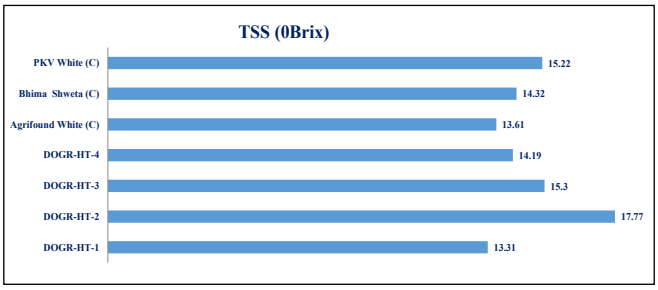

Figure 1: TSS of entries

Figure 2: High TSS entry DOGR-HT-2

4. CONCLUSION

The variety DOGR-HT-2 which reported a high TSS value of 17.77°Brix is highly suitable for processing or dehydration in Telangana.

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