Evaluation of Different Genotypes of Late Kharif Onion (*Allium Cepa* L.) Under The Gangetic Plains of West Bengal, India

ABSTRACT

Aim: Onions, (*Allium cepa* L.) is one of the highly significant bulbs crops extensively cultivated in India. The investigation entitled "Evaluation of different genotypes of Late Kharif Onion (*Allium Cepa* L.) under the Gangetic plains of West Bengal"is aimed at suggesting the more locally suitable genotypes to the farmer as well as the researchers.

Study Design: The experiment was conducted in randomized block design (RBD) with seven genotypes and they were randomized in three replications. This Experiment deals with seven different late kharif onion genotypes which consist of viz. Bhima Shakti, Bhima Kiran, Bhima Raj, DOGR-1605, NHRDF-Red-2, DOGR-1606 and PRO-7.

Place and Duration of Study: The research investigation was conducted at C-Block farm, Bidhan Chandra Krishi Viswavidyalaya, Kalyani, Nadia, West Bengal during the year 2022-2023.

Methodology: 30 days old seedlings were transplanted at 15 cm between lines and 10 cm within it. All other intercultural operations were done as and when necessary. Harvesting of bulbs was done at maturity stage. Biometrical observations and yield attributing characters were recorded from randomly selected 10 plants from each replication and the quality parameters were evaluated from randomly selected 5 plants.

Results: From the present investigation it was found that the late kharif onion genotype Bhima Shakti emerged with the highest yield (285.80 q-ha) but in terms of other quality parameters the genotype NHRDF -Red-2 found quite good in TSS (14.12˚B) and pyruvic acid content of (6.24 µmol-g), whereas genotypes Bhima Raj, exhibits lowest total sugar of (2.40 %) and reducing sugar of (2.13%).

Conclusion: Although from the above experiment it may be concluded that in case of late kharif onion genotypes the genotypes Bhima Shakti, Bhima Raj and NHRDF-Red-2 performed well.

Keywords: Significant, Biometrical, Total sugar, Reducing sugar, Pyruvic acid,Production, West Bengal.

INTRODUCTION

In India, onion production is divided into three distinct seasons. The first season for growing the onion is as kharif crop. This season contributes approximately 20% to the total onion production in the country. Based on data from the National Horticulture Board (NHB) in 2020, Maharashtra alone contributes approximately 32.6% of the global onion output. The second season, known as the late kharif crop, covers the period following the kharif season and accounts for around 30% of the output. The most significant season for onion production is the rabi crop. This season represents approximately 50% of the total onion production in India. The rabi crop plays a crucial role in meeting the domestic and export demands for onions. Still the late kharif onion production is important to fulfil the market demand as well as to fetch the higher market price in the absence of rabi onion. The produce from the late kharif season is consumed over a span of one to two months due to their high demand in both domestic and export markets. For late kharif onions, the sowing of seeds typically occurs between August to September. Transplanting takes place from September to October. Unlike kharif onions, the seedlings for late kharif onions are ready earlier, allowing for transplanting to occur sooner. The time taken from sowing to transplanting is shorter for late kharif onions compared to kharif onions(Gupta et.al. 2019). Similar to kharif onions, late kharif onions also require three to four

UNDER PEER REVIEW

months to reach maturity. After reaching maturity, some additional time is needed before they are ready for harvesting. Generally, the harvesting of late kharif onions takes place during the months of January to February.

Mahala et al (2019) showed that transplanting of onion in 15×10cm resulted in significantly higher plant height (30.87 cm), number of leaves per plant (12.20), bulb diameter (polar-5.20 cm and equatorial-5.74 cm) and average bulb weight (83.90g).The majority of onion storage units in India are conventional and lack scientific practices, resulting in relatively low storage capacities. During a 3-4 months storage period, various factors contribute to storage losses, including physiological loss in weight (PLW) or moisture loss and shrinkage (30-40%), rotting (20-30%), and sprouting (20-40%). However, during the period from June to November, there is no fresh onion harvest across the country. This period is considered critical as there is a scarcity of fresh onions, leading to an increase in the market price of onion bulbs (Tripathi and Lawande, 2013).

With the aforementioned in mind, the following goals were set for the present enquiry, which looked at “Evaluation of different genotypes of Late Kharif Onion (Allium Cepa L.) under the Gangetic plains of West Bengal”: to estimate the average performance of different qualities of the genotypes, to determine the promising variety fit for growing in West Bengal during the Kharif and pre-Kharif seasons, to identify the suitable genotypes for good storage capacity, to identify the suitable genotypes with good yield.

MATERIAL AND METHODS

The experiment was conducted at "C" Block Farm, located in Kalyani, under Bidhan Chandra Krishi Viswavidyalaya, Mohanpur, Nadia, West Bengal, India, during June, 2022 to March , 23. The experimental site is under subtropical warm and humid region with range of average temperature of 33.71 ̊C (max.) to 12.05 ̊C (min.) and average R.H. of 94.13 % (max.) to 70.62 % (min.) during the experimental period (June, 2022 to March, 2023) the years. In the experiment with seven genotypes namely, Bhima Shakti, Bhima Kiran, Bhima Raj, DOGR-1605, NHRDF-Red-2, DOGR-1606 and PRO-7, were planted and evaluated in randomized block design with three replications. The recommended fertilizer dose of 120 kg N, 50 kg P_2O_5 and 100 kg K_2O ha^{-1} was applied in the plots (1.5 m X 1.0 m). 30 days old seedlings were transplanted at 15 cm between lines and 10 cm within it. Observations on different growth parameters were taken at different times from randomly selected plants from each plot in different replications. There are some parameters which were recorded after harvest from randomly selected plants.Different parameters like growth parameters [i.e., Plant height (cm), Leaf length (cm), Number of leaves per plant, Leaf diameter (cm)], yield and yield attributing characters [i.e., Polar diameter (mm), Days to maturity, Equatorial diameter (mm), Days to harvest, Neck thickness (mm), Marketable yield (q-ha), Average bulb weight (g), Total yield (q-ha) and double bulb (%)] Quality character [i.e., TSS (̊B), Pyruvic acid content (µmol-g), Total sugar (%),Reducing sugar (%),Non-reducing sugar (%)and Dry matter content (%)], disease and pest incidence parameters [i.e., Stemphylium blight (%) and Thrips (%)] and storage parameters [i.e., Physiological weight loss (%), Rotting (%) and Sprouting (%)].All other intercultural operations were done as and when necessary. Harvesting of bulbs was done at maturity stage. Biometrical observations and yield attributing characters were recorded from randomly selected 10 plants from each replication and the quality parameters were evaluated from randomly selected 5 plants. The statistical analysis was done as per methods suggested by Panse and Sukhatme (1954).

RESULTS AND DISCUSSION

1. Growth parameters:

Plant height (cm): The differences in plant height data of seven different late kharif onion genotypes presented in the table-1 showed significant variation. The plant height data varied from 40.58cm-47.55cm. From the different late kharif onion genotypes the highest plant height 47.55cm was recorded in Bhima Kiran genotype followed by the lowest 40.58cm in DOGR-1605. The variation in the plant height of different late kharif onion genotypes might be due to the changes in genetic inheritance of the individual genotypes. Mahala *et al.* during the year 2019 reported similar research work on the variation in plant height between the different onion genotypes.

Number of leaves^{-plant}: The data of variation in number of leaves-plant as presented in the table-1 among the different late kharif onion genotypes was found significant. The data of number of leaves

UNDER PEER REVIEW

per plant varied from 7.20-8.13. Among the different late kharif onion genotypes the genotype Bhima Shakti emerged with the highest number of leaves 8.13 and the lowest number of leaves per plant 7.20 was noticed in the genotype PRO-7. The variation in number of leaves per plant was found similar in the report of Gupta *et al.* in the year 2019.

Leaf length (cm): The variation in leaf length between the seven late kharif onion genotypes presented in the table-1. The leaf length of the plants varied from 33.11-41.81cm. The genotype Bhima Kiran emerged with the highest leaf length 41.81cm and the genotype DOGR-1605 showed the lowest leaf length 33.11cm among the genotypes. The similar research work was also reported by some of the researchers. The variation in leaf length between the genotypes was found similar with the findings of Behera *et al*. (2017).

Leaf diameter (cm): The difference in the leaf diameter of the seven different late kharif onion genotypes as presented in the table-1 was found significant. The variation in leaf diameter of seven different late kharif onion genotypes was ranged from 0.94cm-1.14cm. Among all the late kharif onion genotypes the highest leaf diameter of 1.14cm was recorded form the genotype PRO-7 and the lowest leaf diameter of 0.94cm was observed from the genotype Bhima Shakti. Some of the researchers also reported similar research work. Tripathi *et al.* during the year 2020 has reported similar variation in leaf diameter among the genotypes.

2. **Yield and yield attributing character:**

Polar diameter (mm): The data of variation in the polar diameter of seven different late kharif onion genotypes presented in the table-2 found significant. The variation in polar diameter of different late kharif onion genotypes differ from 47.81mm-52.65mm. Among the different genotypes the genotype Bhima Shakti showed the highest polar diameter 52.65mm followed by the genotype PRO-7 the lowest 47.81mm. Similar to the present investigation Upadhyay *et al.* during the year 2019 reported the variation in polar diameter between the genotypes. The difference in polar diameter might be due to the variability in the individual genetic inheritance of the genotypes.

Equatorial diameter (mm): The variation in equatorial diameter presented in the table-2 showing significant variability among the seven different late kharif onion genotypes. The equatorial diameter between the different genotypes varied from 52.33-60.82mm. The highest equatorial diameter 60.82mm was noted from the genotype DOGR-1606 and the genotype NHRDF-Red-2 emerged with the lowest equatorial diameter 52.33mm among the genotypes. The variation in equatorial diameter was found similar to the research work of Gupta *et al.* during the year 2019. The reason behind the variation in equatorial diameter might be each individual genotypes have different genotypic constitution due to their inheritance pattern.

Neck thickness (mm): The data of neck thickness as presented in the table-2, between the seven different late kharif onion genotypes found significant. The neck thickness among the different late kharif onion genotypes ranges from 4.75mm-7.16mm. The genotype PRO-7 showed the highest neck thickness 7.16mm followed by the genotype Bhima Shakti with the lowest 4.75mm. The genetic inheritance pattern might be the reason that leads to take different days for reaching the maturity which ultimately leads to the difference in the neck thickness. Similar research work of variation in the neck thickness was reported by Gupta *et al.* during the year 2019 and they also mentioned that the neck thickness always varied according to the specific character of the plants.

Average bulb weight (g): The data of average bulb weight presented in the table-2 showed effective difference in the average bulb weight of seven different late kharif onion genotypes. The average bulb weight of the genotypes ranges from 71.10-88.62g. The genotype Bhima Kiran emerged with the highest average bulb weight 88.62g followed by the genotype DOGR-1605 with the lowest 71.10g. The highest and lowest polar and equatorial diameter indicates the differences in the average bulb weight. The varied weight of individual bulb might be due to the changes in the genotype of the seven different late kharif onions. The similar research work has been reported by some of the researchers. The variation in average bulb weight was fond similar in the report of Bal *et al.* during the year 2020.

Double bulb (%): The table-2 represent effective differences in the percentage of double bulb among the different late kharif onion genotypes. The double bulb percentage of different genotypes varies from 1.85-3.70 (%). The genotype NHRDF-Red-2 emerged with the highest double bulb percentage 3.70 and the genotype DOGR-1606 with the lowest 1.85 (%). The variation in double bulb percentage might be due to the genotypic inheritance of the individual genotypes which ultimately affects the total yield and reduces the price of the bulbs in the market. The variation in the double bulb percentage

UNDER PEER REVIEW

was reported by some of the researchers. Tripathy *et al.* during the year 2020 reported similar variation in double bulb percentage among the genotypes.

Days to maturity (days): The late kharif onion genotypes take different times to reach the maturity presented in the table-3. The differences in days taken to reach the maturity varies from 113.33-117.33days. The genotype DOGR-1606 took highest 117.33 days to reach the maturity followed by the genotype PRO-7 with the lowest 113.33 days. The changes in the genetic constitution of the individual genotype along with the variability in the weather parameters might be the cause to take different days to reach maturity. Similar research works were also reported by some of the researchers. The variation in the days taken to reach the maturity found similar in the report of Das *et al.* (2020).

Days to harvest (days): The differences in the days taken to reach the harvest after getting maturity of seven different late kharif onion genotypes represented in the table-3. The data of days to harvest varies from 133.00-140.00 days. The genotype DOGR-1606 took highest 140.00 days to reach the harvesting followed by the genotype DOGR-1605 with the lowest 133.00 days among the different late kharif onion genotypes. The differences in the genetic constitution and the response of different genotypes might be the cause behind different days for reaching the harvesting. Similar research works were also reported by some of the researchers. Meghana *et al.* during the year 2021 reported similar differences in the days taken to harvesting between the different genotypes.

Marketable yield (q-ha): The differences in the marketable yield (q-ha) of different late kharif onion genotypes presented in the table-3. The marketable yield of the different genotypes varied from 82.10-279.61 (q-ha). The highest marketable bulb yield of 279.61 (q-ha) was recorded from the genotype Bhima Shakti followed by the yield of 82.10 (q-ha) from the genotype PRO-7. The difference in marketable yield of seven late kharif onion genotypes might be due to the impact of different genes with their yield attributing character. Similar research works were reported by some of the researchers. The variation in the marketable yield differed between the genotypes as reported by Bal *et al.* during the year 2020.

Total yield (q-ha): The significant variation in the total yield (q-ha) between seven different genotypes of late kharif onion was presented in the table-3. The variation in the data of total yield of the genotypes ranges from 87.99-285.80 (q-ha). Among the different late kharif onion genotypes the genotype Bhima Shakti showed the maximum yield of 285.80 (q-ha) followed by the lowest yield 87.99 (q-ha) from the genotype PRO-7. The different genetic constitution of the different late kharif onion genotypes and their response to the varied weather parameters might be the reason behind the variation in the total yield. The production of some unmarketable bulbs, sprouting and rotting lead to the differences between the total yield and the marketable yield. The unmarketable bulbs ultimately result in total yield reduction of the genotypes. The variation in the total yield was found similar with the findings of Ananthan *et al.* (2010).

3. **Quality characters:**

TSS (˚B): The data of TSS (˚B) content of the seven genotypes of late kharif onion presented in the table-4 showed significant variation. The amount of TSS content of the genotypes ranges from 12.07-14.12 (˚B). The genotype NHRDF -Red-2 showed the highest TSS 14.12 (˚B) content among the different late kharif onion genotypes and the genotype DOGR -1606 showed the minimum TSS content 12.07 (˚B). Behera *et al.* during the year 2017 reported similar variation in the TSS (˚B) content among the different genotypes.

Total sugar (%): The variation in the total sugar (%) content among the different genotypes of late kharif onion presented in the table -4. The total sugar (%) content of the different genotypes varied from 2.40-3.21 (%). The maximum amount of total sugar content 3.21 (%) was found from the genotype Bhima Kiran and the lowest total sugar content was recorded from the genotype Bhima Raj (%). Similar research works were done by some of the researchers. The variation in the total sugar (%) content between the different genotypes was found similar with the findings of Ananthan (2010).

Reducing sugar (%): The variation in the reducing sugar (%) content among the different genotypes of seven late kharif onion presented in the table-4. The amount of reducing sugar (%) content among the genotypes varied from 2.15-2.91 (%). The highest amount of reducing sugar 2.91 (%) found from the genotype Bhima Kiran followed by the lowest 2.15 (%) from the genotype Bhima Raj. Das *et al.* in the year 2017 reported similar variation in the reducing sugar (%) content among the genotypes.

UNDER PEER REVIEW

Non reducing sugar (%): The differences in the content of non-reducing sugar (%) of seven late kharif onion genotypes presented in the table-4. The amount of non-reducing sugar (%) varied from 0.25-0.32 (%). The genotype DOGR-1605 showed the highest amount of non-reducing sugar 0.32 (%) and the genotype DOGR-1606 the lowest 0.25 (%) among the different genotypes of late kharif onion. The changes in the content of non-reducing sugar percentage might be due to the variation in the total sugar content and the reducing sugar content. The variation in the non-reducing sugar content among the different genotypes of onion were corroborated with the findings of Manjunathagowda*et al.* (2021).

Pyruvic acid content (µmol-g): The differences in the amount of pyruvic acid content between the genotypes of late kharif onion presented in the table-4. The variation in pyruvic acid content ranges from 3.76-6.24 (µmol-g). The genotype NHRDF-Red-2 contains the highest 6.24 (µmol-g) amount of pyruvic acid and the genotype DOGR-1606 the lowest 3.76 (µmol-g) among all the genotypes. The similar research works were also reported by some of the researchers. The variation in pyruvic acid content (µmol-g) between the genotypes are found corroborated with the report of Manjunathgowda*et al.* (2021).

Dry matter content (%): The data of dry matter content of different genotypes of late kharif onion presented in the table-4 implies the variability between the genotypes. The variation in dry matter content among the genotypes varied from 6.21-8.19 (%). The maximum amount of dry matter content 8.19 (%) was found from the genotype Bhima Shakti followed by the genotype DOGR-1605 the lowest 6.21 (%). The genetic inheritance of the individuals and the variation in the moisture content of the genotypes might be the reason behind the variation in the dry matter content (%) between the genotypes. The variation in dry matter content were found corroborated with the findings of Upadhyay *et al.* (2020).

4. **Disease and Pest incidence:**

Stemphylium blight (%): The variation in the attack of Stemphylium blight (%) represent in the table-5 on the different genotypes of late kharif onion was found significant. The variation in the attack of the disease ranges from 23.12-33.59 (%). The highest attack 33.59 (%) of the disease was observed in the genotype NHRDF-Red-2 followed by the lowest 23.12 (%) from the genotype Bhima Raj. The variation in the attack percentage of the disease might be due to the resistance power of the individual genotype along with the availability of the favourable weather parameters.

Thrips incidence (%): Differences in the thrips attack percentage presented in the table-5, among the different genotypes of late kharif onion. The differences in the percentage of attack of thrips ranges from 22.22-44.11 (%). The genotype Bhima Raj emerged with the maximum attack of thrips 44.11 (%) followed by the genotype DOGR-1606, the lowest 22.11 (%). The differences in the attack percentage of thrips might be due to the resistance capacity of the different genotypes with the help of different genetic constitution.

5. **Storage parameters:**

Physiological weight loss (%): The variation in the physiological weight loss of the seven different genotypes of late kharif onion presented in the table-6. The data of physiological weight loss percentage varies from 13.56-19.48 (%). Among the different genotypes, the maximum physiological weight loss 19.48 (%) was recorded from the genotype PRO-7 and the genotype Bhima Shakti, the lowest 13.56 (%). The presence of moisture into the bulb might be the reason behind the differences in the physiological weight loss percentage.

Rotting (%): There was a significant difference in rotting (%) presented in the table-6 among the seven different genotypes of late kharif onion. The percentage of rotting among the genotypes varied from 10.01-14.59 (%). The genotype PRO-7 showed the maximum percentage of rotting 14.59 (%) and the lowest 10.01 (%) was found from the genotype Bhima Shakti. The differences in the percentage of rotting were found might be due to the aeration during storage and the content of moisture of the whole bulbs.

Sprouting (%): The mean data of sprouting (%) presented in the table-6 showed significant variation between the different genotypes of late kharif onion. The sprouting percentage among the genotypes varied from 9.15-13.18 (%). The genotype PRO-7 showed the maximum sprouting 13.18 (%) and the genotype Bhima Shakti emerged with the lowest 9.15 (%). The availability of darkness and the presence of moisture into the bulbs itself might be the reason for differences in bulb sprouting percentage.

UNDER PEER REVIEW

CONCLUSION

From the current research work it was found that the late kharif onion genotype Bhima Shakti emerged with the highest yield (285.80 q-ha) but in terms of other quality parameters the genotype NHRDF-Red-2 found quite good in TSS (14.12°B) pyruvic acid content (6.24 µmol-g), and Bhima Raj in total sugar (2.40 %) and reducing sugar (2.13 %) are found quite good. In respect to the storage parameters the genotype Bhima Shakti exhibits lowest physiological loss in weight of (13.56 %) and lowest rotting percentage of (10.01%) and the lowest sprouting percentage of (9.15%). Amongst the genotypes Bhima Raj and DOGR-1606 has found the best in respect of less infestation of disease and pest, especially Bhima Raj tolerant to Stemphylium blight and DOGR-1606 was tolerant to Thrips. From the above experiment it may be concluded that in case of late kharif onion genotypes the genotypes Bhima Shakti, Bhima Raj and NHRDF-Red-2 performed well.

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UNDER PEER REVIEW

UNDER PEER REVIEW

Table-1: Mean performances of growth parameters of late kharif onion

Genotypes	Plant height(cm) at 70 DAT	Number of leaves per plant	Leaf length(cm) at 70 DAT	Leaf diameter (cm) at 70 DAT
Bhima Shakti	43.76	**8.13**	37.80	**0.94**
Bhima Kiran	**47.55**	7.97	**41.81**	1.11
Bhima Raj	43.18	7.83	39.11	1.08
DOGR-1605	**40.58**	7.47	**33.11**	0.99
NHRDF-Red-2	41.27	7.63	35.74	1.02
DOGR-1606	43.11	7.30	38.81	1.13
PRO-7	43.01	**7.20**	36.87	**1.14**
Mean	43.21	7.65	37.61	1.06
S.Em. ±	1.498	0.189	1.894	0.037
CD at 5%	4.62	0.58	5.84	0.11
CV (%)	6.01	4.28	8.73	6.00

Table-2: Mean performances of yield attributing character of late kharif onion

Genotypes	Polar diameter(mm)	Equatorial diameter(mm)	Neck thickness(mm)	Average bulb weight(g)	Double bulb (%)
Bhima Shakti	**52.65**	60.43	**4.75**	75.80	2.59
Bhima Kiran	51.66	58.40	6.16	**88.62**	2.22
Bhima Raj	50.18	58.38	6.60	80.24	2.96
DOGR-1605	52.23	60.62	5.15	**71.10**	2.22
NHRDF-Red-2	49.18	**52.33**	4.88	76.28	**3.70**
DOGR-1606	48.27	**60.82**	6.98	85.60	**1.85**
PRO-7	**47.81**	54.51	**7.16**	86.00	3.33
Mean	50.28	57.93	5.95	80.52	2.70
SE(m) ±	1.064	1.947	0.537	4.830	0.374
CD at 5%	3.28	6.00	1.66	14.88	1.15
CV (%)	3.67	5.82	15.64	10.39	24.05

UNDER PEER REVIEW

Table-3: Mean performances of yield and yield attributing characters of late kharif onion genotypes

Genotypes	Days to maturity	Days to harvest	Marketable yield(q^{-ha})	Total yield(q^{-ha})
Bhima Shakti	115.33	134.67	**279.61**	**285.80**
Bhima Kiran	114.00	136.33	235.84	241.88
Bhima Raj	113.67	137.33	100.74	108.89
DOGR-1605	114.33	**133.00**	154.61	163.25
NHRDF-Red-2	114.67	134.33	266.77	273.29
DOGR-1606	**117.33**	**140.00**	192.28	198.73
PRO-7	**113.33**	134.33	**82.10**	**87.99**
Mean	114.67	135.71	187.42	194.26
SE(m) ±	1.038	1.468	11.504	11.274
CD at 5%	3.20	4.52	35.45	34.74
CV (%)	1.57	1.87	10.63	10.05

Table-4: Mean performances of quality parameters of late kharif onion

Genotypes	TSS (°B)	Total sugar (%)	Reducing Sugar (%)	Non-Reducing Sugar (%)	Pyruvic Acid (µ mole/g)	Dry Matter Content (%)
Bhima Shakti	12.70	2.86	2.57	0.29	4.74	**8.19**
Bhima Kiran	14.05	**3.21**	**2.91**	0.30	5.63	6.91
Bhima Raj	12.97	**2.40**	**2.13**	0.27	5.20	7.59
DOGR-1605	13.97	3.18	2.86	**0.32**	4.36	**6.21**
NHRDF-Red-2	**14.12**	3.09	2.79	0.30	**6.24**	7.16
DOGR-1606	**12.07**	2.57	2.32	**0.25**	**3.76**	7.33
PRO-7	13.33	2.85	2.59	0.26	4.79	8.05
Mean	13.32	2.88	2.60	0.28	4.96	7.35
SE(m) ±	0.167	0.082	0.074	0.013	0.172	0.351
CD at 5%	0.51	0.25	0.23	0.04	0.53	1.08
CV (%)	2.17	4.93	4.95	7.79	6.00	8.27

UNDER PEER REVIEW

Table-5: Mean performances of disease and pest incidences

Genotypes	Stemphylium blight (%)	Thrips (%)
Bhima Shakti	27.15	30.22
Bhima Kiran	29.49	43.56
Bhima Raj	**23.12**	**44.11**
DOGR-1605	27.63	22.56
NHRDF-Red-2	**33.59**	23.67
DOGR-1606	29.83	**22.22**
PRO-7	26.69	23.22
Mean	28.21	29.94
SE(m) ±	0.959	1.145
CD at 5%	2.95	3.53
CV (%)	5.88	6.62

Table-6: Mean performances of storage parameters of late kharif onion

Genotypes	Physiological weight loss (%) at 90 days	Rotting (%) at 90 days	Sprouting (%) at 90 days
Bhima Shakti	**13.56**	**10.01**	**9.15**
Bhima Kiran	13.97	11.10	10.48
Bhima Raj	14.80	12.29	11.75
DOGR-1605	15.07	13.04	11.28
NHRDF-Red-2	16.06	12.64	11.33
DOGR-1606	17.46	14.04	12.14
PRO-7	**19.48**	**14.59**	**13.18**
Mean	15.77	12.53	11.33
SE(m) ±	0.861	0.655	0.645
CD at 5%	2.65	2.02	1.99
CV (%)	9.45	9.06	9.86

UNDER PEER REVIEW

UNDER PEER REVIEW

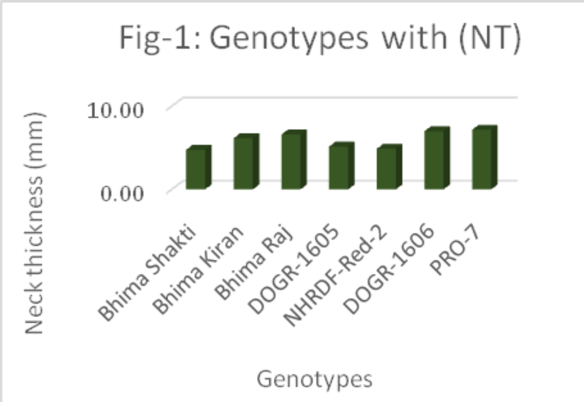

Fig-1: Genotypes with (NT)

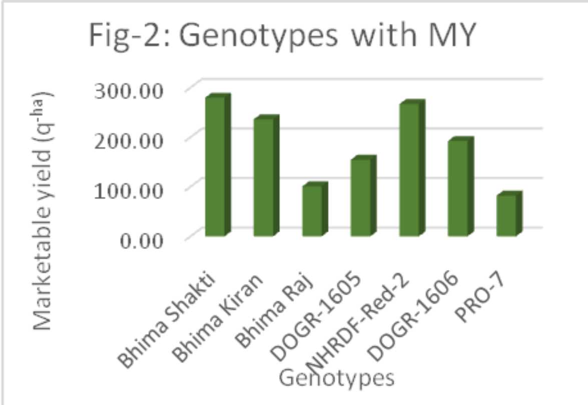

Fig-2: Genotypes with MY

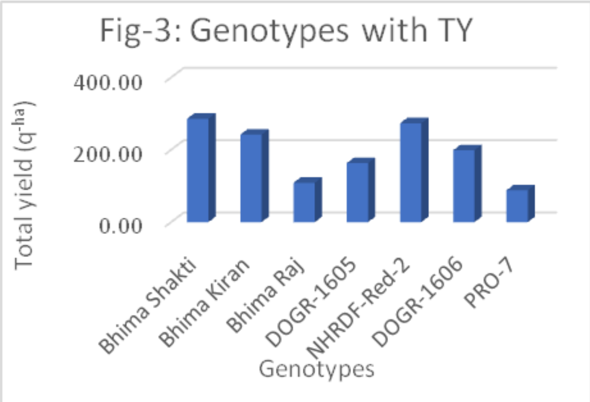

Fig-3: Genotypes with TY

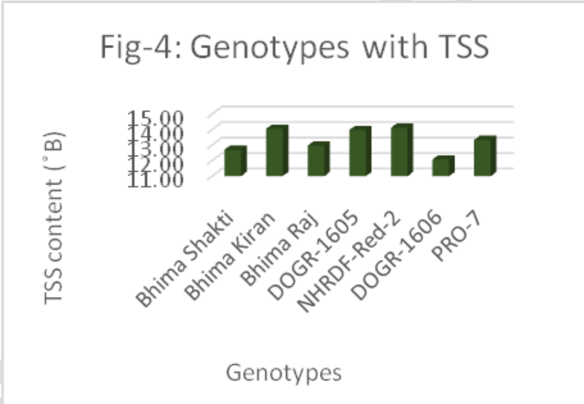

Fig-4: Genotypes with TSS

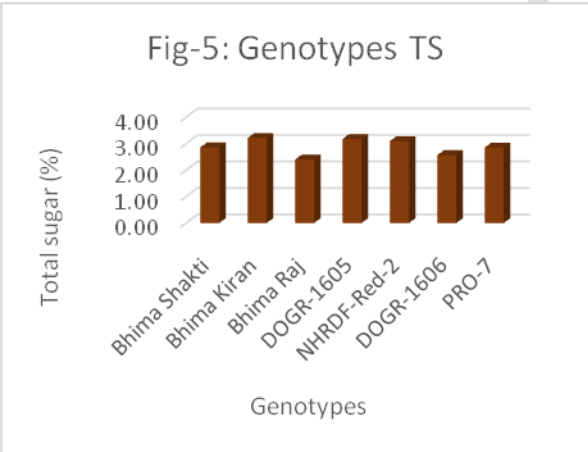

Fig-5: Genotypes TS

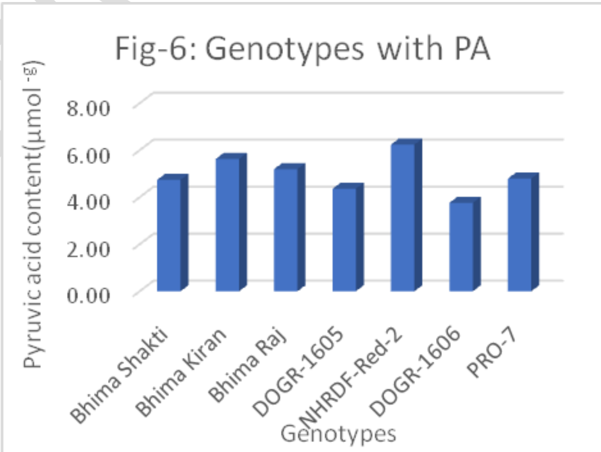

Fig-6: Genotypes with PA

NT- Neck thickness, MY- Marketable yield, TY- Total yield, TSS- total soluble solids, TS-total sugar, PA- Pyruvic acid content

Plate 1: Plots of genotypes and Harvested bulbs of late kharif onion genotype