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Assessment of Onion (Allium Cepa L.) Genotypes for Horticultural Traits During Kharif Season

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ABSTRACT

The present investigation entitled "Assessment of onion (*Allium Cepa* L.) genotypes for horticultural traits during kharif season" was conducted at C"-Block farm, Bidhan Chandra Krishi Viswavidyalaya, Kalyani, Nadia, West Bengal during the year 2022- 2023. The experiment was conducted in simple randomized block design (RBD) with seven genotypes and they were randomized in three replications. This Experiment deals with seven different kharif onion genotypes which consist of (viz. DOGR-1627, N-53, Bhima Super, Balwan, Bhima Dark Red, Baswant-780 and Agrifound Dark Red). Through the current investigation the genotype DOGR-1627 was found better than the others in terms of yield (491.49 q^{-ha}), double bulb percentage (2.96 %), neck thickness (5.59 mm) and days taken for maturity (124.67 days) as well as for harvesting (139.00 days). But in terms of quality parameters the genotype Balwan showed maximum Total soluble solids (TSS) of (14.30˚ B), Bhima dark red in total sugar percentage (2.47 %), reducing sugar percentage (2.25 %) and the highest polar diameter was recorded from the genotype Basawant-780 (59.57 mm). The genotypes from kharif group could be selected for further improvement and breeding work in future in this particular growing region. Although from the above experiment it may be concluded that in case of Kharif onion, the genotype DOGR-1627 found to be an ideal genotype in respect to marketable yield, neck thickness, double bulb percentage and days taken for maturity.

Key words: onion, genotypes, horticulture, kharif season,

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, which is available from April to June. 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. The produce from the kharif season is consumed over a span of one to two months due to their high demand in both domestic and export markets. Typically, kharif onions in India are sown in nursery beds between June and July. The transplanting process usually takes place from the last week of July to the second week of August, although it can also occur in the first week of August. The onions take approximately three to four months to mature after transplanting. Following maturity, it takes an additional ten to twenty days for the onions to be ready for harvest. The harvesting of

kharif onions is typically carried out from November to December. 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).

MATERIALS 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-March, 23. The soil of experiment site was sandy loam in texture with 0.61 (%) organic carbon, 203.26 kg^{-ha} total nitrogen, available phosphorous 7.54 kg^{-ha}, available potassium 178.57 kg^{-ha} and pH 7.12. The experimental site is under subtropical warm and humid region with range of average temperature of 33.71℃ (max.) to 12.05℃ (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 varieties namely, DOGR-1627, N-53, Bhima Super, Balwan, Bhima Dark Red, Baswant-780 and Agrifound Dark Red 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 (1mm X 1.5m). 36 days old seedlings were planted 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 sample 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:

Growth parameters

Plant height (cm): The plant height data presented in table-1 showed that seven different kharif onion genotypes varied significantly. The plant height varied from 48.95cm-54.72cm. Among the different genotypes the highest plant height of 54.72cm was recorded in Balwan genotype followed by 48.95cm in Agrifound Dark Red. The variation in plant height of the different genotypes might be due to the genetic inheritance of the individual genotypes as well as the factor related to temperature for growth and yield of the plant. The similar results were also founded by some of the workers. The highest plant height variation among the genotypes were similar with the findings of Mahala *et al.* (2019).

Number of leaves^{-plant}: Number of leaves-plant within the different kharif onion genotypes showed significant effect and the results are presented in table-1. Among the different genotypes the genotype Agrifound Dark Red showed the maximum number of leaves 8.83 and the minimum number of leaves per plant was obtained from the genotype DOGR-1627 with the value of 8.33. Similar research work was done by Gupta *et al.* during the year 2019.

Leaf length (cm): There was a significant variation of leaf length among the seven genotypes of kharif onion as mentioned in the table-1. The highest leaf length was recorded from the genotype Bhima Dark Red and the genotype Agrifound Dark Red showed the lowest leaf length among the other genotypes. The genotype Bhima Dark Red exhibit the leaf length of 49.69 cm and the genotype Agrifound Dark Red

showed the leaf length 0f 43.42 cm. The similar result was also found by some of the researchers. The highest leaf length variation among the genotypes was found similar with the findings of Behera *et al.* (2017).

Leaf diameter (cm) : There was a significant difference in the leaf diameter of the seven genotypes of kharif onion as presented in the table-1. The leaf diameter of seven different kharif onion genotypes varied from 0.98cm-1.06cm. Among all of the kharif onion genotypes the genotype Agrifound Dark Red represent the highest leaf diameter of 1.06cm and the genotype Bhima Super showed the lowest leaf diameter of 0.98cm. The similar results were also reported by some of the researchers. The variation in the leaf diameter among the genotypes are found similar with the findings of Tripathi *et al.* (2020).

Yield and yield attributing character:

Polar diameter (mm): The existence of variability in the polar diameter of seven different kharif onion genotypes presented in the table-2. The polar diameter of different genotypes varied from 56.94 mm-59.57 mm. Among the different genotypes the highest polar diameter 59.57mm was recorded in the genotype Baswant-780 followed by the lowest 56.94mm in the genotype N-53. The similar results were also found by some of the researchers. The results are in conformity with the findings of Upadhyay *et al.* (2019).

Equatorial diameter (mm): The data of equatorial diameter presented in the table-2 showing the variability of seven different kharif onion genotypes. Among the different genotypes the equatorial diameter varied from 64.85-75.45mm. Among the different genotypes the highest equatorial diameter 75.45mm was recorded from the genotype Agrifound dark Red and the lowest equatorial diameter 64.85mm was recorded from the genotype DOGR-1627. Gupta *et. al*. during the year 2019 reported that the equatorial diameter of different genotypes varied significantly among the different genotypes. The variation in equatorial diameter might be the reason that each individual genotypes may have different characteristics due to their inheritance characters.

Neck thickness (mm): The variation in the neck thickness among the seven different genotypes of kharif onion was presented in the table-2. Among the different genotypes of kharif onion the neck thickness ranges from 5.57mm-7.36mm. The highest neck thickness 7.36mm was recorded from the genotype Baswant-780 and the lowest 5.57mm was recorded from the genotype Bhima Super. The variation in the neck thickness might be due to the difference in the requiring time of maturity as well as in the genetic constitution of the different genotypes. Gupta *et al.* during the year 2019 reported that the highest and lowest neck thickness always varied according to the specific character of the plants.

Average bulb weight (g): There was an effective difference in the average bulb weight of seven kind of kharif onion genotypes as presented in the table-2. There was a significant range of average bulb weight ranges from 96.10-124.37g. The highest average bulb weight 124.37g was recorded from the genotype Balwan followed by the lowest 96.10g from the genotype Bhima Dark Red. The changes in the average bulb weight might be due to the changes in the genotype of the seven different kharif onion kinds which ultimately leads to the changes in the yield of the genotypes. Bal *et al.* during the year 2020 reported that the maximum average bulb weight always varied according to the specific parameters of the plants.

Double bulb (%): There are several effective differences in the double bulb percentage among the different genotypes of kharif onion which is represented in the table-2. The value of double bulb percentage varies from 2.96-5.93 (%). The highest amount of double bulb percentage 5.93 was recorded from the genotype Agrifound dark Red and the lowest amount 2.96 (%) was recorded from the genotype DOGR-1627. This is a genotypic character which affects the total yield and the acceptability of the bulbs

that ultimately reduces the market price. The similar results were also found by some of the researchers. The highest variation in double bulb percentage among all the genotypes are found similar with the findings of Tripathy *et al*. (2014).

Days to maturity (days): There was a significant variation in the days taken to reach the maturity which is represented in the table-3, of different kharif onion genotypes. The days taken for maturity varies from 124.67-129.67 days. The genotype Bhima Dark Red which was required the highest days 129.67 and the lowest 124.67 days was taken by the genotype DOGR-1627 to reach the maturity. The changes in the days taken to maturity might be due to the genetic inheritance of the individual genotypes as well as the impact of the temperature, rainfall and the other weather conditions. Das *et al*. during the year 2020 reported through an experiment that the highest and lowest days taken to attain the maturity always varied according to the specific character of the plants.

Days to harvest (days): The kharif onion genotypes take different times to reach the harvest after getting maturity which is represented in the table-3. The days taken to reach the maturity varies from 139.00-151.00days. Among the different kharif onion genotypes the genotype Bhima Super takes the highest 151.00 days and the genotype DOGR-1627 takes the lowest 139.00 days to reach the harvesting. The differences in the days taken for reach the maturity might be due to the changes in the genetic constitution. The similar results were also found by some of the researchers. The highest and lowest days taken to reach the harvesting varied among the genotypes are in conformity with the findings of Meghana *et al.* (2021).

Marketable yield (q-ha): The significant differences in the marketable yield (q-ha) of different kharif onion genotypes was expressed in the table-3. Among them the marketable yield varies from 481.49-235.21(q-ha). The genotype DOGR-1627 represent the highest marketable bulb yield 481.49 ((q-ha) followed by the genotype Balwan with the yield of 235.21 (q-ha). The marketable yield difference of seven kharif onion genotypes might be due to the effect of different genes with their yield contributing traits. Bal *et al*. during the year 2020 reported that the maximum marketable yield always varied according to the specific character of the plants.

Total yield (q-ha): The effective differences in the total yield (q-ha) of seven different kharif onion genotypes was characterized in the table-3. The total yield of the genotypes varies from 240.77-491.49 (q-ha). Among the kharif onion genotypes, the genotype DOGR-1627 shows the highest yield 491.49 (q-ha) and the genotype Balwan with the lowest yield 240.77 (q-ha). The differences in the total yield of the different genotypes might be due to the differences in the genetic constitution and the response of the genotypes to the varied climatic conditions. The differences in the marketable yield and the total yield might be due to the production of some unmarketable bulbs which also leads to the yield reduction. Similar research work was reported by Ananthan *et al.* (2021).

Quality character:

TSS (°B): The TSS (°B) data presented in the table-4 showed that the seven genotypes of kharif onion varied significantly. The TSS content of the different genotypes varied from 11.93-14.30 (°B). Among the different kharif onion genotypes the genotype Balwan showed the maximum 14.30 (°B) TSS content and the genotype DOGR-1627 represent the minimum 11.93 (°B) TSS content. The similar research work has been reported by some of the researchers. The variation in TSS content among the genotypes was found similar with the findings of Behera *et al.* (2017).

Total sugar (%): The data of total sugar (%) presented in the table-4 showed significant variation among the different genotypes of kharif onion. The total sugar content of the genotypes ranges from 2.47-3.10

(%). The genotype Balwan showed the highest total sugar content 3.10 (%) and the genotype Bhima Dark Red the lowest 2.47 (%). Similarly, Ananthan during the year 2010 reported that the total sugar content of onion bulbs varied according to the specific character of the bulbs.

Reducing sugar (%): The genotypes of seven kharif onion showed significant variability in the reducing sugar content presented in the table-4. The reducing sugar content of the genotypes varied from 2.25-2.72 (%). Among the genotypes the highest reducing sugar 2.72 (%) found in the genotype Balwan and the lowest 2.25 (%) recorded from the genotype Bhima Dark Red. The similar results were also reported by some of the researchers. The variation in reducing sugar content among the genotypes were corroborated with the findings of Das *et al*. (2017).

Non reducing sugar (%): The variability in the non-reducing sugar (%) content of seven different kharif onion genotypes presented in the table-4. The non-reducing sugar content varied from 0.22-0.38 (%). Among the genotypes of kharif onion the genotype Balwan showed the highest non reducing sugar 0.38 (%) and the genotype Bhima Dark Red the lowest 0.22 (%). Manjunathagowda *et al*. during the year 2019 have reported similar research work and mentioned the variation in the non-reducing sugar content, always varied according to the specific character of the bulbs.

Pyruvic acid content (µmol-g): The varying amount of pyruvic acid content of different kharif onion genotypes presented in the table-4. The pyruvic acid content varied from 4.27-5.87 (µmol-g). Among all the genotypes the genotype N-53 contains the highest 5.87 (µmol-g) pyruvic acid content and the genotype Bhima Dark Red the lowest 4.27 (µmol-g). The similar results were also found by some of the researchers. The highest variation in pyruvic acid content among all the genotypes are corroborated with the findings of Manjunathagowda *et al*. (2019).

Dry matter content (%): The variation in dry matter content of different kharif onion genotypes illustrated in the table-4 implies the variability of the genotypes. Among the genotypes the dry matter content varies from 5.31-7.96 (%). The genotype Agrifound Dark Red showed the maximum dry matter content 7.96 (%) and the genotype Balwan the lowest 5.31 (%). The variation in dry matter content might be due to the variation in the moisture content of the genotypes as well as the genetic inheritance of the individuals. Similar research work was reported by Upadhyay *et al.* during the year 2017.

Disease and pest incidence:

Stemphylium blight (%): The data in table-5 of Stemphylium blight (%) represent the attack of the disease in the different genotypes of kharif onion was found significantly. The attack of the disease varied from 17.02-36.18 (%). Among the genotypes the highest attack 36.18 (%) of the disease found from the genotype Balwan and the lowest 17.02 (%) from the genotype Agrifound Dark Red. The differences in the percentage of the attack of the disease might be due to the resistive character of the individual genotypes.

Thrips attack (%): The significant variability in the thrips attack percentage between the different kharif onion genotypes presented in the table-5. The percentage of attack of thrips varies from 23.89-32.78 (%). among the genotypes the genotype Baswant-780 showed the maximum attack of thrips 32.78 (%) and the genotype DOGR-1627 the lowest 23.89 (%). The tolerance capacity of the different genotypes might be the cause of the significant difference as well as the individual genetic inheritance creates resistiveness.

Storage parameters:

Physiological weight loss (%): The physiological weight loss percentage data presented in the table-6 showed significant variance between the seven different kharif onion genotypes. The physiological weight

loss percentage varies from 12.28-16.10 (%). Among the genotypes the genotype Bhima Super showed the maximum physiological weight loss 16.10 (%) and the genotype Balwan the lowest 12.28 (%). The variation in the physiological weight loss percentage might be due the presence of moisture content of the bulb.

Rotting (%): The mean data of rotting (%) presented in the table-6 showed significant variation among the different genotypes of the onion. The rotting percentage of the genotypes varied from 8.88-13.11 (%). The maximum percentage of rotting 13.11 (%) found from the genotype Agrifound Dark Red and the lowest 8.88 (%) found from the genotype Balwan. The variation in the percentage of the rotting found significant due to the aeration and the content of moisture of the whole bulbs.

Sprouting (%): The percentage of sprouting (%) data presented in the table-6 showed significant variation between the different kharif onion genotypes. The sprouting percentage varied from 9.75-12.13 (%). Among the different genotypes the genotype Agrifound Dark Red exhibit the highest sprouting 12.13 (%) and the genotype DOGR-1627 the lowest 9.75 (%). The differences in the sprouting percentage might be due to the absence of light and the availability of the moisture content into the bulb.

Through the current investigation the genotype DOGR-1627 was found better than the others in terms of yield (491.49 q^{-ha}), double bulb percentage (2.96), neck thickness (5.59 mm) and days taken for maturity (124.67 days) as well as for harvesting (139.00 days) though the highest polar diameter was recorded from the genotype Baswant-780 (59.57mm). But in terms of quality parameters the genotype Balwan showed maximum TSS (14.30°B) but Bhima Dark Red exhibit lowest total sugar percentage of (2.47 %) and reducing sugar percentage of (2.25%). In respect to the storage parameters the genotype Balwan exhibits lowest physiological loss in weight of (12.28 %) and lowest rotting percentage of (8.88 %) and the lowest sprouting percentage of (9.75 %) was recorded from the genotype DOGR-1627. Amongst the genotypes Agrifound Dark Red and DOGR-1627 has found the best in respect of less infestation of disease and pest, especially Agrifound Dark Red tolerant to Stemphylium blight and DOGR-1627 was tolerant to Thrips. From the above experiment it may be concluded that in case of Kharif onion, the genotype DOGR-1627 found to be an ideal genotype in respect to yield and yield attributing characters as well as pest incidence, but the genotypes Balwan and Bhima Dark Red were found quite good for the quality parameters.

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

Genotypes	Plant height(cm) at 70 DAT	Number of leaves per plant at 70 DAT	Leaf length(cm) at 70b DAT	Leaf diameter(cm) at 70 DAT
DOGR-1627	52.26	**8.33**	46.90	1.01
N-53	51.91	8.57	47.70	1.04
Bhima Super	51.19	8.70	46.62	**0.98**
Balwan	**54.72**	8.63	48.58	1.03
Bhima Dark Red	54.50	8.73	**49.69**	1.05
Basawant-780	50.87	8.70	46.05	1.02
Agrifound dark Red	**48.95**	**8.83**	**43.42**	**1.06**
Mean	52.06	6.05	47.00	1.03
SE(m) ±	2.913	0.364	3.118	0.033
CD at 5%	8.97	1.08	9.61	0.10
CV (%)	9.69	10.41	11.49	5.51

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

Genotypes	Polar diameter(mm)	Equatorial diameter (mm)	Neck thickness(mm)	Average bulb weight(g)	Double bulb (%)
DOGR-1627	58.14	**64.85**	5.59	110.30	**2.96**
N-53	**56.94**	68.06	6.69	100.03	4.44

Bhima Super	57.48	68.20	**5.57**	109.57	4.07
Balwan	58.85	70.00	7.33	**124.37**	3.70
Bhima Dark Red	59.22	65.34	5.94	**96.10**	4.44
Baswant-780	**59.57**	70.26	**7.36**	107.90	3.33
Agrifound dark Red	59.22	**75.45**	7.23	108.37	**5.93**
Mean	58.49	68.88	6.53	108.09	4.13
SE(m) ±	2.208	2.476	1.301	11.993	0.413
CD at 5%	6.80	7.63	4.01	36.95	1.27
CV (%)	6.54	6.22	34.52	19.22	17.33

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

Genotypes	Days to maturity(days)	Days to harvest(days)	Marketable yield(q^{-ha})	Total yield (q^{-ha})
DOGR-1627	**124.67**	**139.00**	**481.49**	**491.49**
N-53	125.67	143.67	339.20	346.53
Bhima Super	129.00	**151.00**	369.97	375.46
Balwan	127.00	143.33	**235.21**	**240.77**
Bhima Dark Red	**129.67**	147.00	453.22	457.89
Baswant-780	127.67	146.67	305.02	308.35
Agrifound dark Red	128.00	145.67	264.26	267.59
Mean	107.38	125.67	349.77	355.44
SE(m) ±	1.423	1.240	37.953	37.262
CD at 5%	4.38	3.82	116.95	114.81
CV (%)	2.29	1.71	18.79	18.16

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

Genotypes	TSS (˚B)	Total sugar (%)	Reducing Sugar (%)	Non-Reducing Sugar (%)	Pyruvic Acid (μmol^{-g})	Dry Matter Content (%)
DOGR-1627	**11.93**	2.58	2.32	0.26	4.71	5.99
N-53	13.40	2.51	2.26	0.25	**5.87**	7.90
Bhima Super	13.07	2.80	2.52	0.28	4.45	5.63
Balwan	**14.30**	**3.10**	**2.72**	**0.38**	5.16	6.82
Bhima Dark Red	13.23	**2.47**	**2.25**	**0.22**	**4.27**	**5.31**
Baswant-780	12.10	2.99	2.69	0.29	4.75	7.55
Agrifound dark Red	12.63	3.02	2.71	0.30	4.60	**7.96**
Mean	12.95	2.78	2.50	0.28	4.83	6.74
SE(m) ±	0.535	0.116	0.103	0.018	0.213	0.180
CD at 5%	1.65	0.36	0.32	0.05	0.66	0.55

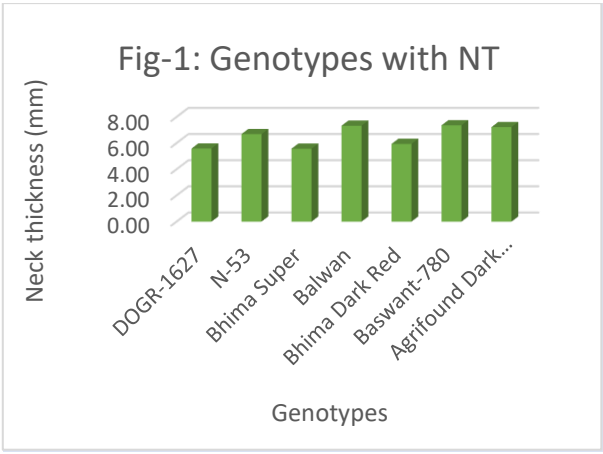
CV (%)	7.15	7.22	7.12	10.78	7.64	4.63

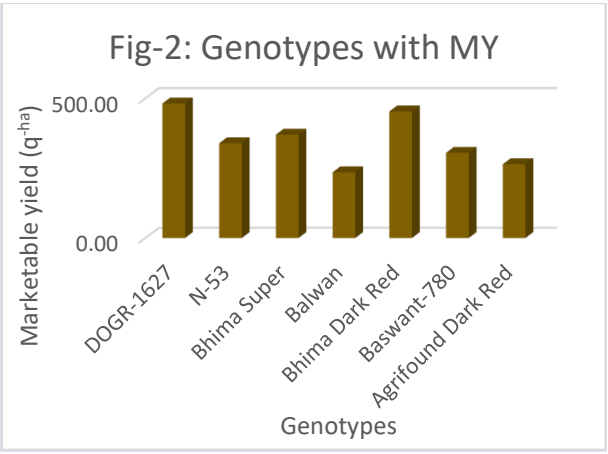
Table-5: Mean performances of disease and pest incidence of kharif onion genotypes

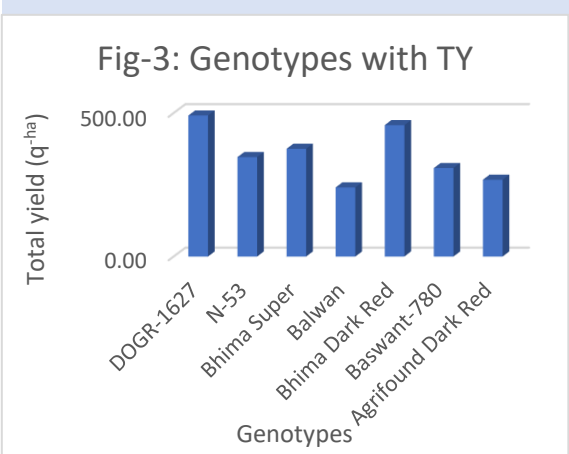
Genotypes	Stemphylium blight (%)	Thrips (%)
DOGR-1627	27.41	**23.89**
N-53	31.13	27.56
Bhima Super	19.51	24.33
Balwan	**36.18**	25.56
Bhima Dark Red	19.79	27.78
Baswant-780	26.46	**32.78**
Agrifound dark Red	**17.02**	24.78
Mean	25.36	26.67
SE(m) ±	1.871	1.690
CD at 5%	5.77	5.21
CV (%)	12.78	10.98

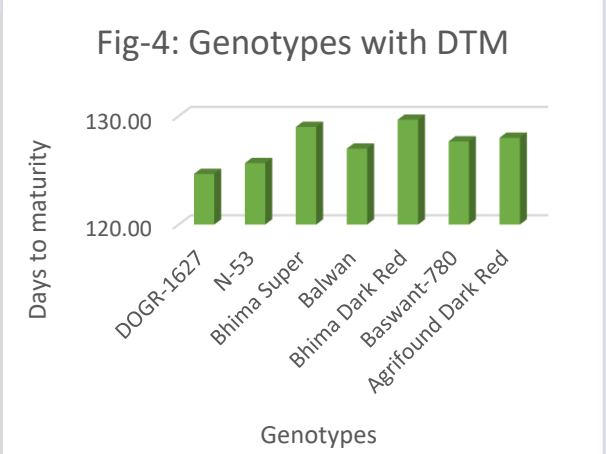
Table-6: Mean performance of storage parameters of kharif onion genotypes

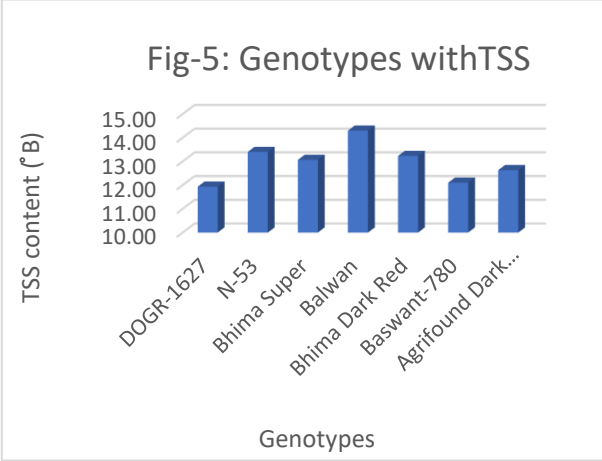
Genotypes	Physiological weight loss (%) at 90 days	Rotting (%) at 90 days	Sprouting (%) at 90 days
DOGR-1627	15.11	11.32	**9.75**
N-53	15.47	11.59	12.03
Bhima Super	**16.10**	10.41	10.01
Balwan	**12.28**	**8.88**	10.10
Bhima Dark Red	14.24	10.77	11.44
Baswant-780	15.15	11.55	10.57
Agrifound dark Red	15.80	**13.11**	**12.13**
Mean	14.88	11.09	10.86
SE(m) ±	0.889	0.633	0.546
CD at 5%	2.74	1.95	1.68
CV (%)	10.35	9.89	8.71

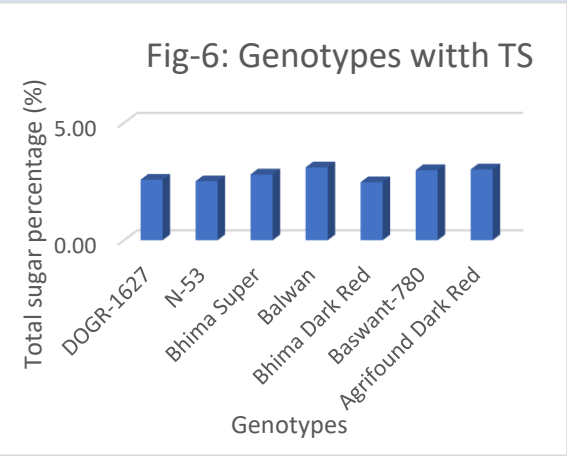












NT- Neck thickness, DTM- Days to maturity, MY- Marketable yield, TY- Total yield, TSS- total soluble solids, TS-total sugar

Plate (A): nursery bed for kharif onion, Kharif onion plot and the experimental plot

Plate(B): Polar diameter (PD) and neck thickness (NT) measurement


Agrifound
Dark Red
Baswant-780
Bhima Dark Red
Balwan

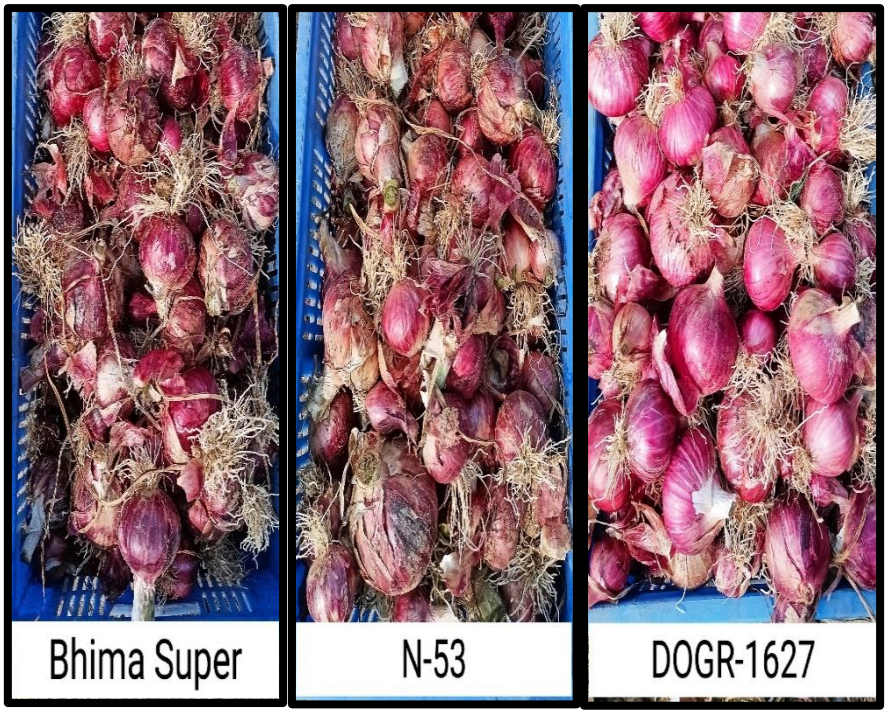


Plate (C): Bulbs of kharif onion genotypes and leaf senescence