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Storage Performance of various Late *kharif* Onion (*Allium cepa* L.) varieties using Three Sowing Dates in Assam

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ABSTRACT: Five late *kharif* onion varieties were sown at three different dates for storability assessment under natural ventilation conditions at Department of Horticulture, Assam Agricultural University, Jorhat, Assam. The bulbs of various onion varieties had different shape and colours. Sprouting, rotting and rooting of bulbs were recorded from ten stored bulbs at 1, 2 and 3 months of storage and expressed in percentage. Weight loss at the end of three months in all the combinations were recorded during *Kharif* season for two consecutive years 2020-21 and 2021-22. Rots, sprouts and roots were generally low in the late *kharif* onion varieties in Assam conditions. Variety Bhima Super sown on 25th August (9.77%) showed good storage performance and variety Arka Kalyan (13.96 %) sown on 15th September exhibited poor storage performance.

Keywords: storage, sprouts, *kharif*, rotting and rooting.

INTRODUCTION

Onion (*Allium cepa* L.) is an important vegetable as well as spice crop. Late *kharif* onion is available when the prices are high in the market it should also possess good storability with a long rest period with less sprouts and rots. Onion is grown more than one season in most of the tropical countries and it is also stored for 1 to 6 months to fulfill market requirements. There are two distinct storage temperature and humidity regimes for onion *i.e.,* 0-2 °C & 70% RH and 25-30 °C & 70% RH. The second condition prevails in tropical countries like India, which encourage more storage losses. Moreover, onion is stored under ambient conditions in tropical regions as the low temperature storage facilities are rarely available. Onions are listed under the less perishable vegetable crop, however, losses are inevitable during storage. In India, about 30-40% of onion is lost during post harvest, due to the lack of proper processing and storage facilities. The postharvest losses mainly consist of sprouting, rotting, rooting and weight loss. Due to the cultivar or pre and post harvest environmental conditions onion cultivar differs in their ability to storage (Kopsell and Randle 1997). The growth rate of the sprout inside the bulb varies according to cultivar and storage temperature (Chope *et al*., 2006). By following proper pre and post harvest management practices, storage losses can be reduced. Even after following the proper management practices, if the variety has the character of low storage life, all the practices will be futile to reduce the losses. Date of sowing is also one of the important factors, which influences not only the growth and yield of onion crop but also the storability of bulbs as a climatic factor. So, sowing of various varieties at different dates and their interaction, to test the suitable dates and varieties for good bulb production and storage should be standardize.

Therefore, this study was conducted to investigate the effect of different sowing dates of different late *kharif* onion varieties on storage ability of some onion cultivars under the environmental conditions of North-East India region to know the storage losses in onion and identifying the best combination of varieties and sowing dates having good storage life.

MATERIALS AND METHODS

Five onion varieties (Arka Kalyan, Bhima Dark Red, Agrifound Dark Red, Bhima Super and Bhima Red) sowing at three different dates (25th August, 5th

September and 15th September) were tested during late *kharif* season of the year 2020-21 and 2021-22 under similar condition with the recommended practices. After harvesting, produce was cured for three days in field and a week under shade. Cured bulbs were stored in natural ventilated place at Department of Horticulture, College of Agriculture, Assam Agricultural University, Jorhat, Assam. All the observations *viz.*, sprouting, rotting, rooting and bulb weight loss were recorded from ten stored bulbs at 1, 2 and 3 months and expressed in percentage. For determining the sprouting, rotting and rooting percentage on stipulated days after storage, the bulbs showing a sprout, rot and roots were separated and counted. The percentage, which indicated the number of the bulbs sprouted, rotted or rooted on 30, 60 and 90 days after storage was calculated by using the formulae given below. Data was analyzed using SAS. Square root transformation of data on storage losses was done.

$$\text{Sprouting (\%)} = \frac{\text{Number of bulbs sprouted till the date of recording}}{\text{Initial number of bulbs stored}} \times 100$$

$$\text{Rotting (\%)} = \frac{\text{Number of bulbs rotted till the date of recording}}{\text{Initial number of bulbs stored}} \times 100$$

$$\text{Rooting (\%)} = \frac{\text{Number of bulbs rooted till the date of recording}}{\text{Initial number of bulbs stored}} \times 100$$

$$\text{Bulb weight loss (\%)} = \frac{W_0 - W_1 \text{ or } W_2 \text{ or } W_3}{W_0} \times 100$$

W_0 = Fresh weight of bulb at harvest
W_1 = Bulb weight after 1 month of harvest
W_2 = Bulb weight after 2 months of harvest
W_3 = Bulb weight after 3 months of harvest.

RESULTS AND DISCUSSION

Effects of different sowing dates, varieties and their interaction on TSS: Effect of sowing dates (Table 1 and 2) was non- significant for TSS but effect of varieties was significant for TSS content in bulbs. Maximum (12.94 °Brix) TSS was recorded in var. Bhima Red which was at par with var. Bhima Super (12.75 °Brix) and minimum (11.37 °Brix) TSS was recorded invar. Arka Kalyan (V_1). Significant interaction effects of sowing date and variety was also observed. The highest (13.00 °Brix) TSS was found in var. Bhima Red sown on 5th September (D_2V_5). The lowest (11.22 °Brix) TSS was found in D_3V_1, which was at par with D_1V_4, D_1V_5, D_2V_4, D_3V_2 and D_3V_5. Total soluble solids in onion bulbs were significantly influenced due to different varieties and interaction of sowing dates and varieties. The increased TSS was due to enhanced physiological activity and availability of nutrients and the development of a strong source and sink relationship. These results are in conformity with the findings of Tripathy *et al.* (2014); Hirave *et al.* (2015); Santra *et al.* (2017); Ram and Kumar (2018) ; More *et al.* (2019). The variation among all the varieties may be because of the genetic constitution and their interaction with environment during the growing period.

Effect of different sowing dates, varieties and their interaction on sprouting (%) at 1, 2 and 3 months after storage: No sprouting was recorded at 1 month after storage in any variety. Significant effect of sowing dates, varieties and their interaction were observed on bulb sprouting two months after storage (Table 1 and 2, Fig. 1). Minimum sprouting 1.70% was recorded in D_2 (5th September)and maximum 2.31 % sprouting in D_1 (25th Aug). Variety Bhima Super showed minimum (1.26%) sprouting percent while Arka Kalyan showed maximum (2.80%) sprouting percent. Minimum (1 %) sprouting was recorded in D_2V_4 (Bhima Super sown on 5th September) which was statistically similar to D_3V_4 while maximum sprouting (3.32 %) of bulbs in D_1V_1 followed by D_1V_3 which, however, was significantly different from D_3V_1, two months after storage. Varieties and their interaction with sowing dates showed significant effect on sprouting percent three months after storage. Minimum (2.23%) sprouting was observed in variety Bhima Super and maximum (3.92%) in Arka Kalyan. Minimum (1.39%) sprouting percent was recorded in D_3V_4 and maximum (4.07%) in D_2V_1 followed by D_1V_1 and D_2V_3 is similar to D_3V_1.

Sprouting is one of the principal factors limiting storage life of onion bulbs. Onion varieties varied significantly in the percentage of sprouted bulbs during storage and sprouting increases with increase in storage period. The sprouting of onion starts in later part of storage when the bulb dormancy is over. Bulbs remain dormant in early 30 days of storage. The findings were in conformity with the results of Ddamulira *et al.* (2019); Patil *et al.* (2003). The delay in the sprouting of stored onion varieties was attributed to the fact that onion bulbs are naturally dormant at maturity and the length of this dormancy depends on conditions under which the bulbs are stored. Minimum sprouting was observed in variety V_4 (Bhima Super). The variation in percent sprout among onion varieties tested was probably due to the fact that sprouting is a normal physiological change in stored bulbs that develops reproductive shoots; however, this change depends on storage conditions and cultivars. However, since in this study storage condition for all varieties were the same (at room temperature) the variation in dormancy was probably due to varietal difference rather than storage conditions. D_3V_4 (Bhima Super sowing at 15th September) registered minimum sprouting after three months of storage. It may be due to different dormancy period requirement for various cultivars. It is obvious that dormancy is greatly determined by genotype but can be modified by environment and biotic factors. These results were conformity with findings of Abbey

et al. (2000); Mohanty *et al.* (2002); Baninasab and Rahemi (2006); Kalyani *et al*. (2018).

Effect of different sowing dates, varieties and their interaction on rotting (%) at 1, 2 and 3 months after storage: Significant effect of sowing dates, varieties and their interaction were observed on bulb rotting percent after 1, 2 and 3 months storage (Table 1 and 2, Fig. 2). Minimum (2.47%) rotting in bulbs after one month of storage was observed for mid sowing (5th September) and maximum (2.78%) was observed for late sowing (15th September). Variety Bhima Super showed minimum (1.77%) bulb rotting percent and maximum found in variety Arka Kalyan (3.26%). Minimum (1.39%) rotting was also observed in D_3V_4 was at par with D_1V_2, D_1V_3, D_1V_4, D_1V_5, D_2V_2, D_2V_3, D_2V_4, D_2V_5, D_3V_2, D_3V_3 and D_3V_5. Maximum (3.32%) value was recorded in D_2V_1 was not statistically different with D_3V_1. After two months of bulbs storage the minimum (3.22 %) rotting percent was observed from early sowing (D_1) and maximum (3.45 %) rotting was found in mid sowing (D_2). Minimum (2.42%) rotting was recorded in var. Bhima Super while the maximum (3.88%) was in var. Arka Kalyan. The least rotting was observed in D_3V_4 (1.77%) and maximum rotting found in D_1V_1 and D_2V_1 (3.95%). Minimum (4.28%) rotting after three months of storage was recorded for late sowing (15th Sep) while maximum (4.91 %) rotting found in mid sowing (5thSeptember). Bhima Super exhibited minimum rotting (3.61 %) and Arka Kalyan showed maximum (5.60%) rotting. Significant interaction effect of date of sowing and varieties revealed that minimum (2.58%) rotting was seen in D_3V_4 (Bhima Super Sowing at 15th September) while maximum (5.85%) rotting was found in D_1V_1 (Arka Kalyan sowing at 25th August) after three months of storage. These results of bulb rotting clearly indicate that during early (1 MAS) month of storage rotting was low than later (3 MAS) months *i.e.,* observation rotting percentage showed that there was linear increase in rotting losses. A substantial increase in onion decomposition during storage was recorded. The lowest rot loss in the Bhima Super cultivar may be due to the fact that, this cultivar is suitable to storage conditions. Wide range of rotten bulb among different genotype could be because of the different level of resistance against the pathogens as concluded by Ddamulira *et al.* (2019); Ojha *et al.* (2019) under different climatic conditions with different varieties.

Effect of different sowing dates, varieties and their interaction on weight loss (%) at 1, 2 and 3 months after storage: From the data presented in Table 3 and 4 (Fig. 3) it is evident that there were significant variations in bulb weight loss (%) due to date of sowing, varieties and their interaction after 1, 2 and 3 months storage. Minimum (3.89%) weight loss was recorded in 25th Aug (D_1) sowing and maximum (5.70%) weight loss was recorded in crop grown from 15th Sep (D_3) at 1 month after storage. Significant effect of varieties was observed and minimum (4.52%) weight loss recorded in V_4 (Bhima Super) and maximum (5.06%) weight loss recorded V_1 (Arka Kalyan). The lowest weight loss (3.62%) was recorded in D_1V_4 and the highest reduction (6.01%) was recorded in D_3V_3 which, however, was at par with D_3V_1& D_3V_2 after 1 month of storage. The least weight loss (7.27%) was observed in 25th Aug (D_1) and highest loss (9.66%) was recorded in 15th Sep (D_3) sowing at 2 MAS. Varieties also showed significant effect on weight loss percent at 2 months after storage. The minimum weight loss (7.95%) was recorded in var. Bhima Super (V_4) and maximum weight loss (9.07%) was registered by var. Arka Kalyan (V_1). The minimum weight loss (6.77%) was recorded in D_1V_5 and the maximum loss (10.34%) was recorded in D_3V_1 which was also at par with D_3V_2 and D_3V_3. The least weight reduction (10.36%) was observed in D_1 but the highest (13.31%) was recorded in D_3 after 3 MAS. The bulbs of var. Bhima Super (V_4) proved to be better store with minimum weight loss (11.12%) and maximum weight loss (12.39%) was recorded in var. Arka Kalyan (V_1). The interaction effect of sowing date and variety exhibited lowest weight loss (9.77 %) in D_1V_4 and the highest (13.96%) in D_3V_1 which was at par with D_3V_2 and D_3V_3 after 3 MAS.

Onion bulbs contain 85-90% water. The storage condition influences the rate of water loss due to respiration and transpiration. The storage condition is governed by temperature, relative humidity, air movement and atmospheric pressure. The higher storage losses were due to physiological loss in weight occurring during the drier months when mean temperatures are high with lower humidity. Above results clearly show that minimum weight loss recorded for early (25th August) sowing and maximum for late (15th September) sowing. Variety Bhima Super revealed minimum weight loss while variety Arka Kalyan exhibited maximum weight loss after storage months. The variation among all the varieties may be because of the genetic constitution of varieties and their interaction with environment as similar storage conditions were occur during storage of onion bulbs. The weight loss in onions increases with increased storage period (irrespective of varieties and sowing dates) and also affected by the time of storage due to variation in temperature, relative humidity and rainfall. D_1V_4 (Bhima Super sowing at 25th August) registered minimum rotting after three months of storage. Similar findings were reported by Baninasab and Rahemi (2006); Kalyani *et al.* (2018) under different climatic conditions with different varieties.

Effect of different sowing dates, varieties and their interaction on rooting at 1, 2 and 3 months after storage. Number rooting was observed after 1 month of storage in all varieties. The data pertaining to the effect of sowing dates, varieties and their interaction on bulb rooting (%) 2 and 3 months after storage have been presented in Table 3 and 4 (Fig. 4). Minimum rooting (1.07%) was observed in late sowing (15th Sep) and the maximum (1.23%) in mid sowing (5th Sep) 2 MAS. Significant effect of varieties was also observed on bulb rooting at 2 months after storage. Minimum (1.00%) rooting was registered in var. Bhima Super (V_4) and var. Bhima Red (V_5) while maximum (1.71%) in var. Arka Kalyan (V_1). Interaction effect shows that The minimum (1.00%) bulb rooting at 2 MAS was recorded in D_1V_2 which was statistically similar to D_1V_3, D_1V_4,

D_1V_5, D_2V_3, D_2V_4, D_2V_5, D_3V_1, D_3V_1, D_3V_2, D_3V_4 and D_3V_5 and the maximum (1.77%) in D_1V_1 and D_2V_2. Among the sources of variance, different sowing date, varieties and their interaction showed significant differences in respect to bulb rooting at 3 MAS. The minimum (1.23%) rooting was found in $D_3$and the maximum (1.35 %) rooting was recorded in D_1. Minimum rooting (1.00%) was recorded in V_4 (Bhima Super) and V_5 (Bhima Red) and maximum (1.38%) in V_1 (Arka Kalyan). The observation revealed that minimum rooting was observed in D_1V_2 which was statistically similar toD_1V_3, D_1V_4, D_2V_3, D_2V_4, D_2V_5, D_3V_1, D_3V_1, D_3V_2, D_3V_4 and D_3V_5 and the maximum (2.36%) in D_1V_1 which, however, was at par with D_2V_1, D_2V_1 and D_3V_3.

High relative humidity and insufficient ventilation is the main cause of root growth in onion bulbs. Studies on bulb rooting percent clearly indicate that root initiation is less in almost all treatments. The low rooting in bulbs may be due to proper ventilation conditions during storage. Rooting in bulbs increased with extension of storage period. It may be due to high humidity during the storage. Similar findings were also reported by Kaufman *et al.* (1953); Tripathi and Lawande (2019) under different climatic conditions with different varieties. The variety Bhima Super emerged significantly superior with fewer losses in storage due to rotting, sprouting, rooting and bulb weight loss. Variation in rooting percent among all the varieties may be because of the genetic makeup of varieties and their interaction with environment as similar storage conditions during storage of onion bulbs.

Table 1: Effect of sowing dates and varieties on TSS, sprouting (%) 2 and 3 months after storage and Bulb rotting (%) 1, 2 and 3 MAS (Pooled mean of two years 2020-21 and 2021-22).

Treatment	TSS (°Brix)	Sprouting (%) at 2 MAS	Sprouting (%) at 3 MAS	Bulb rotting (%) at 1 MAS	Bulb rotting (%) at 2 MAS	Bulb rotting (%) at 3 MAS
Sowing date	**Pooled**	**Pooled**	**Pooled**	**Pooled**	**Pooled**	**Pooled**
D_1 (25^{th} Aug)	12.17	(6.00) 2.31	(11.33) 3.27	(6.67)2.51	(10.33)3.22	(22.33)4.71
D_2 (5^{th} Sep)	12.24	(3.33) 1.70	(10.00) 3.01	(6.33)2.47	(11.66)3.45	(24.00)4.91
D_3 (15^{th} Sep)	12.19	(5.33) 2.00	(9.00) 2.91	(6.67)2.54	(10.67)3.26	(19.33)4.28
SEd (±)	**0.08**	**0.25**	**0.31**	**0.27**	**0.19**	**0.24**
CD (0.05)	**NS**	**0.50**	**NS**	**0.55**	**0.38**	**0.49**
Variety	**Pooled**	**Pooled**	**Pooled**	**Pooled**	**Pooled**	**Pooled**
V_1 (Arka Kalyan)	11.37	(8.89) 2.80	(15.00)3.92	(10.00)3.26	(14.44)3.88	(31.67)5.60
V_2 (Bhima Dark Red)	12.55	(4.44) 1.90	(10.00)3.01	(7.22)2.67	(11.67)3.53	(21.67)4.70
V_3 (AFDR)	11.38	(6.67) 2.29	(12.22)3.47	(7.22)2.67	(12.22)3.60	(23.89)4.92
V_4 (Bhima Super)	12.75	(1.11) 1.26	(5.55)2.23	(3.33)1.77	(6.11)2.42	(13.89)3.61
V_5 (Bhima Red)	12.94	(3.33) 1.77	(7.77)2.69	(5.00)2.16	(9.44)3.13	(18.33)4.34
SEd (±)	**0.10**	**0.32**	**0.40**	**0.35**	**0.24**	**0.32**
CD (0.05)	**0.21**	**0.65**	**0.80**	**0.71**	**0.49**	**0.64**

Table 2: Interaction effect of sowing dates and varieties on TSS, sprouting (%) at 2 and 3 months after storage, and Bulb rotting (%) 1, 2 and 3 MAS (Pooled mean of two years 2020-21 and 2021-22).

Treatment	TSS (°Brix)	Sprouting (%) at 2 MAS	Sprouting (%) at 3 MAS	Bulb rotting (%) at 1 MAS	Bulb rotting (%) at 2 MAS	Bulb rotting (%) at 3 MAS
	Pooled	**Pooled**	**Pooled**	**Pooled**	**Pooled**	**Pooled**
D_1V_1	11.48	(10.00) 3.32	(15.00) 3.95	(15.00)3.14	(15.00)3.95	(35.00)5.85
D_1V_2	12.26	(3.33) 1.77	(11.67) 3.35	(12.50)2.93	(11.67)3.53	(20.00)4.53
D_1V_3	11.32	(10.00) 2.93	(13.33)3.52	(10.00)2.54	(11.67)3.53	(21.67)4.70
D_1V_4	12.87	(3.33) 1.77	(8.33)2.76	(5.00)1.77	(5.00)2.16	(16.67)4.11
D_1V_5	12.92	(3.33) 1.77	(8.33)2.76	(7.50)2.16	(8.33)2.93	(18.33)4.37
D_2V_1	11.42	(6.67) 2.16	(16.67)4.07	(15.00)3.32	(15.00)3.95	(31.67)5.59
D_2V_2	12.61	(3.33) 1.77	(8.33)2.53	(10.00)2.54	(11.67)3.53	(25.00)5.07
D_2V_3	11.39	(3.33) 1.77	(13.33)3.74	(10.00)2.54	(11.67)3.53	(28.33)5.38
D_2V_4	12.79	(0.00) 1.00	(6.67)2.54	(7.50)2.16	(10.00)3.32	(16.67)4.16
D_2V_5	13.00	(3.33) 1.77	(5.00)2.16	(5.00)1.77	(8.33)2.93	(18.33)4.37
D_3V_1	11.22	(10) 2.93	(13.33)3.74	(15.00)3.32	(13.33)3.74	(28.33)5.35
D_3V_2	12.78	(6.67) 2.16	(10.00)3.14	(10.00)2.54	(11.67)3.53	(20.00)4.49
D_3V_3	11.42	(6.67) 2.16	(10.00)3.14	(12.50)2.93	(13.33)3.74	(21.67)4.69
D_3V_4	12.59	(0.00) 1.00	(1.67)1.39	(2.50)1.39	(3.33)1.77	(8.33)2.58
D_3V_5	12.92	(3.33) 1.77	(10.00)3.14	(10.00)2.54	(11.67)3.53	(18.33)4.28
SEd (±)	**0.18**	**0.56**	**0.69**	**0.61**	**0.42**	**0.55**
CD (0.05)	**0.36**	**1.12**	**1.38**	**1.23**	**0.84**	**5.85**

Table 3: Effect of sowing dates and varieties on bulb weight loss (%) at 1, 2 and 3 months after storage and Bulb rooting (%) 2 and 3 MAS (Pooled mean of two years 2020-21 and 2021-22).

Treatment	Bulb weight loss (%) 1 MAS	Bulb weight loss (%) 2 MAS	Bulb weight loss (%) 3 MAS	Bulb rooting (%) at 2 MAS	Bulb rooting (%) at 3 MAS
Sowing date	**Pooled**	**Pooled**	**Pooled**	**Pooled**	**Pooled**
D_1 (25th Aug)	3.89	7.27	10.36	(0.67) 1.15	(1.67) 1.35
D_2 (5th Sep)	4.85	8.40	11.60	(1.00) 1.23	(1.33) 1.30
D_3 (15th Sep)	5.70	9.66	13.31	(0.33) 1.07	(1.00) 1.23
SEd (±)	**0.08**	**0.13**	**0.17**	**0.14**	**0.19**
CD (0.05)	**0.16**	**0.27**	**0.34**	**0.29**	**0.37**
Variety	**Pooled**	**Pooled**	**Pooled**	**Pooled**	**Pooled**
V_1 (Arka Kalyan)	5.06	9.07	12.39	(1.67) 1.38	(3.33) 1.71
V_2 (Bhima Dark Red)	4.81	8.53	11.70	(1.11) 1.25	(1.11) 1.25
V_3 (AFDR)	5.05	8.71	12.10	(0.55) 1.13	(1.67) 1.38
V_4 (Bhima Super)	4.52	7.95	11.12	(0.00) 1.00	(0.00) 1.00
V_5 (Bhima Red)	4.64	7.98	11.47	(0.00) 1.00	(0.56) 1.12
SEd (±)	**0.10**	**0.17**	**0.22**	**0.18**	**0.24**
CD (0.05)	**0.21**	**0.35**	**0.44**	**0.37**	**0.48**

Table 4: Interaction effect of sowing dates and varieties on weight loss (%) at 1, 2 and 3 months after storage and Bulb rooting (%) 2 and 3 MAS (Pooled mean of two years 2020-21 and 2021-22).

Treatment	Bulb weight loss (%) 1 MAS	Bulb weight loss (%) 2 MAS	Bulb weight loss (%) 3 MAS	Bulb rooting (%) at 2 MAS	Bulb rooting (%) at 3 MAS
	Pooled	**Pooled**	**Pooled**	**Pooled**	**Pooled**
D_1V_1	4.18	7.88	11.04	(3.33)1.77	(6.67)2.36
D_1V_2	3.85	7.45	10.27	(0.00) 1.00	(0.00)1.00
D_1V_3	4.12	7.40	10.69	(0.00) 1.00	(0.00)1.00
D_1V_4	3.62	6.91	9.77	(0.00) 1.00	(0.00)1.00
D_1V_5	3.73	6.77	10.05	(0.00)1.00	(1.67)1.38
D_2V_1	5.23	8.00	12.17	(1.67)1.38	(3.33)1.77
D_2V_2	4.75	8.35	11.63	(3.33)1.77	(3.33)1.77
D_2V_3	5.04	8.71	11.80	(0.00) 1.00	(0.00)1.00
D_2V_4	4.64	7.92	11.05	(0.00) 1.00	(0.00)1.00
D_2V_5	4.60	8.05	11.34	(0.00) 1.00	(0.00)1.00
D_3V_1	5.79	10.34	13.96	(0.00)1.00	(0.00)1.00
D_3V_2	5.83	9.80	13.22	(0.00)1.00	(0.00)1.00
D_3V_3	6.01	10.04	13.82	(1.67)1.38	(5.00)2.15
D_3V_4	5.31	9.03	12.55	(0.00)1.00	(0.00)1.00
D_3V_5	5.60	9.13	13.00	(0.00)1.00	(0.00)1.00
SEd (±)	**0.19**	**0.30**	**0.38**	**0.32**	**0.41**
CD (0.05)	**0.37**	**0.61**	**0.76**	**0.65**	**0.83**

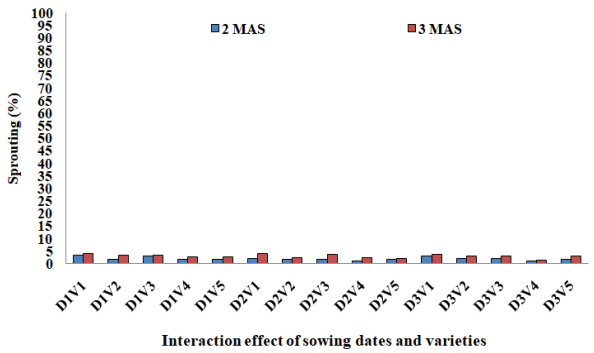

Fig. 1. Graphical representation of Sprouting (%) after 2 and 3 MAS on pooled analysis.

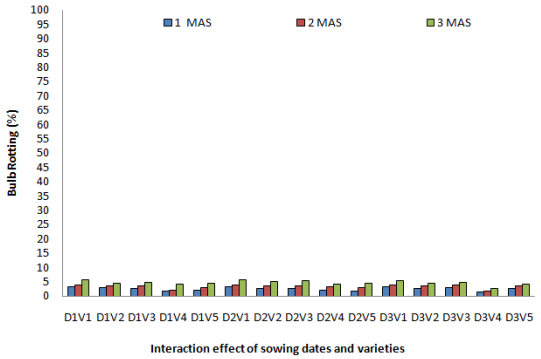

Fig. 2. Graphical representation of Rotting (%) 1, 2 and 3 MAS on pooled analysis.

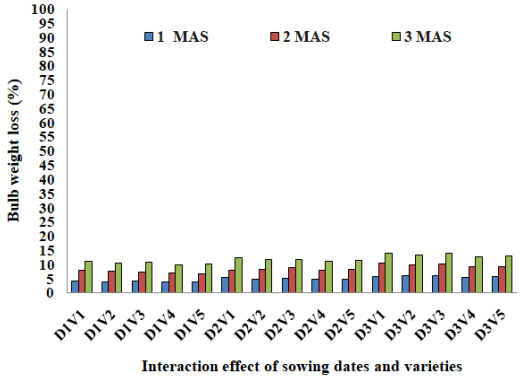

Fig. 3. Graphical representation of Bulb weight loss (%)1, 2 and 3 MAS on pooled analysis.

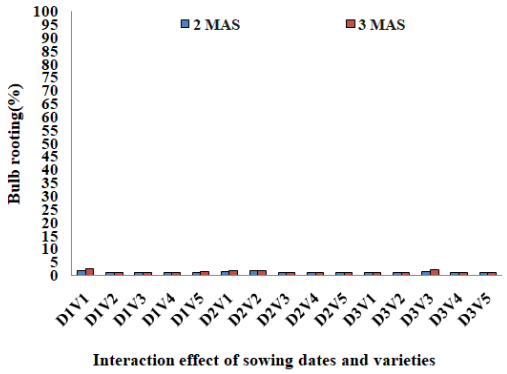

Fig. 4. Graphical representation of Bulb rooting (%) 2 and 3 MAS on pooled analysis.

Plate 1. Storage studies.

CONCLUSIONS

Based on research results, it can be concluded that the sowing dates, varieties and their interaction showed significant effect on most of the storage parameters of onion bulb. The variety Bhima Super (V_4) emerged significantly superior with fewer losses in storage due to rotting, sprouting, rooting and bulb weight loss. Post harvest studies also revealed early sowing D_1 (25th August) performed better than other sowing dates. Among the treatment combinations, D_1V_4 (Bhima Super on 25th August sowing) was the best in storage after 3 months of storage so it can be successfully stored for three months after harvesting under Jorhat conditions of Assam.

FUTURE SCOPE

The number of cultivars was only five for this study so more new varieties may be evaluated across the season in future.

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Conflict of Interest. None.

REFERENCES

Abbey, L., Danquah, O. A., Kanton, R. A. L. and Olympio, N. S. (2000). Characteristics and storage performance of eight onion cultivars. *Ghana J. Sci.*, *40*, 9-13.

Baninasab, B. and Rahemi, M. (2006). The effect of high temperature on sprouting and weight loss of two onion cultivars. *Am. J. Plant Physiol., 1* (2), 199-204.

Chope, G. A., Terry, L. A. and White, P. J. (2006). Effect of controlled atmosphere storage on abscisic acid concentration and other biochemical attributes of onion bulbs. *Postharvest Bio. Technol.*, *39,* 233-242.

Ddamulira, G.; Kalali, F. and Maphosa, M. (2019). Yield and storage performance of onion (*Allium cepa* L.) genotypes under in situ and ex-situ Conditions. *Int. J. Plant. Soil Sci., 30*(4), 1-7.

Kalyani, G., Murkute, A. A., Bhagat, Y. and Gopal, J. (2018). Post-harvest losses in different varieties of onion. *Indian J. Hort.*, *75* (2), 314-318.

Kaufman, J., Hruschka, H. W. and Hardenburg, R. E. (1953). Onion pre packaging tests. *Pre-Package, 7,* 9- 18.

Kopsell, D. E. and Randle W. M. (1997). Onion cultivars differ in pungency and bulb quality changes during storage. *Hort Sci., 32,* 1260-1263.

Hirave, P. S., Wagh, A. P., Alekar, A. N. and Kharde, R. P. (2015). Performance of red onion varieties in *kharif* season under Akola conditions. *J. Hortic.*, *2* (2), 1-3.

Mohanty, B. K., Hossain, M. M. and Prusti, A. M. (2002). Performance of onion cultivars in *kharif* season. *Advances in Plant Sci., 15* (2), 603-606.

More, S. M., Kale, V. S., Wanare, A. and Deshmukh, S. D. (2019). Response of *kharif* onion varieties to time of set planting. *Int. J. Sci. Res., 8* (1), 245-247.

Ojha, M. D., Kumar, V., Pal, M., Tiwari, D., Kumar, N. and Singh, P. K. (2019). Effect of date of planting and varieties on growth, yield and storability of *rabi* onion (*Allium cepa* L.). *J. Pharmacogn. Phytochem., 8*(4), 1908-1911.

Patil, R. S., Sood, V., Garande, V. K. and Masalkar, S. D. (2003). Studies on natural topfall in rangda (i.e. late *kharif*) onion. *Asian J. of Hort.*, *5* (1), 242-244.

Ram, B. and Kumar, U. (2018). Performance of onion (*Allium cepa* L.) genotypes for growth, yield and quality.*Int. J. Chem. Stud*., *SP, 4*, 128-131.

Santra, P., Manna, D., Sarkar, H. K. and Maity, T. K. (2017). Genetic variability, heritability and genetic advance in *kharif* onion (*Allium cepa* L.). *J. crop. weed., 13* (1), 103-106.

Tripathi, P. C. and Lawande, K. E. (2019). Onion storage in tropical region — a review. *Current Horticulture*, *7* (2), 15-27.

Tripathy, P., Sahoo, B. B., Priyadarshini, A., Das S. K. and Dash D.K. (2014). Standardization of *kharif* onion cultivars. *Int. j. bio-resour. stress manag*., *5* (2), 269-274.

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