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Growth, Yield and Storage Performance of Onion as Influenced by Planting Time and Storage Condition

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Abstract: The experiment was conducted at the Horticulture Farm of Bangladesh Agricultural University, Mymensingh during November, 2000 to August 2001 to determine optimum planting time on growth, yield and storage performance of onion. Three dates of planting viz., November 22, December 7 and 22 and, two storage conditions viz., inside sand and open on bamboo platform. The planting time had significant effect on growth, yield components, yield and also storage parameter studied. The November 22 planting produced the highest yield (25 t ha^{-1}) by increasing leaf number per plant(11.73), bulb diameter (5.31cm), fresh weight of bulb(59.60g) and dry matter content of bulb(13.44%). In the three planting times, the rotting percentage was higher (15.51, 8.66 and 8.34 respectively) under inside sand storage. The highest weight loss (29.21%) and sprouting (1.98%) were obtained by November 22 planting with open storage on bamboo platform.

Key words: Onion, growth, yield, planting time, storage condition

Introduction

Onion (*Allium cepa* L.) is one of the most important bulb and spice crops in Bangladesh as well as in the world. It is widely used for various purposes such as green leaf as vegetables, bulbs as salad and in the preparation of soups, sauces, stew, gravies, stuffings, fried fish, meat etc. It has some medicinal value and is successfully applied on bruises and wounds for early heal –up (Vohra *et al.,* 1974). Onion is a thermo and photosensitive crop and optimum temperature for its cultivation is 13-24^{0}C (Rashid, 1983). It is commercially cultivated in the greater district of Faridpur, Rajshahi, Dhaka, Comilla, Mymensingh, Jessore, Rangpur and Pabna. Among the spices grown in the country, onion ranks first in respect of production and second in respect of area (BBS, 1999). On an average, if we consider 25g onion essential for individual person as daily requirement, then the total annual requirement of Bangladesh stands at 450 thousand tons whereas, our total production is 134 thousand tons and thereby a shortage of 316 thousand tons per annum becomes apparent has been prevailing in our country (BBS, 2001). Moreover, the demand of onion is increasing day by day with the increasing number of population. To meet this shortage, Bangladesh has to import onion from India and Pakistan every year at the cost of its hard earned foreign currency (Hussain and Islam, 1994). Onion production is greatly influenced by agronomic practices among which, planting time is one of the important factors that greatly governs the growth and yield of onion (Mondal *et al.,* 1986). Early planting gives the longest growth cycle (Izquierdo *et al.,* 1981) and Bhattari *et al.* (1995) obtained the highest yield from early planting (16 November). But the farmers of Bangladesh can not adopt early planting due to climatic limitations (viz. late rainfall, standing flood water or covering the land by T-aman rice etc.). On the other hand, high temperature faced by late planting causes early maturity resulting in lower yield. Optimum time of planting provide favourable conditions for maximum vagetative growth and it is not available with the delayed planting (Mondal and Hussain, 1980; Attar and Korla, 1991).

The onion bulb is grown during, only, in winter season in Bangladesh and it decays swiftly in stored condition. But it needs the steady supply of onion in market through out the year for consumption and also planting materials in the next year. The useful storage system is needed to reduce storage loss caused by different factors. Considering the above facts, the present study has been undertaken to determine the appropriate time of planting for maximization of bulb production and also storage behaviour of onion.

Materials and Methods

The experiment was conducted at the Horticulture Farm of the Bangladesh Agricultural University, Mymensingh during the period from November, 2000 to August, 2001. The crop was raised during November to April and storage performance of the harvested bulbs was studied

for about four months of April to August, 2001 at the Farm house. The soil of the experimental plot belongs to the Old Bramhmaputra Floodplain Alluvial Tract. The selected area was medium high land having soil $_{P}$H6.8, 0.92% organic carbon, 0.12% total N, 20 ppm Olsen P and 0.13 me% ammonium acetate K. The crop received total rainfall was 134.7 mm during the period of crop growth from November, 2000 to April, 2001. Three times of planting viz., November 22, December 7 and December 22 and, two storage conditions, viz., storage in open condition on bamboo platform and storage inside dry sand. The experiment was laid out in Randomized Complete Block Design with three replications. The seedlings were raised from well prepared seedbed on three dates of seed sowing of the variety, BARI Peaj 1. Fifty five days old seedlings with tops and roots pruned were transplanted on three dates according to the treatments following single row system of planting with a spacing of 20cm X 10cm. The unit plot was 3m X 1m. Light watering was given just after transplanting. Manure and fertilizers were applied according to the recommendation of Bangladesh Agricultural Research Institute (1996) of cowdung @ 10 t ha^{-1} and urea, triple super phosphate(TSP), muriate of potash (MOP) at the rate of 260, 200 and 150 kg ha^{-1}, respectively. The whole amount of cowdung and TSP were applied during final land preparation. Urea and MOP were applied as top dress in two equal installments after 25 and 50 days after transplanting of seedlings. Gap filling was done within seven days after transplanting with the same aged seedlings already grown as border crops. Weeding and mulching were done manually by `Khurpi` as and when necessary to keep the crop free from weeds and to maintain better soil aeration and conserve soil moisture. A constant moisture supply was maintained by applying irrigation. Irrigation was stopped before 3 weeks of harvesting to ensure better storage performance. Three sprayings of Rovral were applied to control purple blotch disease at an interval of a couple of weeks starting from one month after transplanting. Bolting was discouraged by pinching of the flower stalks whenever they appeared during the growing period of the crop. The crop was harvested after 115 days after transplanting. Before 10 days of harvest, the plant was bended to soil level by hands to hasten maturity. Curing of bulbs were done in a room at ambient temperature (29.6 ± 2.6) ^{0}C and 80-85% RH for seven days and then stored in a well ventilated thatched house according to the treatments. Data were collected on plant growth, yield contributing characters, yield and different parameters on storage conditions. The data on various characters were statistically analyzed using MSTAT-C computer package program. The significance of the differences among the pairs of treatment means were evaluated by the Least Significant Difference (LSD) test for the interpretation of the results.

Results and Discussion

Effect of planting time: Plant height was differed significantly among different planting times (Table 1). November 22 planting produced maximum plant height (54.79 cm) at 90 days after planting (DAP) followed by December 7 planting (51.21 cm). The minimum plant height (45.71cm) was obtained from December 22 planting. This result is in agreement with the results of Badaruddin and Haque(1977) who observed the similar trend of reduction in plant height with delayed planting. Leaf number per plant showed significant variation due to differed planting times (Table 1). November 22 planting produced the highest number of leaves per plant (11.73) at 90 DAP and December 22 planting produced the lowest number of leaves (9.22). Hussain and Islam (1994) also reported that early planting produced larger number of leaves per plant which decreased gradually with delayed planting. Significant variation occurred in respect of the percentage of bolting, November 22 planting produced maximum bolting (43.91%) followed by that of December 7 (37.33%) and the minimum bolting (28.62%) was given by December 22 planting (Table 1). Natlob and EL-Habar (1983) and Bhattaria *et al.* (1995) stated that early planting significantly increased percentage of bolting. November 22 (68.26%) and December 7 (66.51%) plantings were produced statistically similar of split bulbs (Table 1). The lowest percentage of split bulbs (61.16%) was given by December 22 planting. The result was in support of by Natlob and EL- Habar (1983) who obtained the highest percentage of split bulbs from November 15 planting. The maximum diameter of bulb (5.31cm) was found at November 22 planting and was statistically similar with that of December 7 planting (4.98 cm) whereas, the minimum (4.71 cm) was observed on the December 22 planting showing dissimilar results with November 22 planting (Table 1). Heath (1943) reported that higher temperature enhanced bulbing process and lower temperature delayed it. Confirming his experience it was observed that higher temperature that prevailed in case of early crop possibly favoured bulb growth and development producing bulbs of increased diameter. On the other hand, lower temperature with gradual delay in planting reduced the bulb diameter. The bulb weight was maximum (59.60 g) on November 22 planting followed by that of December 7 (53.84 g) which was statistically similar and the lowest (47.86 g) was obtained from December 22 planting (Table 1).

Table 1: Single effect of different time of planting on growth, yield contributing characters and yield of onion

Treatment	Plant height (cm) (90 DAP)	No of leaf/ plant (90 DAP)	% of bolting	% of split bulb	Diameter of bulb (cm)	Fresh wt of bulb (g)	Dry matter content of bulb (%)	Yield (t ha^{-1})
T1(November 22)	54.79	11.73	43.91	68.26	5.31	59.60	13.44	25.22
T2 (December 7)	51.21	10.38	37.33	66.51	4.98	53.84	12.39	23.77
T3 (December 22)	45.71	9.22	28.62	61.16	4.71	47.86	11.52	21.01
LSD (0.05)	6.81	1.46	3.89	4.96	0.38	5.46	1.26	2.54
LSD (0.01)	11.29	2.42	5.36	6.84	0.52	7.52	1.73	3.50

DAP=Days after planting

Table 2: Combined effects of planting time and storage condition on cumulative percentage of decay and rotten loss of onion bulbs at different days of storage period

Treatment combinations	15 DAS	30 DAS	45 DAS	60 DAS	75 DAS	90 DAS	105 DAS	120 DAS
T1O	0.90	1.24	3.02	5.03	6.55	8.81	11.75	14.35
T1S	2.28	3.72	4.08	6.35	8.20	10.02	12.78	15.51
T2O	0.53	2.02	2.62	4.71	5.84	7.02	7.22	7.63
T2S	1.06	2.73	3.55	5.34	6.27	6.76	7.59	8.66
T3O	0.20	1.55	2.77	4.63	6.09	6.43	6.92	7.93
T3S	0.83	2.49	3.39	5.20	6.27	6.31	7.55	8.34
LSD (0.05)	0.09	0.16	0.28	0.70	0.40	0.59	0.92	0.83
LSD (0.01)	0.12	0.22	0.38	0.94	0.54	0.79	1.23	1.11

Table 3: Combined effects of planting time and storage condition on cumulative percentage of weight loss of onion bulbs at different days of storage period

Treatment combinations	15 DAS	30 DAS	45 DAS	60 DAS	75 DAS	90 DAS	105 DAS	120 DAS
T1O	12.48	14.43	16.20	19.85	23.14	25.13	27.37	29.21
T1S	9.24	11.57	15.03	18.63	21.16	22.98	24.99	27.10
T2O	5.70	8.53	11.61	15.37	18.68	21.31	23.34	25.17
T2S	5.37	8.07	10.90	14.13	16.76	19.29	20.86	23.39
T3O	5.16	7.49	10.80	15.12	17.59	20.80	22.73	24.35
T3S	4.98	6.94	9.70	13.51	15.61	18.63	20.25	22.40
LSD (0.05)	0.63	0.64	0.71	1.36	2.12	1.73	1.75	1.38
LSD (0.01)	0.84	0.86	0.95	1.82	2.85	2.32	2.36	1.85

Table 4: Combined effect of planting time and storage condition on cumulative percentage of onion sprouting at different storage period

Treatment combinations	15 DAS	30 DAS	45 DAS	60 DAS	75 DAS	90 DAS	105 DAS	120 DAS
T1O	00	00	00	00	1.32	1.45	1.68	1.98
T1S	00	00	00	00	1.00	1.27	1.67	1.80
T2O	00	00	00	00	0.74	0.82	1.25	1.25
T2S	00	00	00	00	0.32	0.51	0.84	0.93
T3O	00	00	00	00	0.67	0.58	1.10	1.20
T3S	00	00	00	00	0.31	0.50	0.94	1.05
LSD (0.05)	-	-	-	-	0.09	0.13	0.10	0.17
LSD (0.01)	-	-	-	-	0.12	0.18	0.13	0.23

Time of planting
T1: November 22
T2: December 7
T3: December 22

Storage condition
S: Sand storage
O: Open storage on bamboo platform

DAS= Days after storage

Maximum vegetative growth as well as large number of leaves was produced at November 22 planting. Onion bulb growth and swelling is related with production of more leaf number. It is a known fact that higher production of leaf causes increased photosynthesis activities leading to more accumulation of photosynthates and thereafter production of heaviest bulb. This is in agreement with the report of Mohanty *et al.* (1990) which was possibly the cause of more fresh weight of bulb per plant of November 22 planting. The highest percentage of dry matter (13.44%) was recorded when the crop was planted on November 22 planting and the lowest (11.52%) was obtained by December 22 planting (Table 1).

The yield of onion bulb was influenced significantly by the different time of plantings (Table 1). The highest bulb yield (25.22 t) per hectare was obtained from November 22 planting followed by 23.77 and 20.90 ton from December 7 and December 22 plantings, respectively (Table 1). However, there was no significant difference in yield between November 22 and December 7 plantings. The result was in agreement with the findings of Mohanty *et al.* (1990) and Bhattarai *et al.* (1995). Perhaps November 22 planting favoured more vegetative growth in terms of leaf number production resulting in the highest bulb yield.

Storage performance: Data on the cumulative percentage of rotten bulbs, weight loss and sprouting of onion bulbs in storage at an interval of 15 days up to 4 months were influenced by the combined effect of time of planting and storage conditions (Table 2, 3 & 4). Rotting of bulbs of

onion started immediately after harvest and continued throughout the whole storage period but in different rates (Table 2). The highest percentage of rotting (15.51) resulted from treatment combination of November 22 planting with inside dry sand storage and the lowest was (7.63) in December 7 planting with open storage condition at 120 days after storage (DAS). The percentage of rotting loss was higher from the inside dry sand storage under all the planting times. But, statistically similar results were obtained on December 22 planting under both the storage conditions. The weight loss varied from 29.21 to 22.40% at 120 DAS. Significantly higher cumulative weight loss were occurred in the open storage on bamboo platform under every planting time than the inside dry sand storage (Table 3). The results revealed that sprouting was started after 60 days of storage under all the treatment combinations (Table 4). The highest percentage of sprouting of bulbs (1.98) was obtained in early planting with open storage in bamboo platform and the lowest (0.93) observed under the combination of December 7 planting with inside sand storage.

Onion of bamboo platform was not kept overlapped, rather they were kept spreaded. The condition helped each and every onion to receive fresh air all the time during storage. As a result, they loss moisture quickly. Simultaneously, the lower rate of weight loss in the onion bulbs stored inside sand was probably due to the fact that sand acted as barrier for free movement of gases, this mechanical barrier reduced evapotranspiration of bulbs and thus decreased weight loss. Again due to mechanical barrier, there was increase in carbon di oxide and reduction on oxygen level surrounding the stored bulbs which hindered metabolic activities of stored onion bulbs to some extent. As a consequence, there was less percentage of sprouting which lead to minimum utilization of stored materials and there by resulted in minimum weight loss of onion bulbs. The results revealed that November 22 planting time was better for the production of onion. Late planting with inside dry sand storage was fruitful method for long time storage of onion.

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