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EFFECT OF MOTHER BULB SIZE AND PLANTING TIME ON GROWTH, BULB AND SEED YIELD OF ONION

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Abstract

Onion bulbs of different sizes (20g, 15g and 10 g) were planted at different dates viz., 30 October and 15 and 30 November to observe their effects on growth, bulb and seed yield of onion. The mother bulb size and planting dates showed significant influence on growth, bulb and seed yield of onion. The large mother bulb and early planting were favourable for getting higher bulb and seed yields. The treatment combinations of large mother bulb (20 g) and 30 October planting time gave the highest bulb (17.52 t/ha) and seed (402.80 kg/ha) yield.

Key words: Onion, mother bulb size, planting time, growth, yield.

Introduction

Onion (*Allium cepa* L.) is one of the most important spices as well as vegetable crops of Bangladesh. It ranks first among the spices grown here both in acreage and production (BBS, 2003). The yield of onion in Bangladesh (3.94 t/ha) is very low compared to that of the world (17.01 t/ha) average (FAO, 2000). Onion requires long-day length for production and maturation of bulb (Amin and Rahim, 1995), but in Bangladesh short-day length prevails in the growing season of onion. So, to minimize the cultivation and production problems, emphasis must be given to improve cultivation methods of onion, such as proper planting geometry, optimum mother bulb size and planting time, accurate fertilization and other cultural practices viz., weeding and mulching. Many attempts were taken in the recent past to augment the yield and to improve the quality of onion seed (Bhonde *et al.*, 1996). But no definite and profitable technology has yet been developed which can be recommended to the farmers for growing onion seed at a commercial scale. A few well adapted indigenous varieties, such as Taherpuri, Zhitka, Faridpur Bhati are used to produce onion seeds in limited areas of Bangladesh. Workers of different onion growing countries of the world have identified the optimum time for raising seed crops in their own countries. Planting time is one of the most important factors that greatly influence the growth and yield of onion (Mondal *et al.*, 1986; Amin and Rahim, 1995; Ahmed and Munshi, 1995). Adjusting planting time is very important because of the short winter seasons of Bangladesh. Early planting is best for onion production (Badaruddin and Haque, 1977). Mondal (1980) considered last week of October

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as the best planting time for the highest yield and best quality onion seeds. Mother bulb size has also a pronounced effect on growth and yield of onion. Karim *et. al.* (1999) observed the best yield of onion with large size mother bulb (20 g). The present investigation was, therefore, undertaken to find out the optimum size of mother bulb and planting time needed to achieve the best possible growth, and bulb and seed yields of onion under the existing agro-climatic conditions of Bangladesh.

Materials and Method

The experiment was conducted at the experimental field of Rajshahi University, Rajshahi during the *rabi* season of 2005-06 using a promising local variety Taherpuri (indigenous). The land was medium high having sandy loam textured soil with pH 6.5 under the low Ganges river floodplain agroecological zone AEZ-12. Three levels of bulb size viz., large (20 g), medium (15 g) and small (10 g) and three levels of planting time viz, 30 October, 15 November and 30 November were considered as treatments in the experiment. The experiment was laid out in a randomized complete block design with three replications. The unit plot size was 1.2m x 1.5m. Bulbs were planted at a spacing of 20 cm x 15 cm. The land was prepared by ploughing and laddering properly during the month of October 2005 and fertilized with well decomposed cowdung, urea, triple superphosphate (TSP), murate of potash (MP) and gypsum at the rate of 5 ton, 260 kg, 266 kg, 150 kg and 110 kg per hectare, respectively (Ahmed and Shahiahan, 1991). The entire quantity of cowdung, TSP, MP, gypsum and half of urea were applied as basal. The remaining urea was applied in two equal splits at 25 and 50 days after planting. Cultural practices, such as weeding, irrigation and mulching were done as and when necessary. Ten plants from each plot were selected randomly at harvest for collection of data on growth, yield components and yield. Data were analyzed statistically following MSTAT-C package program and the mean differences were evaluated by Duncun's Multiple Range Test (DMRT) following Gomez and Gomez (1984).

Results and Discussion

Effect of mother bulb size

Different sizes of onion mother bulb showed significant effect on growth, yield components and yield of bulb and seed except bulb length (Table 1 and 2). The maximum plant height (61.07 cm) and number of leaves per plant (18.23) were produced by large mother bulb, which was significantly higher than the medium and small sized bulb. Bulb diameter, bulb volume, bulb weight per plant and bulb yield were increased with the increase of mother bulb size. The maximum bulb diameter (5.38 cm), bulb volume (32.82 cc), bulb weight per plant (47.96 g) and bulb yield (14.68 t/ha) were obtained from large mother bulb, which was significantly higher than medium and small sized bulb, whereas the minimum

(4.33 cm, 25.78 cc, 44.33 g and 7.47 t/ha, respectively) were found from small mother bulb. The similar trend was found in number of flowers per umbel, fruit set (%), weight of seeds per plant, 1000-seed weight and seed yield. The highest 1000-seed weight (2.87 g) and seed yield (392.3 kg/ha) were obtained from large mother bulb, which were significantly different from other two sizes of mother bulb. Mollah *et al.* (1997) and Karim *et al.* (1999) reported that large mother bulb showed better performance in bulb and seed production of onion compared to that of medium and small mother bulb.

Table 1. Effects of mother bulb size and planting time on growth and yield of onion.

Treatments	Plant height (cm)	No. of leaves/plant	Bulb length (cm)	Bulb diameter (cm)	Bulb volume (cc)	Bulb wt/plant (g)	Bulb yield (t/ha)
Bulb size							
Large	61.07a	18.23a	3.37	5.38a	32.82a	47.96a	14.68a
Medium	59.37b	16.08b	3.28	4.72b	31.19b	47.80b	12.06b
Small	57.37c	11.73c	3.03	4.33c	25.78c	44.33c	7.47c
F-test	**	**	ns	**	**	**	**
CV (%)	1.44	3.77	7.3	6.32	6.73	1.22	1.28
Planting time							
30 October	62.29a	16.72a	3.53	5.11	32.69a	48.85a	13.89a
15 November	59.29b	15.20b	3.18	4.81	30.0Db	47.70b	11.18b
30 November	56.23c	14.12c	2.98	4.50	27.09c	43.54c	9.14c
F-test	**	**	ns	**	**	**	**
CV (%)	1.44	3.77	7.3	6.32	6.73	1.22	1.28

Values having common letter(s) in a column do not differ significantly at 5% level as per DMRT ** indicates significant at 1% level and ns indicates not significant at p 0.05.

Table 2. Effects of mother bulb size and planting time on seed yield of onion.

Treatments	No. of flowers/umbel	Fruit set (%)	Weight of seeds/plant (g)	1000-seed wt (g)	Seed yield (kg/ha)
Large	231.4a	72.47a	2.24a	2.87a	392.3a
Medium	224.4h	70.21b	1.97h	2.70b	371.1b
Small	206.5c	64.87c	1.25c	2.23c	346.1c
F-test	**	**	**	**	**
CV (%)	5.33	4.65	4.98	3.82	1.32
Planting time					
30 October	226.6a	71.16a	2.17	2.74	383.2a
15 November	220.4b	69.35b	1.76	2.58	369.4b
30 November	215.2c	67.03c	1.52	2.47	356.8c
F-test	**	**	**	**	**
CV (%)	5.33	4.65	4.98	3.82	1.32

Values having common letter(s) in a column do not differ significantly at 5% level as per DMRT * indicates significant at 5% level and ** indicates significant at 1% level at p≤0.05.

Effect of planting time

Different planting times showed significant effect on most of the characters studied except bulb length, bulb diameter, weight of seeds per plant and 1000-seed weight (Table 1 and 2). October 30 planting produced the longest plants (62.29 cm) and the highest number of leaves per plant (16.72) compared to other plantings. Bulb volume, bulb weight per plant and bulb yield were decreased with the delay of planting time. The highest bulb volume (32.69 cc), bulb weight per plant (48.85 g) and bulb yield (13.89 t/ha) were recorded in 30 October planting time. The similar trend was observed in case of seed yield. The highest number of flowers per umbel (226.6), fruit set (71.16%) and seed yield (383.2 kg/ha) were found in 30 October planting time, which was significantly higher than other two planting dates. With the delay of planting, plant height and growth period were gradually reduced. At early planting, plants received comparatively high temperature which might have promoted vegetative growth resulting in the maximum plant height and the longest growth period. Plants at early planting also showed the highest bulb diameter, bulb volume, individual bulb weight and gave the highest bulb yield per plant and per ha (Ahmed and Munshi, 1995). The maximum yield at the early planting was due to the cumulative contribution of all the yield contributing characters influenced by comparatively high temperature and long day length. On the other hand, slow vegetative growth period, bulb volume, bulb diameter, bulb weight and yield were observed at late planting because of lower atmospheric temperature and short day length. These findings coincided with that of Lisabao *et al.* (1985), Singh *et al.* (1991) and Khokhar *et al.* (1970).

Interaction effect

Interaction between mother bulb size and planting time had significant effect on growth, yield components and yield of bulb and seed (Table 3 and 4). The maximum plant height (65.78 cm) and number of leaves per plant (20.15) were recorded in large mother bulb with 30 October planting time, which was significantly higher than all other treatment combinations (Table 3). Large mother bulb with early planting gave the highest bulb length (3.95 cm), bulb diameter (5.79 cm) and bulb volume (35.73 cc), whereas the lowest bulb length (2.82 cm), bulb diameter (4.10 cm) and bulb volume (24.76 cc) were found in small mother bulb with 30 November planting time. The maximum bulb weight per plant (50.25 g) and bulb yield (17.52 t/ha) were observed in large mother bulb with 30 October planting time, whereas the minimum bulb weight per plant (38.98 g) and bulb yield (5.30 t/ha) were found in small mother bulb with 30 November planting time, which were significantly different from rest of treatment combinations.

Table 3. Interaction effects of mother bulb size and planting time on growth and yield of onion at harvest.

Interaction (Bulb size × planting time)		Plant height (cm)	No. of leaves/plant	Bulb length (cm)	Bulb diameter (cm)	Bulb volume (cc)	Bulb wt/plant (g)	Bulb yield (t/ha)
Large	30 October	65.78a	20.15a	3.95a	5.79a	35.73a	50.25a	17.52a
	15 Noember	60.29bc	18.08b	3.20b	5.26ab	32.80ab	47.89d	14.25b
	30 November	57.15e	16.465cd	2.98b	5.10ab	29.92bc	45.75f	12.10c
Medium	30 October	61.65b	17.15 be	3.45ab	4.95ab	33.55ab	49.38b	14.25b
	15 Noember	59.30cd	16.07d	3.25b	4.89ab	30.10bc	48.11c	11.92c
	30 Noember	57.19e	15.01c	3.15b	4.32b	29.92bc	45.90f	10.02d
Small	30 October	59.45cd	12.88f	3.19b	4.60b	28.80c	46.92c	9.91d
	15 Noember	58.27de	11.45g	3.09b	4.29b	27.10c	47.10e	7.20e
	30 Noember	54.38f	10.89g	2.82b	4.10b	24.76d	38.98g	5.30f
F-test		**	*	*	*	*	**	**
CV (%)		1.44	3.77	7.3	6.32	6.73	1.22	1.28

Table 4. Interaction effects of mother bulb size and planting time on seed yield of onion at harvest.

Interaction (Bulb size × planting time)		No. of flowers/umbe	Fruit set (%)	Wt of seeds/plant (g)	100-seed wt (g)	Seed yield (kg/ha)
Large	30 October	235.15a	75.05a	2.55a	3.02a	402.80a
	15 Noember	230.75b	73.10b	2.30b	2.84ab	395.92c
	30 November	228.28c	69.25e	1.88c	2.75b	378.22d
Medium	30 October	231.98b	71.66c	2.42ab	2.86ab	396.10b
	15 Noember	225.35d	69.97d	1.85c	2.72b	365.20e
	30 Noember	215.82e	68.99f	1.65d	2.52c	352.10f
Small	30 October	212.75f	66.78g	1.55d	2.35cd	350.81g
	15 Noember	205.18g	64.98h	1.15e	2.20de	347.22h
	30 Noember	201.56h	62.85i	1.05e	2.15e	340.12i
F-test		**	**	*	*	**
CV (%)		5.33	4.65	4.98	3.82	1.32

Values having common letter(s) in a column do not differ significantly at 5% level as per DMRT * indicates significant at 5% level and ** indicates significant at 1% level at $p \leq 0.05$.

Almost similar trend was found in number of flowers per umbe, fruit set (%), weight of seeds per plant, 1000-seed weight and seed yield. The highest number of flowers per umbe (235.15) and fruit set (75.05 %) were observed in the treatment combination of large mother bulb with 30 October planting time and the lowest (201.56 and 62.85) was in small mother bulb with 30 November

planting time (Table 4). Weight of seeds per plant, 1000-seed weight and seed yield of onion decreased with the delay in planting time irrespective of mother bulb size. The highest weight of seeds per plant (2.55 g), 1000-seed weight (3.02 g) and seed yield (402.80 kg/ha) were obtained from large mother bulb with early planting (30 October) and the lowest weight of seeds per plant (1.05 g), 1000-seed weight (2.15 g) and seed yield (340.12 kg/ha) from small mother bulb with late planting (30 November).

The overall results obtained from this study revealed that early planting was always essential to get higher bulb and seed yield because yield was significantly reduced with delay in planting. The treatment combination of large mother bulb with 30 October planting time was more suitable than the rest of the treatment combinations under the soil and climatic condition of Rajshahi for bulb and seed production of onion.

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