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EFFECTS OF PLANTING TIME AND VARIETY ON ONION PRODUCTION

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ABSTRACT
The experiment was conducted at the Horticultural Field of the Department of Crop Science and Technology of Rajshahi University, Bangladesh, during growing season of 2014-15 to investigate the effects of planting time on the growth and yield of three local varieties of onion. The experiment consists of two factors viz.three planting times and three varieties. The planting date 30 December gave the highest yield (11.73 t/ha).Taherpuri variety also significantly produced the highest yield (11.95 t/ha) than other varieties of onion.Their combined effect was also significantly produced the highest yield of bulb (13.47 t/ha) from 30 December planting and Taherpuri variety of onion. The treatment combination 30 December and Taherpuri produced the highest yield of bulb (13.47 t/ha), which were significantly different from all other treatment combinations. The results suggested that Taherpuri variety and 30 December planting time produced more effective growth and yield performance on seed to bulb onion production.

1. Introduction

(Allium cepa L.) is one of the most important spice as well as vegetables of the world. The centre of origin of the crops is west China and the desert lying east of the Caspian Sea (Jones and Mann, 1996). The major onion growing countries of the world are India, Pakistan, China, Korea, Netherland, Israel, Japan, Turkey, Syria, Egypt, USA, Lebanon (FAO, 2012). Bulb is the main edible portion of onion. In Bangladesh, it is grown in almost all the districts, but commercially cultivated in greater districts of Faridpur, Rajshahi, Dhaka, Mymensingh, Comilla, Jessore, Rangpur, Kustia, Bogura and Pabna (BBS, 2012). On an average, the total annual requirement of onion in Bangladesh is about 16,50,000 metric tons but production is 10,52,000 metric tons (Anon., 2012).

Bangladesh has to import onion from India and China every year to meet up the demand of our people (Hossain and Islam, 2006).The farmers of Bangladesh cannot adopt early planting due to climatic limitations. In the month of September - October, the late rain and flood water in the low lying areas make the early planting impossible. This situation at the beginning of growing season delays planting in most cases. Under favorable conditions, higher yield may be obtained in a shorter growing season. Planting at proper time has a prominent effect on the growth and yield of onion. Early planting is the

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best for onion bulb production (Attar and Korla, 1991).To boost up the production of onion in Bangladesh, efforts should be made to increase the per hectare yield through the improved varieties, optimum planting/sowing time etc.

2. Materials and methods

The research work was carried out at the Botanical Garden Field of Rajshahi University, Bangladesh in 2014-15 growing season. Soil texture of this area is clay to loam. The selected site was a medium high land and the pH of the soil was 8.10 with organic matter content of 2.56%, but onion yielded better at a pH range of 5.8-6.5 (Bose *et al*., 1993). The soil sample of the experimental area has been analyzed in the Bangladesh Soil Resources Development Institute. The research works, consists of two factors A. varieties (Taherpuri, Kalash Nagori and Faridpuri Vati) and B. Planting times (December 30, January 10, January 20).The experiment was laid out in a Randomized Complete Block Design (RCBD) with three replications. The experimental land was first divided into three blocks, each containing nine plots total twenty seven (27) unit plots. The size of unit plot was 1m × lm. Treatments were assigned at randomly to 9 plots of each block. The space kept between blocks was 50 cm and between the plots was 30 cm. The whole amount of well decomposed cow dung and TSP was applied during the final land preparation. The total quantity of Urea and MP was applied as top dressing into two equal installments, first after 30 days and the second after 50 days of transplanting of seedlings (Rashid, 1983). All the required cultural operation was given uniformly when necessary. Harvest was done by hand when leaves of plant become yellowish. Data were collected on time taken days to plant height (cm), number of leaves per plant, length of bulb (cm), diameter of bulb (cm), dry matter of bulb (percentage), individual bulb weight (g), yield per plot (g), yield per hectare (t/ha). The collected data on different parameters under study were statistically analyzed using MSTAT-C program. The means for all the treatments were calculated and analyses of variances for all the characters were performed by F-variance test. The significance of the differences among the pairs of treatment means was evaluated by the least significance difference (LSD) test at 1% level of probability (Gomez and Gomez, 1984) for the interpretation of results.

3. Results and Discussion

3.1 Plant height (cm)

Plants from 30 December planting attained maximum height 34.59 cm while 20 January produced minimum height 29.29 cm (Fig.1). In 30 December longer sunny days which probably enhanced meristematic cell elongation and cell division resulting in the maximum plant height. The height of onion plant decreased as the planting time was delayed **(**Lisbao*et al.*,1985). Varieties had highly significant influence on the plant height at different growth. Highest plant height (35.90 cm) was recorded in Taherpuri variety at 60 days after planting and the lowest plant height (29.98 cm) was recorded from Faridpuri Vati. Combined effect of planting time and variety on plant height was found significant except 15 DAP (Table4). The highest plant height (38.56 cm) was recorded in the treatment combination of 30 December planting with Taherpuri variety at 60 days after planting and the lowest plant height (29.29 cm) was noticed in the variety Faridpuri Vati planted on 30 December (Izquierdo *et al.,* 1981).

3.2 Number of leaves

Number of leaves per plant was influenced significantly by the planting dates and varieties except combined application at 45 DAP. The plants which planted on 30 December exhibited higher (4.88) number of leaves per plant compared to the plant from 20 January planting (4.28)(Fig.2).Early planting seems to be obtained favorable climate and longer time for growth than the late plating

(Ahmed, 2007). The maximum number of leaves (4.88) was found in Taherpuri variety and the minimum (4.28) in FaridpuriVati variety at 60 days after planting (Table 6). The maximum number (5.22) of leaves per plant was obtained from the variety Taherpuri when planted at 30 December at 60 days after planting while the minimum number of leaves per plant (4.02) was obtained from the Faridpuri Vati when planted at 20 January (Table 7)

3.3 Bulb length (cm)

Different varieties and planting dates had highly significant effect on bulb length but combined effect was insignificant. The longer bulb 3.63 cm was recorded from the 30 December planting and the lowest 3.27 cm in 20 January planting (Table 1). The longest bulb (3.66cm) was produced by the variety Taherpuri and the lowest bulb length (3.25cm) was recorded from variety Faridpuri Vati (Table 2) (Pathak *et al.* 1996). The maximum bulb length (3.82 cm) was obtained from Taherpuri when planted at 30 December and the minimum (3.12 cm) was obtained from the treatment combination of 20 January planting and Faridpuri Vati variety .Combined effect of planting time and varieties on bulb length was non-significant (Table 3).

3.4 Bulb diameter (cm)

Diameter of the bulb of onion plants for different planting dates and varieties varied highly significant. The higher bulb diameter was recorded in 30 December planting (3.74 cm) and the lowest from 20 January planting (3.21cm).Larger bulb with earlier planting time also found(Badaruddin and Haque, 1977) (Table 1). The maximum (3.82 cm) bulb diameter was recorded in Taherpuri and the minimum bulb diameter (3.13 cm) was recorded from FaridpuriVati variety(Table 2). Bulb diameter of different onion varieties showed much variation (Masthanareddy and Sulikery, 1998).The bulb diameter was recorded to be the maximum (4.18 cm) at the treatment combination of 30 December planting with Taherpuri variety and the minimum (2.77 cm) was recorded at the treatment combination of 20 January planting with FaridpuriVati of onion variety. Combined effect of planting time and varieties on bulb length was non-significant (Table 3).

3.5 Individual bulb weight (g)

Significant difference in fresh weight of onion bulbs per plant was noticed due to the effect of date of planting and varieties. The bulb weight was recorded to be higher (17.18 g) at 30 December planting and lower (12.87 g) at 20 January planting (Fig. 4). Onion planted on 30 December produced heavier and larger bulbs resulting in the highest weight (Izquierdo *et al.*, 1981). The average fresh weight of bulb was recorded to be the highest (17.44 g) in Taherpuri and the lowest (12.75 g) in Faridpuri Vati (Fig.6). The maximum bulb weight (19.84 g) was obtained from Taherpuri when planted at 30 December and the minimum average bulb weight (10.47 g) was obtained from Faridpuri Vati when planted at 20 January (Table 3).

3.6 Dry matter content of bulb

Variety and planting date of bulb significantly influenced the dry matter content. The higher percentage of dry matter content (15.48%) was obtained at 30 December planting. The lowest percentage (14.50%) was found at 20 January (Table 1). The highest percentage of dry matter (16.47%) showed Taherpuri and the lowest dry matter percentage (13.47%) was found in Faridpuri Vati variety**(**Table2). 30 December planting from Taherpuri variety showed highest percentage of dry matter content (16.85%) and the lowest result (13.18%) was found from variety Faridpuri Vati when planted at 20 January**(**Table 3).

3.7 Yield of bulb per plot (g)

Due to different varieties and planting dates, the yield of bulb per plot was varied significantly. The

maximum yield of bulb per plot was recorded in 30 December planting (1718 g) and minimum from 20 January planting (1286 g) (Fig.5).The maximum yield per plot of onion (1744 g) was recorded from Taherpuri variety and the minimum (1274 g) from Faridpuri Vati variety (Fig. 7).At combined treatment the highest yield (1984 g) was obtained from Taherpuri variety when planted at 30 December. On the other hand, the lowest yield (1047 g) was observed at 20 January planting time and Faridpuri Vati variety **(**Table 3).

3.8 Bulb yield (t/ha)

Differences in planting date and variety also highly significantly influenced the bulb yield of onion per hectare. The 30 December planting gave higher bulb yield 11.73 t/ha and the lowest bulb yield 8.99 t/ha at 20 January planting **(**Table 1). Longer period of photosynthesis that leds to more deposition of photosynthates during the vegetative growth of plants which contributed to increase the bulb yield in early planting (Davis and Jones, 1944). The highest yield of onion bulb per hectare (11.95 t/ha) was obtained from the variety Taherpuri, and the lowest yield (8.85 t/ha) was obtained from Faridpuri Vati (Table 1) (Resende *et al.*,1996). The highest yield of onion bulb per hectare (13.47 t/ha) was recorded from the variety Taherpuri when planted at 30 December. The lowest yield of bulb per hectare (7.33 t/ha) was recorded from the variety Faridpuri Vati when planted at 20 January **(**Table 3).

4. Conclusions

It is observed from the present study that among the planting date 30 December gave the highest yield. Higher yield, higher plant height, higher number of leaves, bulb length, bulb diameter, individual weight of bulb and maximum dry matter content were obtained from Taherpuri variety. Taherpuri variety may be used to maximize production of onion through seed to bulb production method. As per hectare production of onion obtained from this experiment is high so it should be economically benefited. As well as economic point of view a combination of 30 December planting and Taherpuri variety may be recommended for maximizing seed to bulb onion production.

Conflict of interests

All manuscripts that are submitted to the journal do not have any conflicts of interest.

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TABLES

Table1. Effects of planting time on bulb length, bulb diameter, dry matter and yield of onion

Planting time	Bulb length (cm)	Bulb diameter (cm)	Dry matter of bulb (%)	Yield per plot (g)	Yield (t/ha)
T_1	3.63	3.74	15.48	1718	11.73
T_2	3.54	3.60	15.07	1568	10.85
T_3	3.27	3.21	14.50	1286	8.99
Level of significance	**	**	*	**	*
LSD	0.155	0.1708	0.6044	69.44	0.5305

Table2. Effect of varieties on bulb length, bulb diameter, dry matter and yield of onion

Varieties	Bulb length (cm)	Bulb diameter (cm)	Dry matter (%)	Yield (t/ha)
V_1	3.66	3.82	16.47	11.95
V_2	3.52	3.57	15.10	10.77
V_3	3.25	3.13	13.47	8.85
Level of significance	**	**	*	**
LSD	0.1550	0.1708	0.6044	0.5305

Table3. Combined effect of planting time and varieties on bulb length, bulb diameter, dry matter and yield of onion

Treatment combination	Bulb length (cm)	Bulb diameter (cm)	Individual bulb weight (g)	Dry matter (%)	Yield per plot (g)	Yield (t/ha)
T_1V_1	3.82	4.18	19.84	16.85	1984	13.47
T_1V_2	3.73	3.79	17.61	15.86	1761	12.05
T_1V_3	3.33	3.28	14.10	13.72	1410	9.66
T_2V_1	3.74	3.89	17.92	16.80	1792	12.21
T_2V_2	3.60	3.59	15.47	14.90	1547	10.76
T_2V_3	3.30	3.33	13.67	13.49	1367	9.57
T_3V_1	3.45	3.52	14.56	15.76	1456	10.17
T_3V_2	3.23	3.32	13.56	14.56	1356	9.49
T_3V_3	3.12	2.77	10.47	13.18	1047	7.33
Level of significance	NS	NS	*	**	*	**
LSD	-	-	0.8897	0.8170	88.97	0.732

Table 4. Effect of varieties on plant height of onion

Varieties	Plant height (cm) at				
	15 DAP	30 DAP	45 DAP	60 DAP	75 DAP
V_1	22.86	30.02	33.42	35.90	34.19
V_2	21.88	27.29	31.45	34.56	32.43
V_3	19.02	24.84	18.10	29.98	27.73
Level of significance	**	**	**	**	**
LSD	1.088	1.276	1.223	0.9967	1.023

Table 5. Combined effect of planting time and varieties on plant height

Treatment combination	Plant height (cm)				
	15 DAP	30 DAP	45 DAP	60 DAP	75 DAP
T_1V_1	24.50	31.91	35.42	38.56	36.53
T_1V_2	23.53	29.57	32.56	35.17	34.33
T_1V_3	21.11	27.35	29.76	30.05	28.65
T_2V_1	23.52	32.65	35.25	36.64	35.4
T_2V_2	22.45	28.58	32.36	35.20	32.24
T_2V_3	18.69	24.55	28.03	30.62	27.76
T_3V_1	20.56	25.50	29.60	33.31	30.72
T_3V_2	19.65	23.72	29.45	32.52	30.60
T_3V_3	17.25	22.62	26.52	29.29	26.77
Level of significance	NS	**	*	**	**
LSD	-	2.210	1.567	1.726	1.772

Table 6. Effect of varieties on number of leaves per plant of onion

Varieties	Number of leaves per plant				
	15 DAP	30 DAP	45 DAP	60 DAP	75 DAP
V_1	2.93	3.87	4.38	4.88	4.50
V_2	2.63	3.58	4.04	4.52	4.21
V_3	2.51	3.33	3.86	4.28	3.76
Level of significance	**	**	**	**	**
LSD	0.1550	0.1657	0.1604	0.1757	0.1550

Table 7. Combined effect of planting time and varieties on number of leaves per plant of onion

Treatment combination	Number of leaves per plant				
	15 DAP	30 DAP	45 DAP	60 DAP	75 DAP
T_1V_1	3.31	4.18	4.85	5.22	4.85
T_1V_2	2.68	3.67	4.31	4.97	4.52
T_1V_3	2.44	3.47	4.20	4.45	4.16
T_2V_1	2.86	3.77	4.18	4.85	4.40
T_2V_2	2.65	3.51	3.98	4.29	4.02
T_2V_3	2.57	3.27	3.70	4.04	3.57
T_3V_1	2.62	3.66	4.13	4.56	4.26
T_3V_2	2.56	3.55	3.82	4.28	4.10
T_3V_3	2.53	3.26	3.67	4.02	3.56
Level of significance	**	**	NS	*	NS
LSD	0.2684	0.2870	-	0.2943	-

** = Significant at 1% level of probability

* = Significant at 5% level of probability

NS = Non-significant

LSD= Least Significant Difference

T_1= 30 December, 2014

T_2= 10 January, 2015

T_3= 20 January, 2015

V_1= Taherpuri

V_2= Kalash Nagori

V_3= Faridpuri Vati

FIGURES

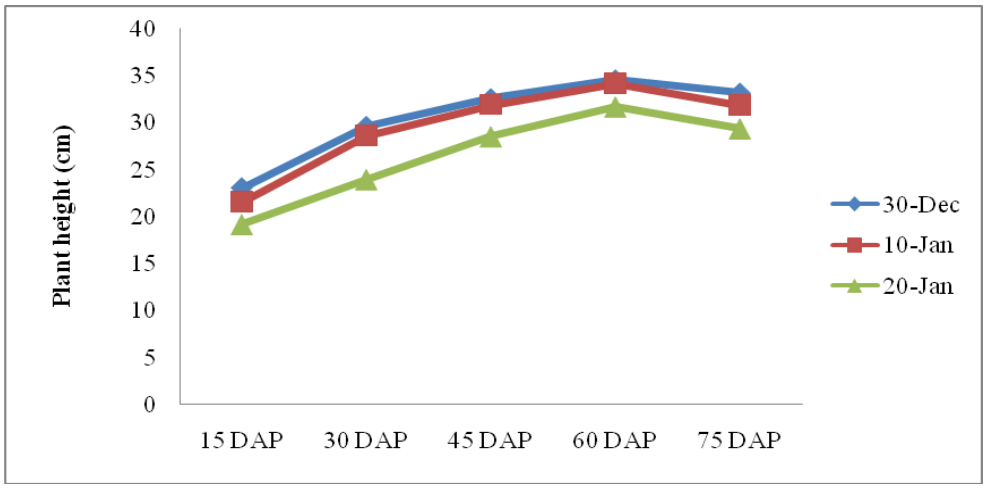

Figure1. Effect of planting time on plant height of onion

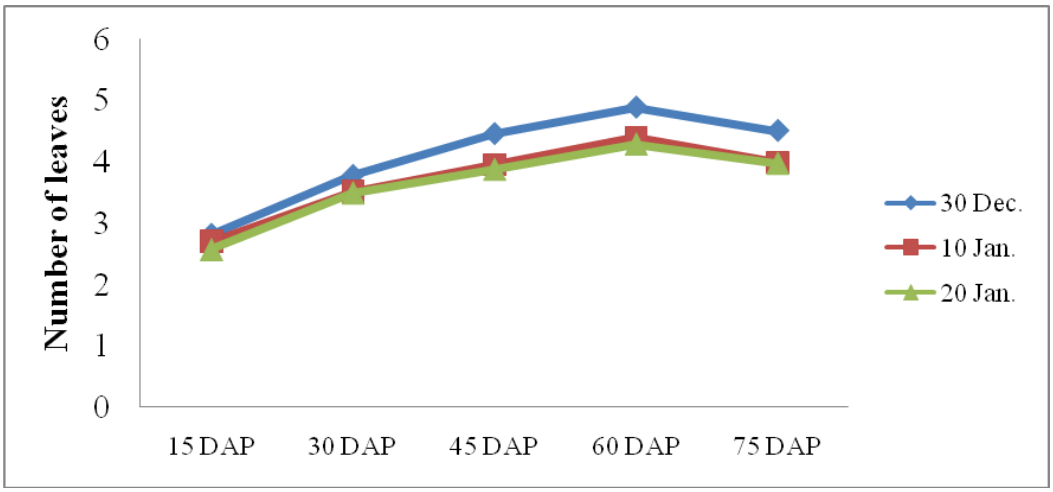

Figure2. Effect of planting time on number of leaves per plant of onion

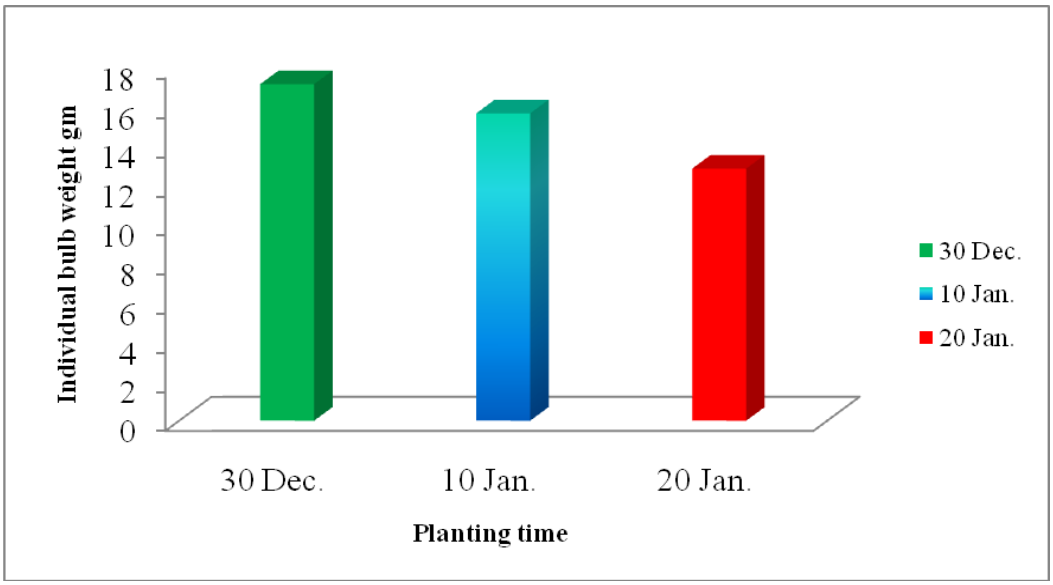

Figure 4. Effect of planting time on individual bulb weight (g)

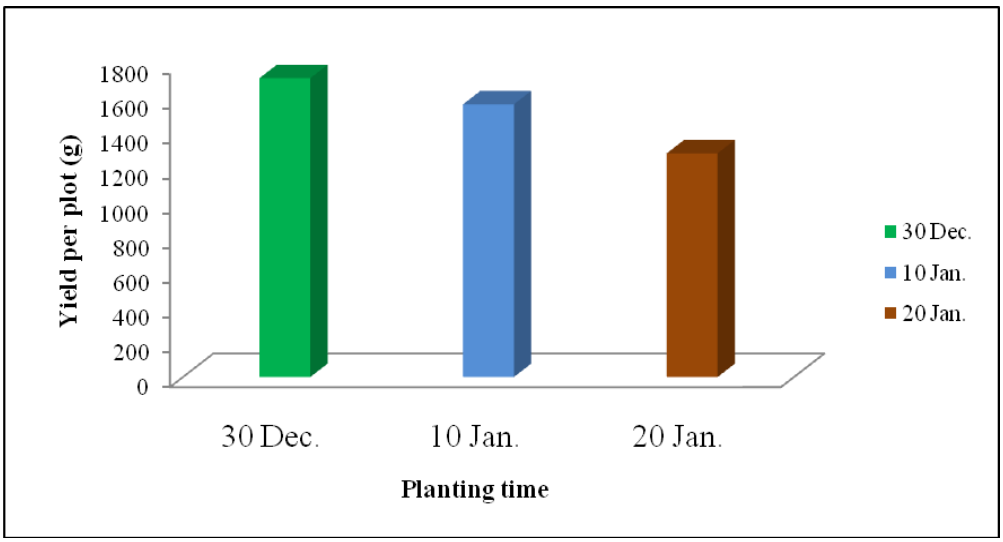

Figure 5. Effect of planting time on yield per plot (g)

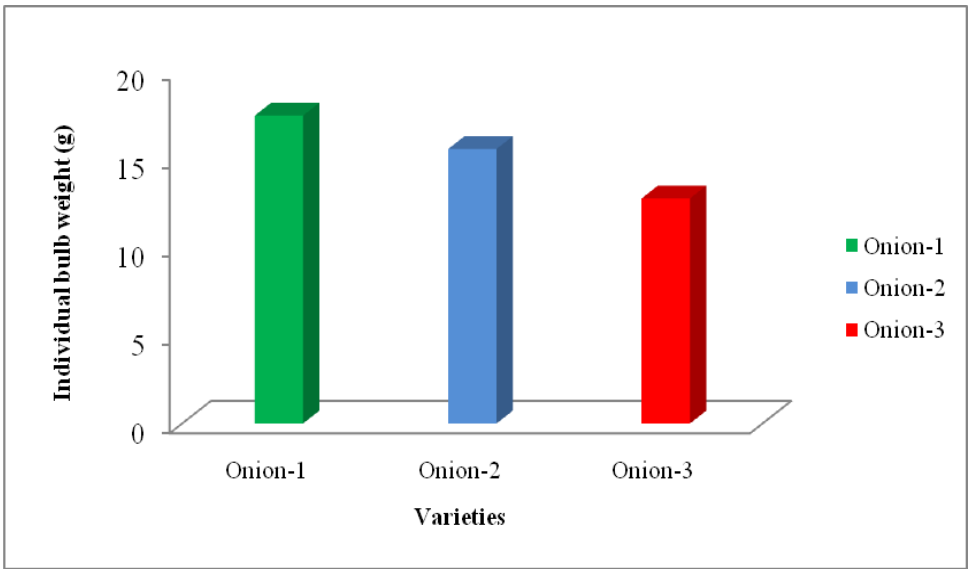

Figure 6. Effect of varieties on individual bulb weight (g)

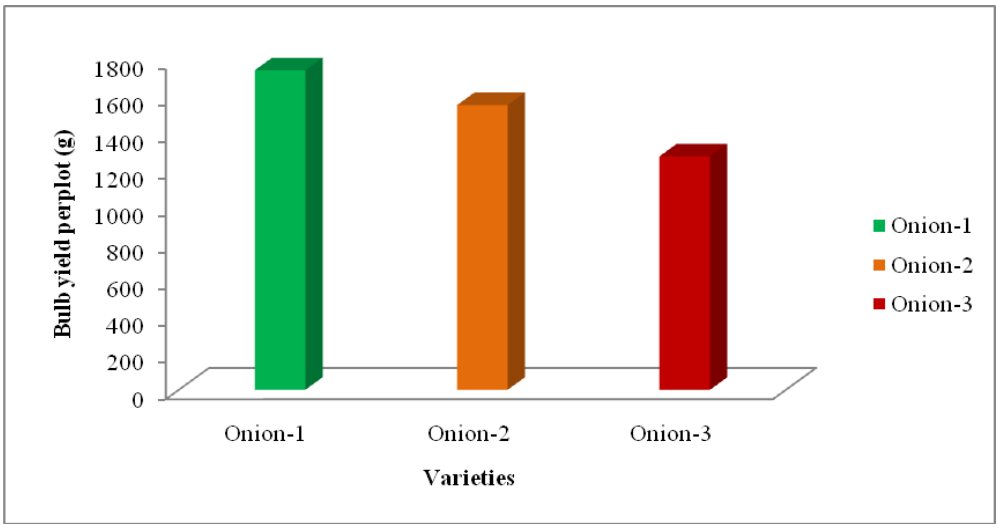

Figure 7. Effect of varieties on yield per plot (g)