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Effect of Mulch and Bulb Size on Growth of Onion (*Allium cepa* L.)

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Abstract: The effect of mulch and bulb size on the growth of onion was studied using four mulch treatments, viz., non-mulch i.e. control, ridge method of mulch, straw and black polyethylene mulch; and five different sizes of seed bulbs, viz., very small (0.5 g), small (1.0 g), medium (1.5 g), large (2.5 g) and very large (4.5 g). Mulching and bulb size had significant effect on plant height, leaf number, pseudostem diameter, root number and length. The interaction effect of mulch and bulb size was significant in plant height, root length and root number but it was non-significant in leaf number and pseudostem diameter.

Key words: Onion (*Allium cepa* L.), bulb size, mulch, growth factors

Introduction

Onion (*Allium cepa* L.) is one of the most important bulb crop in Bangladesh as well as in the world. It is used as a delicious vegetable and spice crop in many countries of the world including Bangladesh. It has a medicinal value and contains an appreciable amount of various nutrients. In Bangladesh, onion ranks top in respect of production and second in area (Anonymous, 1999). According to Anonymous (1999), Bangladesh produces 131 thousand mt of onion per year from 33,198 hectares of land. But this yield is very low as compared to other onion producing countries of the world and even our country. Onion production is mainly influenced by environmental factors, cultivars and different cultural practices (Mondal *et al.*, 1986; Mondal, 1991). The mulching and bulb size might play a vital role to reach the maximum growth of onion plant. Mulch reduces water loss resulting in more conservation of soil moisture. The growth of onion can be increased by the application of mulching (Mia, 1996; Rekowski, 1997). So, artificial mulching by using ridge, straw and black polythene sheet etc. to be helpful in this situation. On the other hand, bulb size also influenced the plant growth of onion. Information based on the effect of mulch and bulb size on the growth of onion under Bangladesh conditions is not conclusive. In such circumstances, the experiment was undertaken to study the effect of mulch and bulb size on the growth of onion plant.

Materials and Methods

The experiment was conducted at the Horticulture Farm, Bangladesh Agricultural University, Mymensingh in order to study the effect of mulch and bulb size on the growth of onion during the period from November' 1999 to March' 2000. The selected experimental plot was well drained medium high land having a soil pH 6.8. The land was ploughed with the help of power tiller and fertilized at the rate of 10 tons of cowdung, 250 kg urea, 210 kg TSP, 170 kg MP and 100 kg Gypsum per hectare. The whole amount of cowdung was applied immediately after opening the land and total amount of urea, TSP, MP and Gypsum were applied during the final land preparation. The experiment was laid out in randomized complete block design with three replications. The size of each plot was 1.0 × 0.8m² and onion bulbs were planted at 20 × 10cm² spacing.

The experiment was consisted of two factors: A viz., four mulch treatment [Control (M₀), ridgemethod (M₁), straw (M₂), Block polythene sheet (M₃)] and B viz., five bulb sizes (0.5g (S₁), 1.0g (S₂), 1.5g (S₃), 2.5g (S₄) and 4.5g (S₅)).

Ridge or light earthing up (M₁) was done after 2 weeks of planting when the plants were 10 cm tall. Straw and block polythene mulch were used immediately after seedling raising. The crop was always kept under careful observation, weeding, gap filling and plant protection were done as and when necessary but irrigation was not applied in the plot. The crops were harvested at different dates from 26 February to 9 March' 2000 in different plots. Plant height was measured by meter scale from 10 randomly selected plants from ground level to the tip of the longest leaf at 15 days

interval starting from 20 days after planting up to 80 days and leaf number was counted at the same time. Pseudostem diameter was measured at the neck of plants with slide caliper at harvest. Root length was estimated with the help of centimeter scale and root number was counted after harvest. The collected data were analyzed by analysis of variance method. The mean of different parameters was compared by LSD test as described by Gomez and Gomez (1984).

Results and Discussion

Plant height: The effect of mulching on plant height was found to be statistically significant at different days after planting. It was observed that plant height increased gradually with the passage of days after planting (Table 1). But it was found to decrease gradually after 50, 65 and 80 days of planting due to drying up of tip of leaves under different mulch conditions. At each DAP, comparatively higher plant height was found by using straw mulch than other treatments of mulch. Straw mulch produced the tallest plant, which was statistically identical to black polythene mulch. Mia (1996) found that plants grown with mulch exhibited higher plant height of onion. With straw mulch plant received more soil moisture and temperature which might promote the vegetative growth resulting in the maximum plant height.

Plant height gradually increased with the passage of time from 20 DAP to 80 DAP in case of very small (S₁), small (S₂) and medium (S₃) size bulb, but in case of large (S₄) and very large (S₅) size bulb, plant height decreased after 50 DAP. Plant height slightly decreased after 50 DAP due to drying of tip of leaves. Lazic (1975) reported that larger bulb increased the plant height as compared to smaller bulb. Taller plants produced from large size bulb may be due to enhanced vegetative growth caused by maximum amount of stored food materials in them. The combined effect of mulch and bulb size on plant height at different days after planting was significant at 35, 50 and 65 DAP. Very large size bulb gave the highest plant height at 20 to 50 days after planting, when the bulb planted in straw mulch condition.

Pseudostem diameter: The influence of different mulch on pseudostem diameter of onion was found to be statistically significant. The highest pseudostem diameter (1.30 cm) was observed with black polythene mulch which was statistically different from other treatments (Table 1). The lowest pseudostem diameter (1.08 cm) was observed in control condition. Mia (1996) reported that onion grown with mulch gave the higher pseudostem diameter. Differences in pseudostem diameter were found to be statistically significant due to bulb size. The pseudostem diameter increased gradually with the increase in bulb size. The highest diameter (1.27 cm) was found from very large size bulb and the lowest (1.05cm) was obtained from very small size bulb. The variation in diameter of pseudostem due to the combine effect of mulch and bulb size was found to be statistically insignificant.

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Table 1: Effect of different mulch and bulb size on plant height, pseudostem diameter and root length of onion.

Treatments	Plant height (cm) at					Pseudostem diameter (cm)	Root length (cm)
	20 DAP	35 DAP	50 DAP	65 DAP	80 DAP		
Mulch							
Open flat (M ₀)	24.17	32.14	36.60	35.30	36.30	1.08	15.19
Ridge method (M ₁)	24.95	33.21	35.96	36.02	36.66	1.11	14.62
Straw (M ₂)	28.97	38.32	41.92	44.96	45.39	1.17	15.88
Black polythene (M ₃)	27.40	37.57	42.65	44.42	42.95	1.30	13.42
LSD (0.05)	1.24	1.92	1.16	1.38	3.05	0.09	0.83
(0.01)	1.66	2.58	1.56	1.85	4.08	0.12	1.12
Level of significance	**	**	**	**	**	**	**
Bulb size							
Very small (S ₁)	21.36	31.68	36.50	42.09	42.53	1.05	15.72
Small (S ₂)	25.26	34.22	39.16	41.33	42.24	1.12	16.05
Medium (S ₃)	27.71	36.99	40.78	41.18	41.57	1.16	13.91
Large (S ₄)	28.05	36.46	39.13	48.13	38.74	1.22	14.80
Very large (S ₅)	29.47	37.26	40.84	38.16	36.54	1.27	13.39
LSD (0.05)	1.38	2.15	1.30	1.54	3.41	1.10	0.93
(0.01)	1.85	2.88	1.74	2.06	4.56	1.14	1.25
Level of significance	**	**	**	**	**	**	**
Mulch × Bulb size							
M ₀ S ₁	20.50	30.75	34.46	35.94	37.13	1.00	16.07
M ₀ S ₂	21.87	30.09	33.75	34.18	36.22	1.05	14.33
M ₀ S ₃	26.00	36.80	41.93	39.68	38.67	1.08	13.38
M ₀ S ₄	25.83	31.18	34.11	32.92	34.62	1.11	14.98
M ₀ S ₅	26.66	31.87	36.76	33.74	34.90	1.17	17.17
M ₁ S ₁	21.40	29.57	30.74	36.33	38.56	1.01	15.67
M ₁ S ₂	23.59	33.12	38.90	37.64	37.88	1.06	15.60
M ₁ S ₃	25.13	33.84	36.65	35.08	37.82	1.10	13.50
M ₁ S ₄	26.91	35.18	37.87	36.87	36.43	1.15	16.37
M ₁ S ₅	27.70	34.34	36.63	34.20	32.60	1.23	11.95
M ₂ S ₁	22.83	33.94	40.21	49.62	48.88	1.05	18.67
M ₂ S ₂	28.34	35.35	39.37	45.75	50.00	1.14	15.83
M ₂ S ₃	30.42	37.84	43.15	44.46	46.22	1.19	15.17
M ₂ S ₄	30.35	41.27	39.94	40.40	43.50	1.21	15.55
M ₂ S ₅	32.92	43.20	46.93	44.60	38.33	1.28	14.17
M ₃ S ₁	20.73	32.17	38.61	46.46	45.55	1.15	12.47
M ₃ S ₂	27.25	38.32	44.63	47.75	44.87	1.24	18.43
M ₃ S ₃	29.93	39.50	42.18	45.49	43.57	1.29	13.60
M ₃ S ₄	29.13	38.21	44.60	42.32	40.40	1.40	12.30
M ₃ S ₅	30.61	39.63	43.25	40.10	40.35	1.41	10.28
LSD (0.05)	2.77	4.31	2.60	3.08	6.82	0.20	1.86
(0.01)	3.71	5.77	3.48	4.13	9.13	0.27	2.50
Level of significance	-	*	**	**	-	-	**

* Significant at 0.05 level

** Significant at 0.01 level

Root length: Significant variation was observed in root length among mulch treatments (Table 1). The highest root length was obtained with straw mulch (15.88 cm), second with control (15.19 cm) and the lowest in black polythene mulch (14.42 cm). Under non-mulched condition, less soil moisture was present. So, roots were extended to find out water or moisture. As a result, root length was found to be higher in control than black polythene mulch. On the contrary, more soil moisture and higher temperature were present under straw mulch conditions, which may promote the vegetative growth of onion plant. As a result, maximum root length was obtained in straw mulch condition.

There was a significant variation in root length at harvest among the bulb size treatments. The maximum root length (16.05 cm) was obtained from small size bulb and the minimum (13.39 cm) in large size bulb. Small sized bulb contained less amount of stored food material and this food material was used within short time for vegetative growth. Root length at harvest was significantly influenced by the treatment combination of mulch and bulb size. The highest root length (18.67 cm) was measured when very small size bulb grown in straw mulch condition but it was lowest (10.28cm) when black polythene sheet was used in case of very large size bulb.

Leaf number plant⁻¹: Different mulch treatments exhibited significant variation in respect of leaf number plant⁻¹ at different days after planting. The number of leaves plant⁻¹ was gradually increased from 20 to 50 days after planting and thereafter, it

decreased due to drying of lower leaves (Table 2). At each DAP, the maximum number of leaves plant⁻¹ was produced with black polythene mulch in comparison with other mulch treatments. More number of leaves plant⁻¹ obtained by black polythene mulch may be due to more soil moisture conservation which caused rapid vegetative growth. This finding also corroborated with the results of Mondal *et al.* (1986).

Bulb size had significant effect on leaf number plant⁻¹ at different days after planting. From 20 to 50 DAP, leaf number increased with the passage of time, and thereafter, it decreased due to drying of leaves. At each DAP, very large size bulb was found to produce significantly the highest number of leaves plant⁻¹ compared with other bulb size, but at 65 DAP and 80 DAP, the variation in leaf number among S₁, S₂, S₃ and S₄ treatments were statistically identical. This result is also similar with the results of Shaha and Rahman (1995). Comparatively more number of leaves produced by larger bulb, which might be due to higher amount of stored food materials in them responsible for producing more leaves than the smaller bulb. The combine effect of mulch and bulb size was not significant in respect of leaf number at different days after planting.

Root number plant⁻¹: The variation in root number plant⁻¹ among the mulch treatments was found to be statistically significant. The maximum number of roots plant⁻¹ (54.47) was counted from non-mulch practice, where as, the least number (45.85) was obtained from black polythene mulch followed by straw and ridge method

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Table 2: Effect of different mulch and bulb size on leaf number and root diameter of onion.

Treatments	Leaf number at					Root number plant ⁻¹
	20 DAP	35 DAP	50 DAP	65 DAP	80 DAP	
Mulch						
Open flat (M ₀)	3.20	8.97	9.60	9.36	4.97	54.47
Ridge method (M ₁)	2.87	8.12	9.55	8.53	4.63	46.71
Straw (M ₂)	2.89	7.58	10.13	8.62	4.73	46.75
Black polythene (M ₃)	3.31	9.57	12.03	10.31	5.71	45.85
LSD (0.05)	0.30	0.98	1.05	0.95	0.46	4.88
(0.01)	0.40	1.31	1.41	1.27	0.62	6.54
Level of significance	**	**	**	**	**	**
Bulb size						
Very small (S ₁)	1.46	6.17	7.00	8.35	4.80	47.48
Small (S ₂)	1.81	6.19	7.94	8.10	4.35	47.87
Medium (S ₃)	2.77	7.63	9.47	8.48	4.56	45.58
Large (S ₄)	3.48	8.31	10.94	8.62	4.72	48.39
Very large (S ₅)	5.81	14.41	16.29	12.50	6.60	52.90
LSD (0.05)	0.34	1.09	1.17	1.06	0.52	5.46
(0.01)	0.45	1.46	1.57	1.42	0.69	7.31
Level of significance	**	**	**	**	**	-
Mulch × Bulb size						
M ₀ S ₁	1.60	7.13	6.40	4.93	4.93	50.00
M ₀ S ₂	1.77	5.97	7.42	3.90	3.90	51.43
M ₀ S ₃	3.03	7.73	8.87	4.33	4.33	49.23
M ₀ S ₄	3.80	8.77	9.93	4.93	4.93	53.37
M ₀ S ₅	5.77	15.27	15.40	6.73	6.73	68.30
M ₁ S ₁	1.37	6.73	6.50	4.37	4.37	40.20
M ₁ S ₂	1.83	5.93	7.03	3.87	3.87	55.33
M ₁ S ₃	2.50	6.67	8.43	3.67	3.67	39.33
M ₁ S ₄	3.00	7.63	10.20	4.43	4.43	51.43
M ₁ S ₅	5.67	13.63	15.60	6.80	6.80	47.27
M ₂ S ₁	1.27	4.70	7.03	4.37	4.37	49.70
M ₂ S ₂	1.73	5.50	8.17	4.33	4.33	34.13
M ₂ S ₃	2.63	6.90	9.27	4.40	4.40	44.87
M ₂ S ₄	3.67	7.97	11.23	4.93	4.93	49.43
M ₂ S ₅	5.13	12.43	14.97	5.60	5.60	55.63
M ₃ S ₁	1.60	6.10	8.09	5.57	5.57	50.03
M ₃ S ₂	1.90	7.37	9.13	5.30	5.30	50.56
M ₃ S ₃	2.93	9.23	11.33	5.83	5.83	48.90
M ₃ S ₄	3.47	8.87	12.40	4.60	4.60	39.33
M ₃ S ₅	6.67	16.30	19.20	4.27	7.27	40.40
LSD (0.05)	0.68	2.18	2.35	1.03	1.03	10.92
(0.01)	0.91	2.92	3.14	1.39	1.39	14.62
Level of significance	-	-	-	-	-	**

** Significant at 0.01 level

of soil mulch (Table 2). Number of roots plant⁻¹ of onion at harvest was not significantly affected by bulb size treatments. It was observed that the combination of mulches and bulb size had statistically significant effect on root number plant⁻¹ at harvest. Plants those raised from larger size bulb in non mulch condition produced maximum number of roots plant⁻¹ (68.30). The minimum number of roots plant⁻¹ (34.13) was counted from the smaller size bulb planted in straw mulch. From the above study it was found that all the parameters studied were significantly influenced by mulching and different sizes of onion bulb. It is suggested that planting of large size onion bulb using straw mulch will give the better growth of onion plant.

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