

Effect of spacing on growth and yield of two lines of garlic under dry land condition

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Abstract: The investigation was carried out to find the effect of plant spacing on growth and yield of two lines of garlic under dry land condition at BAU, Mymensingh during 2005 to 2006. The two-factor experiment had 4 Plant spacing: 10cm × 10cm (150 plants/1.5 m²), 15cm × 10cm (100 plants/1.5 m²), 15cm × 15cm (66 plants/1.5 m²) and 20cm × 10cm (75 plants/1.5 m²) and 2 garlic lines: G₂ and G₁₉. The experiment was conducted in randomized complete block design (RCBD) with 3 replications. The results revealed that the plant height, number of leaves per plant, fresh weight of bulb, length and diameter of bulb, total number of cloves, yield per plot and yield per hectare were significantly influenced by the treatment of the experiments under study. Results showed that G₁₉ was the best for yield and yield contributing characters than G₂. Yield and yield contributing characters were found to be maximum in garlic lines G₁₉. Garlic line G₁₉ gave the highest yield per plot (2.02 kg) and yield per hectare (16.07 t/ha). The lowest yield per plot (1.65 kg) and yield per hectare (13.09 t/ha) was observed with garlic line G₂. The treatment of 15cm × 15 cm spacing gave the highest yield per plot (2.03 kg) and yield per hectare (16.21 t) and 10cm × 10cm spacing gave the lowest yield per plot (1.60 kg/plot) and yield per hectare (13.16 t). The combined effect of garlic lines and plant spacing revealed significant variation in bulb yield and various yield components. The garlic genotype G₁₉ gave the highest (18.67 t/ha) yields at the closest spacing (10 cm × 10 cm) at Mymensingh.

Key words: plant spacing, lines of garlic, dry land condition.

Introduction

Plant spacing influences the growth and yield of garlic. Yield of garlic is dependent on the number of plants accommodated per unit area of land. Planting of garlic at proper spacing also increases the yield and improves the grade of bulbs. Wider spacing increased number of leaves and greater plant height of garlic has been reported by several authors (Purewal and Daragan, 1961; Om and Srivastava, 1977). Increased bulb size in garlic with wider spacing has been noted by a number of authors (Couto, 1958; Genkov, 1961; Menezes *et al.* 1974). Accommodation of reduced number of plants per unit area involves wider spacing. This directly reduces the yield (Paquet, 1961; Duimovic and Bravo, 1979; Rahim *et al.*, 1984). Thus the increased number of plant per unit area in closer spacing compensates the loss of reduced bulb sizes and ultimately increases the yield. Reports generally agree that higher plant spacing gave higher yield, but lower bulb weight of garlic (Duranti and Cuocolo, 1984; Duranti and Barbicri, 1986; Rahman and Talukdar, 1986). Purewal and Daragan (1961) found that a spacing of 15 x 7.5 cm was the best for highly economic yield.

Use of high yielding variety is the most important consideration for cultivation of any crop. There was no recommended variety of garlic in Bangladesh before 2005. In Bangladesh, there are many cultivated types of garlic, which are known either by their local or the locality where grown or characteristics of the crop. For the development of suitable varieties of garlic, it is essential to evaluate the characters of the available germplasm properly and conserve the collected materials for future use. Hence, the genetic information on yield and yield contributing characters of the crop species are properly assessed for its improvement. In the above context, the study entitled, the effect of plant spacing on growth and yield of two lines of garlic under dry land condition at BAU, Mymensingh was undertaken to find out the optimum plant density for garlic.

Materials and Methods

The present investigation was carried out to find the effect of plant spacing on growth and yield of two lines of garlic under dry land condition at BAU, Mymensingh during 2005 to 2006. The two-factor experiment had 4 Plant

spacing: 10cm × 10cm (150 plants/1.5 m²), 15cm × 10cm (100 plants/1.5 m²), 15cm × 15cm (66 plants/1.5 m²) and 20cm × 10cm (75 plants/1.5 m²) and 2 garlic lines: G₂ and G₁₉. The experiment was conducted in randomized complete block design (RCBD) with 3 replications. The unit plot size was 1.5m × 1m; total number of treatments: 4 × 2 = 8; Total number of unit plots: 8 × 3 = 24; Date of planting: 9 Nov, 2005; Date of harvesting: 29 March, 2006. Data were recorded on yield and yield contributing characters on height of plant, no. of leaves per plant, fresh weight of bulb diameter of bulb, length of bulb, no. of cloves per bulb, yield of bulb per plot and yield of bulb per hectare. Intercultural operation were done as and when necessary. The difference between the treatment means was judged by Least Significance Test (LSD).

Results and Discussion

The plant spacing greatly influence on the growth and yield of garlic. The initial clove size to be planted has visible effect on yield and other morphological growth attributes in garlic.

Effect of garlic lines: Garlic lines showed significant influence on height of plant, no. of leaves per plant at different days after planting and fresh weight of bulb, diameter and length of bulb, no. of cloves per bulb, yield of bulb per plot and yield of bulb per hectare at harvest. Height of plant and no. of leaves per plant were taken 30, 60, 90, 120 and 135 days after planting (DAP). The tallest plant (75.07 cm), number of leaves per plant (8.00) (Table 1) 120 DAP, fresh weight of bulb (32.22 g), diameter (3.72 cm) and length (3.85cm) of bulb, no. of cloves per bulb (26.15), yield of bulb per plot (2.02 kg) and yield of bulb per hectare (16.07 t/ha) were obtained from the plots in garlic line G₁₉. Height of plant and no. of leaves per plant increased with the time from 30 to 120 days after planting and then it reduced due to senescence while the lowest values on all the above mentioned parameters were found in garlic line G₂. When yield was considered garlic line G₁₉ produced the highest amount (16.07 t/ha) while the lowest (13.09t/ha) was obtained from garlic line G₂ (Table 2). This might be due to the fact that germplasm

G₁₉ had a good genetic potential which enhanced more cell division and cell elongation resulting best performance. These results are in agreement with Rahman

et al. (2005), Islam *et al.* (2004), Azad (2002) and Halim (2000). They also stated that the most promising cultivars (G₂ and G₁₉) in terms of yield potential.

Table 1. Main effect of garlic lines on height of plant and number of leaves per plant under dry land condition at different days after planting at BAU, Mymensingh

Treatments	Height of plant in cm at DAP					No. of leaves/plant at DAP				
	30	60	90	120	135	30	60	90	120	135
G ₁₉	32.20	44.20	64.69	75.07	64.57	5.01	6.21	6.84	8.00	7.52
G ₂	28.17	39.48	57.39	72.17	60.65	4.00	5.39	6.52	7.60	7.98
Level of Significance	**	**	**	**	**	**	**	**	**	**

** = Significant at 1% level of probability

Table 2. Main effect of garlic lines on growth and yield of garlic bulb under dry land condition at harvest at BAU, Mymensingh

Treatments	Fresh wt. of bulb (g)	Length of bulb (cm)	Diameter of bulb (cm)	No. of cloves/bulb	Yield/plot (kg)	Yield (t/ha)
G ₁₉	32.22	3.85	3.72	26.15	2.02	16.07
G ₂	26.17	3.61	3.49	24.97	1.65	13.09
Level of Significance	**	*	**	**	**	**

* = Significant at 5% level of probability, ** = Significant at 1% level of probability

Table 3. Main effect of plant spacing on height of plant and number of leaves per plant under dry land condition at different days after planting at BAU, Mymensingh

Treatments	Height of plant in cm at DAP					No. of leaves/plant at DAP				
	30	60	90	120	135	30	60	90	120	135
10 cm×10 cm	27.45	39.19	56.85	69.82	57.42	4.10	5.15	6.25	7.27	6.75
15 cm×10 cm	29.27	40.56	58.92	72.17	61.37	4.40	5.67	6.54	7.55	7.22
20 cm×10 cm	30.67	42.97	62.55	74.90	64.07	4.67	5.97	6.77	8.02	7.50
15 cm×15 cm	33.35	44.65	65.84	77.60	67.57	4.85	6.40	7.17	8.35	7.95
Level of Significance	**	**	**	**	**	**	**	**	**	**

** = Significant at 1% level of probability

Table 4. Main effect of plant spacing on growth and yield of garlic bulb under dry land condition at harvest at BAU, Mymensingh

Treatments	Fresh wt. of bulb (g)	Length of bulb (cm)	Diameter of bulb (cm)	No. of cloves/bulb	Yield/plot (kg)	Yield (t/ha)
10 cm×10 cm	26.22	3.27	3.17	22.25	2.03	16.21
15 cm×10 cm	28.27	3.57	3.45	24.40	1.87	14.94
20 cm×10 cm	29.87	3.85	3.75	26.07	1.77	14.01
15 cm×15 cm	32.42	4.22	4.05	29.52	1.66	13.16
Level of Significance	**	**	**	**	**	**

** = Significant at 1% level of probability

Table 5. Combined effect of different garlic lines and plant spacing on height of plant and number of leaves per plant under dry land condition at different days after planting at BAU, Mymensingh

Treatment Combination	Height of plant in cm at DAP					No. of leaves/plant at DAP				
	30	60	90	120	135	30	60	90	120	135
V ₁ S ₁	29.20	40.40	56.20	72.60	60.40	4.00	5.20	6.00	7.70	6.50
V ₁ S ₂	32.20	41.63	58.30	75.50	63.27	4.40	5.80	6.17	7.90	7.00
V ₁ S ₃	33.60	44.40	61.40	78.60	66.50	5.00	6.00	6.40	8.40	7.40
V ₁ S ₄	36.40	45.60	64.20	80.50	70.50	5.20	6.40	6.87	8.60	7.80
V ₂ S ₁	26.40	35.60	52.20	71.30	55.40	3.60	4.40	5.60	7.20	6.30
V ₂ S ₂	27.60	37.80	55.40	73.60	60.60	3.80	5.00	5.90	7.50	6.80
V ₂ S ₃	29.60	40.90	58.40	75.80	62.60	4.00	5.30	6.20	8.00	7.00
V ₂ S ₄	31.80	42.80	60.30	78.60	68.70	4.20	5.80	6.60	8.30	7.50
Level of Significance	**	**	**	**	**	**	**	**	**	**

** = Significant at 1% level of probability, V₁ = Garlic line G₁₉, V₂ = Garlic line G₂, S₁ = 10 cm × 10 cm, S₂ = 15 cm × 10 cm, S₃ = 20 cm × 10 cm, S₄ = 15 cm × 15 cm

Table 6. Combined effect of different garlic lines and plant spacing on growth and yield of garlic bulb under dry land condition at harvest at BAU, Mymensingh

Treatment Combination	Fresh wt. of bulb (g)	Length of bulb (cm)	Diameter of bulb (cm)	No. of cloves/bulb	Yield/plot (kg)
V ₁ S ₁	28.00	3.80	3.70	23.50	2.52
V ₁ S ₂	31.00	4.10	4.00	25.00	2.20
V ₁ S ₃	33.00	4.30	4.20	27.00	2.06
V ₁ S ₄	39.00	4.70	4.40	31.60	1.91
V ₂ S ₁	24.00	3.40	3.30	22.00	1.92
V ₂ S ₂	26.00	3.60	3.50	25.30	1.80
V ₂ S ₃	27.00	4.10	3.90	26.20	1.73
V ₂ S ₄	29.00	4.40	4.20	29.60	1.64
Level of Significance	**	**	**	**	**

** = Significant at 1% level of probability, V₁ = Garlic line G₁₉, V₂ = Garlic line G₂, S₁ = 10 cm × 10 cm, S₂ = 15cm × 10cm, S₃ = 20cm × 10cm, S₄ = 15cm×15 cm

Effect of plant spacing: Effect of plant spacing had significant influence on all the parameters studied. The highest plant height (77.60 cm), number of leaves per plant (8.35) (Table 3), bulb diameter (3.17 cm) and length (3.27 cm), fresh weight of bulb (26.22g), no of cloves per bulb (22.25), (Table 4) were found in 15 cm × 15 cm plant spacing. The maximum yield per plot (2.03 kg) and yield per hectare (16.21 t/ha) were obtained in 10cm × 10cm spacing while the lowest values of all the above mentioned parameters were obtained from 10 cm × 10 cm spacing and the lowest yield was recorded in 15 cm×15 cm spacing. The wider spaced crop showed increased performance in respect of yield components and yield of individual plant while close spacing resulted in higher yield per unit area. The wider spaced crop got abundant area around each plant which did not cause them to compete with each other for food and nutrients and as results of which each plant showed better performance in respect of individual character. On the contrary, the closer spacing had more number of plants per unit area which cumulatively helped them to yield more production (Om and Srivastava, 1977; Rahman and Talukdar, 1986; Anwar *et al.* 1996).

Combined effect of garlic lines and seed clove size: A remarkable combined effect was observed between the different plant spacing and different lines of garlic on all the parameters studied different days after planting (Table 5 & 6). The tallest plant (80.50cm) and the maximum number of leaves (8.60) per plant were found in 15 cm×15 cm with garlic line G₁₉ 120 DAP and the shortest plant (26.40 cm) and the minimum numbers of leaves (3.60) were obtained from 10 cm×10 cm with garlic line G₂ 30 DAP (Table 5). The highest fresh weight of bulb per plant (39.00g), length (4.70cm) and diameter (4.40cm) of bulb, number of cloves per bulb (31.60) were obtained from 15 cm×15 cm with garlic lines G₁₉ and the lowest values were found on all the above mentioned parameters from 10 cm×10 cm with garlic lines G₂. The maximum yield per plot (2.52 Kg) as well as yield (18.67 t/ha) were obtained from 10 cm×10 cm with garlic lines G₁₉ and the minimum yield were found from 15 cm×15 cm with garlic line G₂ (Table 6). Garlic line G₁₉ and 10 cm × 10 cm plant spacing produce the maximum yield and also show the best performance in respect of all the yield contributing characters studied. So garlic lines G₁₉ and 10 cm × 10 cm plant spacing may be used in garlic production to get maximum yield.

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