

Effect of planting time and mulch on growth and yield of garlic

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Abstract: A field experiment was conducted at the Horticulture Farm of the Bangladesh Agricultural University, Mymensingh during the period from November, 2004 to March, 2005 to study the effect of different mulches and tillage system on the growth and yield of ten garlic germplasm. Mulches and tillage system used in the experiment were- (i) no mulch but well tilth condition, (ii) water hyacinth in well tilth condition, (iii) straw in well tilth condition, (iv) sotty in well tilth condition, (v) water hyacinth in puddling condition, (vi) straw in puddling condition and (vii) sotty in puddling condition. Ten germplasm viz., G₁, G₂, G₃, G₅, G₆, G₇, G₈, G₉, G₁₀ and G₁₁ were used in the experiment. The experiment was laid out in RCBD with three replications. The results of the experiment revealed that all the parameters of garlic were significantly influenced by the different mulches and tillage system. The highest bulb yield (10.79 t/ha) was recorded from water hyacinth in well tilth condition followed by straw in well tilth condition (10.45 t/ha). The lowest yield (8.41 t/ha) was obtained from sotty mulch in puddling condition. Yield of different germplasm showed highly significant variations. Germplasm G₁₀ gave the highest yield (10.37 t/ha) followed by germplasm G₆ (10.09 t/ha) and G₃ (10.04 t/ha). The lowest yield (8.09 t/ha) was obtained from germplasm G₅. Combined effect of mulches with tillage system and different germplasm showed that germplasm G₁₀ with water hyacinth mulch in well tilth condition produced the highest yield (11.60 t/ha), while the lowest yield (6.60 t/ha) was obtained from the treatment combination of germplasm G₅ and sotty mulch in puddling condition.

Key word: Germplasm, Mulch, Tillage, Garlic, Production

Introduction

Garlic (*Allium sativum* L) is an aromatic herbaceous plant and a rich source of carbohydrates and phosphorus. In Bangladesh and other Asian and Middle- East countries, it is being used in several food preparations, notably in chutneys, pickles, curry powders, curried vegetables, meat preparations, tomato ketchup and the like (Bose and Some, 1990). China leads in the world production of garlic (4986 thousand m. tone) and also in area (372 thousand hectares). But the highest national yield is recorded from Armenia (40 t/ha), and the

major garlic producing countries are china, South Korea, India, Spain, Egypt, United States, Thailand, Turkey and Mexico .The average yield of garlic in this country is only 2.89 t/ha (FAO,2002). The total production of garlic is 38,000 metric tons (BBS, 2000), but the requirement is 85,000 metric tons (Rahim, 1992). Garlic is known to be thermo-and photosensitive (Rahim and Fordham, 1988) and its vegetative growth and bulb development are greatly influenced by growing environment (Jones and Mann, 1963; Rahim, 1988). For successful garlic production, frequent irrigation is needed .but in the

places where garlic is cultivated irrigation facilities are not easily available moreover irrigation increases the cost of production. Mulch reduces water loss resulting in more conservation of soil moisture (Prihar, 1986). There are many reports in support that growth and yield of garlic can be increased by judicious application of mulching (Mia, 1996). So artificial mulching by using water hyacinth straw sotty leaves etc was thought to be helpful in this situation. Therefore, program was undertaken to study the comparative performance of ten germplasm of garlic under different mulches and tillage systems.

Materials and Methods

The field experiment was conducted at the Horticulture Farm, Bangladesh Agricultural University, Mymensingh during the period from November, 2004 to March, 2005, to find out the effect of different mulches and tillage system on the growth and yield of ten garlic germplasm. For this research work, ten germplasm of garlic were collected from Garlic Research Project, Department of Horticulture, BAU, Mymensingh. The experiment consisted of two factors. Factor A: Mulches and Tillage system 1) No mulch but well tilth condition ii) Water hyacinth in well tilth condition iii) Straw in well tilth condition iv) Sotty (*Curcuma amada*) leaves in well tilth condition v) Water hyacinth in puddling condition vi) Straw in puddling condition vii) Sotty (*Curcuma amada*) leaves in Puddling condition Factor B: This factor consisted of ten garlic germplasm. (G₁) Dinajpur (G₂) Devigon (G₃) Dinajpur (G₅) Nilphamari (G₆) Maherpur (G₇) Magura (G₈) Ishurdi (G₉) Ishurdi

(G₁₀) Nilphamari (G₁₁) Magura. The factorial experiment was conducted in Randomized Complete Block Design (RCBD) with three replications. The entire experimental plot was divided into three blocks, each of which was then divided into 70 unit plots. The size of the unit plot was 1m x 1m. Two adjacent unit plots and blocks were separated by 0.5m and 1m drain, respectively. Cloves were also planted around the experimental area to check border effect and planting was done on the 9 November, 2004. Mulching was done immediately after planting cloves. Dried water hyacinth, straw and sotty (*Curcuma amada*) were used as mulching material. Intercultural operations, gap filling, weeding, irrigation, insecticide and fungicide were application as and when necessary. Harvesting was done on 25 March, 2005 when the plants reached maturity showing the sign of normal drying out of most of the leaves. Ten plants were selected randomly from each unit plot for the collection of data during different growing stages of plants. Data were collected in respect of the following characters: plant height, number of leaves per plant, fresh weight of bulb per plant, dry weight of bulb per plant, diameter of bulb, number of cloves per bulb, yield of bulb per plot, yield of bulb per hectare The significance of difference between pair of means was expressed as least significant difference (LSD) test taking the probability level of 5% as the minimum level of significance, though higher levels of significance wherever found, was indicated in results.

Results and Discussion

Effect of mulches and tillage system

Different mulches and tillage system showed significant variation on all the parameters. The highest plant height (68.74 cm), number of leaves (8.09), fresh weight of bulb (21.65 g), dry weight of bulb (5.22 g), bulb diameter (3.63 cm), number of cloves per bulb (23.94), yield per plot (1.08 kg) was achieved from water hyacinth in well tilth condition followed by straw in well tilth condition (1.05 kg),

yield per hectare (10.79 t) was achieved from water hyacinth in well tilth condition followed by straw in well tilth condition (10.45 t) was obtained from water hyacinth mulch in well tilth condition at 105 days after planting followed by water hyacinth in puddling condition (65.81 cm). The lowest plant height (62.47 cm), was obtained from sotty mulch in puddling condition (Table 1).

Table 1. Effect of mulches and tillage system on the growth and yield of garlic

Treatments	Plant height					Number of leaves/plant at					Fresh weight of bulb per plant (g)	Dry weight of bulb per plant (g)	Diameter of bulb (cm)	Number of cloves per bulb	Yield of bulb per plot (kg)	Yield of bulb per hectare
	15 DAP	45 DAP	75 DAP	105 DAP	135 DAP	15 DAP	45 DAP	75 DAP	105 DAP	135 DAP						
T ₁	14.02	26.24	45.66	63.74	58.23	2.83	5.03	6.21	7.05	6.95	19.41	4.53	3.43	21.22	0.97	9.78
T ₂	17.03	35.37	55.78	68.74	60.66	2.75	5.26	6.47	8.09	7.59	21.65	5.22	3.63	23.94	1.08	10.79
T ₃	16.54	34.66	52.33	64.66	58.26	2.89	5.14	6.58	7.91	7	21.03	4.92	3.50	22.82	1.05	10.45
T ₄	16.36	32.33	53.54	65.74	58.33	2.85	5.31	6.55	7.33	6.99	18.94	4.51	3.51	21.77	0.95	9.02
T ₅	16.34	34.88	53.32	65.81	57.34	2.71	5.35	6.41	7.45	6.85	20.05	4.63	3.40	22.34	0.99	9.23
T ₆	16.60	32.02	52.44	64.23	56.74	2.78	5.14	6.44	7.68	7	18.24	4.38	3.48	22.31	0.91	9.02
T ₇	16.35	33.04	52.78	62.47	54.26	2.86	5.25	6.48	7.39	6.97	17.65	4.18	3.28	20.53	0.84	8.41
LSD 1%	1.73	1.95	4.51	2.47	3.53	4.76	0.20	0.16	0.24	0.45	0.55	0.20	0.09	1.46	0.03	0.52
Level of significance	**	**	**	**	**	*	**	**	**	**	**	**	**	**	**	**

T₁=No mulch but well tilth condition, T₂= Water hyacinth in well tilth condition, T₃=Straw in well tilth condition, T₄=Sotty leaves in well tilth condition, T₅=Water hyacinth in puddling condition, T₆=Straw in puddling condition, T₇=Sotty leaves in puddling condition

Table 2. Effect of different germplasm on the growth and yield of garlic

Treatments	Plant height					Number of leaves/plant at					Fresh weight of bulb per plant (g)	Dry weight of bulb per plant (g)	Diameter of bulb (cm)	Number of cloves per bulb	Yield of bulb per plot (kg)	Yield of bulb per hectare
	15 DAP	45 DAP	75 DAP	105 DAP	135 DAP	15 DAP	45 DAP	75 DAP	105 DAP	135 DAP						
G ₁	18.01	32.56	50.66	65.25	55.21	2.92	5.19	6.39	7.51	6.94	19.36	4.40	3.33	22.05	0.96	9.31
G ₂	17.36	30.56	49.56	64.70	55.33	2.87	5.23	6.66	7.50	7.13	19.06	4.52	3.42	21.01	0.97	9.42
G ₃	18.87	31.60	48.26	64.32	54.66	2.86	5.21	6.57	7.60	7.06	19.95	4.46	3.38	21.74	1.00	10.04
G ₅	16.66	25.37	44.06	63.32	54.67	2.56	5.05	6.23	7.44	6.85	16.58	4.50	3.30	23.14	0.81	8.09
G ₆	17.58	32.01	50.33	64.21	55.26	3.00	5.16	6.29	7.49	6.80	0.66	4.75	3.35	21.57	1.01	10.09
G ₇	17.66	32.66	50.99	64.65	54.32	2.98	5.39	6.56	7.49	6.95	19.58	4.48	3.43	21.69	0.96	9.52
G ₈	17.89	33.87	50.23	66.23	56.34	2.81	5.21	6.47	7.58	7.05	20.50	4.75	3.25	21.57	0.99	9.61
G ₉	17.20	32.31	49.66	64.96	55.62	2.86	5.16	6.49	7.55	7.20	19.65	4.73	3.41	23.15	0.98	9.33
G ₁₀	18.36	33.56	51.23	66.93	56.32	2.48	5.47	6.52	7.83	7.34	20.97	5.14	4.38	22.12	1.04	10.37
G ₁₁	18.20	30.66	49.26	65.23	55.51	2.77	5.06	6.30	7.57	7.18	19.33	4.49	3.37	23.19	0.94	9.90
LSD 1%	0.921	2.031	2.521	3.432	2.732	0.173	0.241	0.186	-	-	0.651	0.066	0.108	1.74	0.036	0.521
Level of significance	**	**	**	**	**	**	**	**	*	NS	**	**	**	**	**	**

** = Significant at 1% level of probability, NS = Non significant

G₁ = Sada shil (Dinajpur), G₂ = Sada shil (Deviganj), G₃ = Basher hat (Dinajpur), G₅ = Lal shil (Domar), G₆ = Gangajoli (Meherpur), G₇ = Boron (Magura), G₈ = Mahakunda (Ishurdi), G₉ = Chori (Ishurdi), G₁₀ = Sada shil (Nilphamari), G₁₁ = Shukna (Magura)

This might be due to plant absorption of more moisture from plots under water hyacinth mulch in well tilth condition which favoured maximum vegetative growth resulting in maximum plant

height. Water hyacinth mulch was found more effective in conservation of soil moisture as also reported by Hossain (1996) and Uddin (1997). Similar results were also reported by Hassan (1999) and Bhuiya (1999). They found that the fresh

weight of bulb was significantly influenced by water hyacinth mulch.

Performance of different germplasm

Remarkable variations were observed due to the effect of different germplasm on all the parameters. It was observed that germplasm G₁₀ produced the highest plant height (66.93 cm), number of leaves (7.83), dry weight (5.14g) per plant, bulb diameter (4.38 cm), number of cloves per plant (23.29), yield (1.04 kg) per plot, yield (10.37 t) per hectare at 105 days after planting. The lowest plant height was found in the germplasm of G₅ (63.32 cm) at 105 days after planting (Table 2). These findings agree with the findings of Chowdhury (1992) who worked with 8 local germplasm and reported that G₅ showed the lowest plant height. The differences in plant height among the germplasm might be due to the varietal characteristics. This might be due to the fact that the germplasm G₁₀ had a good genetic potentiality which enhanced more cell division and cell elongation resulting in larger size bulb formation.

Combined effect of different germplasm and mulches & tillage system

Combined effect of germplasm and mulches & tillage system on plant height was found to be highly significant at the different days after planting. Increasing trend in plant height was observed up to 105 days after planting for each condition and thereafter declined. From Table 3, it was found that the highest plant height (70.60 cm), leaf number (9.07), fresh weight of bulb (23.33 g), dry matter weight (5.53 g) of bulb,

diameter (4.50 cm) of bulb, number of cloves (28.53), yield of bulb per plot (1.16 kg) yield of bulb per hectare (11.60 t), was recorded from the treatment combination of germplasm G₁₀ and water hyacinth mulches in well tilled condition (G₁₀T₂) at 105 days after planting. The lowest plant height (55.07 cm) was found in treatment combination of germplasm G₃ and sottony mulch in puddling condition (G₃T₇). This might be due to their genetic physiological characteristic and for their adopted cultural practices.

Conclusion

Water hyacinth mulch in well tilled condition was found to be the most effective and may be used in the cultivation of garlic. Germplasm G₁₀ showed better performance in respect of yield. Germplasm G₁₀ mulched with water hyacinth in well tilled condition gave the highest yield.

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