Asian Journal of Plant Sciences

ISSN 1682-3974

science alert

ANSInet
an open access publisher
http://ansinet.com

Asian Journal of Plant Sciences 2 (8): 639-643, 2003
ISSN 1682-3974
© 2003 Asian Network for Scientific Information

Effect of Planting Time, Mulch and Irrigation on the Growth and Yield of Garlic

[1]M.A.K. Bhuiya, M.A. Rahim and M.N.A. Chowdhury
[1]Bangladesh Institute of Nuclear Agriculture Sub Division, Comilla, Bangladesh
Department of Horticulture, Bangladesh Agricultural University,
Mymensingh-2202, Bangladesh

Abstract: An experiment was conducted to study the effect of planting time, mulch and irrigation on growth and yield of garlic at the Horticulture Farm of Bangladesh Agricultural University, Mymensingh during the period from October 1998 to March 1999. The objective of the work was to find out appropriate planting time and types of mulch and irrigation to get maximum yield of garlic. There were five planting time viz. October 25, November 9, November 25, December 8 and December 23 and seven types of mulch and irrigation treatments viz. Straw, water hyacinth, black polyethylene, transparent polyethylene, 10 days interval irrigation, 20 days interval irrigation and control (no mulch and no irrigation) were used as the experimental treatments. The experiment was laid out in Randomized Complete Block Design with three replications. With the delay in planting time from Oct. 25 yield was chronologically reduced in later plantings. The highest bulb yield (3.9 t ha^{-1}) was recorded when planting was done on October 25 which was statistically identical to November 9 planting (3.5 t ha^{-1}). The lowest yield was obtained from December 23 (2.3 t ha^{-1}) planting. Water hyacinth mulching yielded (4.27 t ha^{-1}) best which was statistically identical with straw mulch (3.97 t ha^{-1}). The lowest yield was obtained from white polyethylene mulch and control. Irrigation at 20 days interval showed better performance over irrigation at 10 days interval and control.

Key words: Garlic, planting time, mulch, irrigation, yield

Introduction

Garlic (*Allium sativum* L.) is an important crop and used as spices throughout Bangladesh. In Bangladesh the average yield of garlic is 3.08 t ha^{-1} (BBS, 1999). It is very low as compared to the countries such as China (14.54 t ha^{-1}). The requirement of garlic in Bangladesh is about 85000 metric tons (Rahim, 1992). Thus current production is 54.11% less than that of total demand. There is no recommended variety/cultivars of garlic in our country.

Time of planting influences the growth and yield of garlic. In Bangladesh the crop is generally planted with the onset of winter (Rashid, 1976). The growth period of garlic is centered on the cool season but their life cycle, particularly from late planting may be extended to the period when high temperature and heavy rainfall prevails which exert unfavorable effects on the growth and development. In Bangladesh, farmers normally plant garlic in the month of November/December. In some parts of Bangladesh, the growers plant garlic in the month of December and January after harvesting of transplanted Aman rice. Thus, the plants are exposed to increasing high temperature before bulb initiation and during growth and development in the period from February to April. As a result, bulb production is low and in some cases, a percentage of the plants do not initiate bulb at all. Therefore, yield can be increased by planting seed clove in optimum time.

Soil moisture is an important factor that influences the growth, development and yield of garlic. Growing period of garlic is mainly dry and soil moisture is dependent on the irrigation and its frequency. On the other hand mulch reduces the water loss from the soil by evaporation (Prihar, 1986). Thus frequency of irrigation and mulch influence growth of bulb and its yield. Hence, an attempt was made to study the effect of date of planting, mulch and irrigation on the growth and yield of garlic. The study will help to identify appropriate planting time and types of mulch and irrigation frequency for better growth and yield of garlic.

Materials and Methods

The experiment was conducted to study the effect of planting time mulch and irrigation on the growth and yield of garlic at the Horticulture Farm of Bangladesh Agricultural University, Mymensingh during the period from October, 1998 to March, 1999. There were five planting time viz. October 25, November 9, November 25, December 8 and December 23 and seven type of mulch and irrigation treatments viz. straw, water hyacinth, black polyethylene, transparent polyethylene, 10 days interval

irrigation, 20 days interval irrigation and control (no mulch and no irrigation) were used as the experimental treatments. The experiment was laid out in Randomized Complete Block Design with three replications. The size of each unit plot was 1x1 m and fifty plants were accommodated in each plot following a spacing of 20 cm x 10 cm. Intercultural operations were done as and when required. Fertilization was done as per recommended dose. Ten plants were randomly selected from each plot. At harvest data recorded on growth, bulb yield and other yield components such as plant height, number of leaves, weight of leaves, bulb diameter and weight of bulb at harvesting time.

Results and Discussion

Time of planting had marked influence on the plant height, number of leaves plant^{-1}, bulb diameter, weight of bulb, weight of leaf and final yield. The highest plant height was recorded from Nov 9 (52.63 cm) while Dec 23 plantation produced the lowest plant height (46.69 cm) (Table 1). Earliest planting gave the highest plant height, probably because the plants received cool temperature and shorter day length which enhanced meristematec elongation of plant. The maximum number of leaves was counted from Nov 25 (8.97), but Dec 23 plantation produced the lowest (8.06). This is possibly due to the plant attained higher vegetative growth, as a result the plants gave higher number of leaves. The result is in agreement with the findings of Rahim *et al.,* 1984 and Sultana *et al.,* 1997. Oct. 25 planting gave the largest bulbs (5.93 cm) followed by 5.02, 2.86, 2.44 and 2.11 cm in Nov 9, Nov 25, Dec 8, Dec 25 planting, respectively (Table 1). The findings are in agreement with the reports of many authors (Rahim *et al.,* 1984; Sultana *et al.,* 1997 and Islam *et al.,* 1998). They reported that in early planting, plants attained higher vegetative growth, which possibly led to the development of larger bulbs. Production of small bulbs in the later plantings may be explained by the fact that the plant did not receive a long cool growing period, which was essential for proper development of garlic bulbs as stated by Rahim and Fordham, 1988.

The bulb weight was maximum (11.68) at Oct 25 planting followed by 10.71, 11.66, 8.57 and 5.70 at Nov 9, Nov 25, Dec 8 and Dec 23 plantings, respectively (Table 1). Earliest (Oct 25) planting gave the highest bulb weight may be due to plant received cool temperature for longer period which possibly increased the vegetative growth and yield of bulb. Therefore, early grown plants produced large sized bulbs resulting in the increased weight. It was also observed that early plantation produced biggest bulbs and weight and decreased with delayed in planting. These findings are in agreement with the reports of many authors (Rahim *et al.,* 1984; Sultana *et al.,* 1997; Islam *et al.,* 1998). The highest weight of leaves plant^{-1} was recorded in Oct 25 planting (5.23 g) which was statistically similar to Nov 9 (4.61 g) planting. The lowest weight of leaves plant^{-1} was obtained from the planting of Dec 8 planting (3.57 g) which was also statistically similar to Dec 23 (3.65 g). The above results agreed with the findings of Sultana *et al.* (1997) and Islam *et al.* (1998). They reported that the early planted crops produced comparatively higher weight of leaves. The highest bulb yield plot^{-1} was obtained from Oct 25 planting (391.22 g) which was statistically similar to that of Nov 9 (356.75 g) and Nov 25 (355.08 g). The lowest yield was found from the planting of Dec 23 (231.20 g). This result is in agreement with the findings of Siddique and Rabbani (1985). They reported that the reduction in yield was about 33 and 80% when the date of planting was shifted from Oct 23 to Dec 3 and Jan. 1, respectively (Table 1). The highest yield was obtained from Oct 25 planting (3.92 t ha^{-1}) followed by Nov 9 (3.58), Nov 25 (3.55 t ha^{-1}), Dec 8 (3.08 t ha^{-1}). Dec 23 (2.31 t ha^{-1}) plantings, respectively. These results agree with the finding of Lipinski (1993). The higher yield obtained from the early planting was probably due to the production of large bulb. In early planting, plants attained higher vegetative growth which possibly led to the development of larger bulb and higher yield. Late planting produced smaller bulbs and lower yield which may be explained in a way that the plants did not get a long cool growing period which was essential for proper development of vegetative growth for garlic (Rahim and Fordham, 1988).

Table 1: Effect of planting time on the growth and yield of garlic

Planting time	Plant height (cm) at maximum growth stage	Number of leaves plant^{-1}	Bulb diameter (cm)	Weight of bulb (g)	Weight of leaves (g)	Yield of bulb (g plot^{-1})	Yield of bulb (t ha^{-1})
Oct 25 (P_1)	44.36	8.34	5.93	11.68	5.23	391.22	3.92
Nov 9 (P_2)	52.63	8.86	5.02	10.71	4.61	356.75	3.58
No 25 (P_3)	42.60	8.97	2.86	11.67	4.28	355.08	3.55
Dec 8 (P_4)	46.80	8.31	2.44	8.57	3.57	308.10	3.08
Dec23 (P_5)	46.69	8.06	2.11	5.70	3.69	231.20	2.31
LSD 5%	2.130	-	0.207	1.730	0.567	40.770	2.62
1%	2.828	-	0.275	2.298	0.753	54.150	5.82
Level of significance	**	NS	**	**	**	**	**

**=Significant at 1% level NS=Non significant 1=Unit plot size was 1m x 1m

Table 2: Effect of mulch on the growth and yield of garlic

Planting time	Plant height (cm)	Number of leaves plant^{-1}	Bulb diameter (cm)	Weight of bulb (g)	Weight of leaves (g)	Yield of bulb (g plot^{-1})	Yield of bulb (t ha^{-1})
M_1	44.40	8.71	2.85	12.53	5.81	397.12	3.98
M_2	43.18	8.41	2.90	12.78	6.12	427.46	4.28
M_3	39.28	8.59	2.79	9.88	3.77	348.34	3.75
M_4	31.80	7.89	2.61	7.03	3.03	250.94	3.85
M_5	34.22	8.13	2.53	7.75	3.31	284.72	3.15
M_6	36.13	8.51	2.77	9.17	4.01	331.64	3.50
M_7	34.88	8.89	2.63	7.02	3.82	260.47	2.62
LSD 5%	3.356	-	-	2.047	0.671	48.24	0.16
1%	4.457	-	-	2.719	0.891	64.07	0.22
Level of significance	**	NS	NS	**	**	**	**

**=Significant at 1% level NS=Non significant 1=Unit plot size was 1mx1 M_1=Straw M_2=Water hyacinth
M_3=Black polyethylene M_4=Transparent polyethylene M_5=10 days interval irrigation M_6=20 days interval irrigation
M_7=Non-mulch (control)

Different mulch material showed remarkable variation in their effect on plant height, number of leaves, bulb diameter, weight of bulb, weight of leaves and yield of garlic (Table 2). The tallest plant was recorded from straw (44.40 cm) and lowest from transparent polyethylene (31.80 cm). The different mulch treatments had no significant effect on leaves number plant^{-1} at all stage of growth (Table 2). Bulb diameter was not influenced significantly by different mulches. The mean values of bulb diameter against respective mulches are presented in Table 2. The maximum individual bulb weight (12.78 g) was obtained from water hyacinth mulch which was statistically similar with that of straw mulch (12.53 g). The increase in weight of bulb produced in mulched plots was possibly due to efficient use of available soil moisture, efficient control of soil temperature, inhibition of weed growth, protection of surface soil erosion, reduction in nutrient loss from soil etc. These results are in agreement with the results of Uddin (1997). He reported mulch influenced bulb size of garlic. The plants grown with the water hyacinth mulch gave maximum weight of leaves (6.12 g) followed by straw mulch (5.81 g). This result differs from the findings of Uddin (1997). He reported that black polyethylene mulch gave maximum weight of leaves. Different mulch materials showed wide variations on yield plot^{-1} which were highly significant (Table 2). The higher yields per plot were achieved from water hyacinth mulch (427.46 g plot^{-1}) which were followed by straw mulch (397.12 g plot^{-1}) and the minimum yield plot^{-1} was obtained from transparent polyethylene treatment (250.94 g plot^{-1}). The water hyacinth mulched plots gave higher yield probably due to maximum plant height and number of leaves which contributed in higher assimilation of photo assimilation ultimately resulting in higher yield plot^{-1}. The above result is in agreement with the previous work of Rabbani and Siddique (1987). The yield of garlic per hectare was found to be statistically significant due to the effect of mulching (Table 2). Water hyacinth mulch produced the highest yield (4.28 t ha^{-1}) which was statistically similar to straw (3.98 t ha^{-1}). However, non-mulched treatment produced the lowest bulb yield (2.62 t ha^{-1}). It was clear that mulched plot gave increased yield than non-mulched plot. This result has an agreement with that of Uddin (1997). Higher yield produced by the mulching treatment was possibly attributed by the better supply of soil moisture, nutrient and better physical conditions.

The results of combined effect of planting time and different mulches in respect of different growth and yield parameters have been presented in the Table 3.The highest plant height was recorded from Nov 25 planting date with straw mulch (47.47 cm) followed by Dec 8 with same mulch (47.33 cm) and lowest from Dec 23 plantain with no mulching treatment (28.33 cm). The maximum number of leaves plant^{-1} were counted from the planting of Nov 9 with black polyethylene (10.73) and lowest transparent polyethylene (5.80). In respect of planting time and mulches did not affect significantly on bulb diameter. From Table 3 it was revealed that time of planting and mulches influenced markedly on individual weight of bulb. Combination of Oct 25 planting and water hyacinth mulch produced the largest bulb (17.93 g). On the other hand Dec 23 planting and irrigation at 20 days interval or control produced the smallest bulb (4.07 g). The highest weight of leaves was obtained from Oct 25 planting with straw mulch (8.80 g) and lowest from white polyethylene (1.93 g). Oct 25 planting with a combination of water hyacinth gave the highest yield plot^{-1} (620.90 g) which was statistically higher among all other treatments. December 23 plantation with no mulch gave the lowest yield (159.26 g plot^{-1}). Significantly highest bulb yield ha^{-1} was recorded from Oct 25 planting when mulched with water hyacinth (6.21 t). Oct 25 plantation with straw mulches (4.52 t), Nov 9 plantation with water hyacinth (4.5 t) and Dec 8 plantation with straw mulch (4.5 t) also gave the appreciable bulb yield ha^{-1}

Table 3: Combined effect of planting time and mulch on the growth and yield of garlic

Treatments		Plant height (cm)	Number of leaves/ plant	Bulb diameter (cm)	Weight of bulb (g)	Weight of leaves (g)	Yield of bulb (g plot^{-1})	Yield of bulb (t ha^{-1})
Planting time	Mulch							
Oct. 25	M_1	40.40	8.27	3.45	16.00	8.80	451.96	4.52
	M_2	39.93	8.73	3.68	17.93	5.60	620.90	6.21
	M_3	34.13	8.43	3.23	11.87	4.17	361.63	3.62
	M_4	29.87	8.40	3.03	8.40	5.67	260.17	2.60
	M_5	29.53	7.40	2.68	7.73	3.83	314.49	3.15
	M_6	39.07	8.27	3.37	11.67	4.20	449.06	4.49
	M_7	37.40	8.87	2.94	8.13	4.33	287.34	2.87
Nov. 9	M_1	40.73	8.80	3.10	11.93	5.93	356.26	3.56
	M_2	45.93	8.07	3.20	16.37	6.93	449.48	4.50
	M_3	46.87	10.73	3.13	10.97	3.53	443.55	4.44
	M_4	35.33	5.80	2.53	5.83	2.73	292.94	2.93
	M_5	39.01	7.93	2.70	8.53	4.67	315.03	3.15
	M_6	36.40	8.07	3.35	11.13	5.00	321.17	3.21
	M_7	40.27	10.53	3.12	9.33	3.47	318.80	3.27
Nov. 25	M_1	47.47	9.27	3.03	16.87	5.53	428.08	4.28
	M_2	42.87	8.07	2.80	12.20	7.07	407.02	4.07
	M_3	35.73	9.33	2.75	10.20	4.53	313.40	3.13
	M_4	33.53	9.47	2.85	9.80	2.80	304.42	3.04
	M_5	33.93	9.03	2.79	9.47	3.33	326.75	3.27
	M_6	36.87	8.40	2.76	10.00	3.47	356.93	3.57
	M_7	36.67	9.20	2.83	13.07	3.20	348.94	3.49
Dec. 8	M_1	47.33	8.20	2.67	11.667	4.47	451.13	4.51
	M_2	45.60	8.53	2.62	10.600	5.07	432.29	4.32
	M_3	36.93	7.87	2.54	8.200	3.27	282.78	2.83
	M_4	31.60	7.87	2.33	6.533	2.00	231.79	2.32
	M_5	37.87	8.67	2.44	8.200	2.10	260.73	2.61
	M_6	38.33	9.00	2.41	9.000	3.07	309.98	3.10
	M_7	31.73	8.00	2.47	5.800	5.00	188.03	1.88
Dec. 23	M_1	46.07	9.00	2.21	6.500	4.33	298.17	2.98
	M_2	41.57	8.67	2.20	7.100	5.93	227.62	2.28
	M_3	42.73	6.56	2.28	8.467	3.33	340.34	3.40
	M_4	29.67	7.93	2.29	4.867	1.93	165.40	1.65
	M_5	30.73	7.53	2.04	4.800	2.60	206.61	2.07
	M_6	30.00	8.83	1.95	4.067	4.33	221.03	2.21
	M_7	28.33	7.87	1.80	4.067	3.10	159.26	1.59
LSD 5%		7.504	1.807	0.548	4.578	1.5000	107.90	1.080
1%			2.400	0.727	6.080	1.993	143.30	1.434
Level of significance	*	**	NS	NS	**	**	**	

*=Significant at 5% level **=Significant at 1% level NS=Non significant 1=Unit plot size was 1m x 1m M_1=Straw
M_2=Water hyacinth M_3=Black polyethylene M_4=Transparent polyethylene M_5=10 days interval irrigation
M_6=20 days interval irrigation M_7=Non-mulch (control)

and the lowest bulb yield was recorded from Dec 23 plantation (1.59 t) in control plot.

References

Bangladesh Bureau of Statistics, 1999. Monthly statistical Bulletin in Bangladesh. Statistics Division, Ministry of Planning, Government of the People's Republic of Bangladesh, pp: 48.

Islam, M.N., M.A. Rahim and H.R.M.M. Anawar, 1998. Effects of date of planting and different germplasms on the growth and seed bulb yield of garlic. Bangladesh J. Seed Sci. and Tech., 2: 45-54.

Lipinski, Z., 1993. Influence of planting date on growth and cropping in several non-bolting garlic types. Biuletyn Warzywniczy, 40 : 45-54.

Prihar, S.S., 1986. Fertilization and water use efficiency in relation to mulching. Seminar on "Fertilizer Use Efficiency Through Agronomic Management, April 5-6, 1986, Dehradum.

Rabbani, M.G. and M.A. Siddique, 1987. Effect of planting method and mulching on yield of two sweet potato varieties. Bangladesh J. Agric., 12: 83-87.

Rahim, M.A., 1992. Spices and plantation crops in national economy. In: Horticulture in National Development. Proceedings of the Sixth National Horticulture Convention and Symposium. Sharfuddin, A. F. M.; Rabbani, M. G. and Aditya, D. K. (Eds.) Bangladesh Soc. Hort. Sci., Department of Horticulture, BAU, Mymensingh, Bangladesh, pp: 24-29.

Rahim, M.A. and R. Fordham, 1988. The advancement of bulbing in garlic with specific reference to late season production in Bangladesh. Acta Hort., 267: 271-272.

Rahim, M.A., M.A. Siddique and M.M. Hossain, 1984. Effect of time of planting, mother bulb size and plant density on the yield of garlic. Bangladesh J. Agril. Res., 9: 112-118.

Rashid, M.M., 1976. Bangladesher Sabji (in Bengali). Bangla Academy, Dhaka, Bangladesh, pp: 460.

Siddique, M.A. and M.G. Rabbani, 1985. Growth and bulbing of garlic in response to low temperature treatment of bulb and planting date. Bangladesh J. Bot., 14: 41-46.

Sultana, S., M.A. Rahim, M.D. Alam and H.R.M.M. Anwar, 1997. Effect of seed clove size and their position within mother bulbs on the growth and yield of garlic. Bangladesh J. Seed Sci. and Tech., 1: 69-75.

Uddin, M.A., 1997. Effect of mulching and fertilizer management practices on the growth and yield of garlic. M.S. Thesis, Department of Horticulture, BAU, Mymensingh, Bangladesh, pp: 31.