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Growth and Bulb Yield of Garlic (*Allium Sativum* L.) Under The Influence of Planting Density Along With different Mulches

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Abstract

The present study was carried out to examine the effect of spacing and mulch on growth and yield of garlic (*Allium sativum* L.) in Lovely Professional University duringwinter season in 2017-18. It consisted 9 treatments with different types of mulch and spacing *viz;* T0 (Control), T1 (Straw with 15x15cm), T2 (Straw with 10x5cm), T3 (FYM with 15x15cm), T4 (FYM with 10x5cm), T5 (White mulch with 15x15cm), T6 (white mulch with 10x5cm), T7 (Black mulch with 15x15cm), T8 (black mulch with 10x5cm) in Shankar variety. The experiment was conducted by using randomized complete block design (RCBD) with three replications. As per resultsrevealed mulch and spacing significantly influenced plant height (30, 60, 90, 120, 150 DAP and at harvest) with FYM and 10x5cm spacing as well as number of leaves (30, 60, 90, 120, 150 DAP and at harvest) by using straw with 15x15cm spacing. White mulch with 10x5cm influenced bulb yield per ha whereas maximum bulb diameter was obtained with FYM and 15x15cm. Highest significant result was observed in FYM and straw mulch with10x5cm spacingfor growth parameters whileFYM and white mulch with 15cm intra row spacing responsible for yield parameters. Therefore, it is suggested that planting of garlic with white mulch and with 15cm intra row spacing produces the highest bulb yield and enhances the quality of garlic.

Keywords: bulb, diameter, mulch, straw, FYM

Introduction

Garlic (*Allium sativum* L., 2n=16) is an important bulbous crop cum spice belongs to the family Alliaceae. It is mainly used for flavouring and seasoning vegetables and meat dishes. In India, total area under garlic cultivation is 230.6 thousand ha and production is 1.251 Tonne with productivity of 4.94 tonnes/ha (Anonymous, 2016). The important garlic growing states in India are Madhya Pradesh, Gujarat, Orissa, Rajasthan, Maharashtra and Uttar Pradesh. It is widely used as a food ingredient in gastric problems. Being a spice crop it

also have some medicinal value which has been used for over 4000 years for assortment of illnesses including migraine, nibbles, intestinal tumours and worms. Garlic is still being utilized as a folk medicine for the treatment of a variety of diseases all over the world (Corzo-Martínez*et al.*,2007).

Garlic is an important crop grown in winter season, under irrigated condition in Vidarbha region. It is well known that, among the various inputs used for the production of garlic, optimum mother clove size and plant spacing have a great influence on the production and quality of garlic. Owing to the absence of relevant information on different aspects of agronomy, particularly in this part of the region, the growers are reluctant to take the production of this crop on commercial scale. Garlic is propagated by vegetative propagation only. A pattern of various systems have been developed over the time in many domain of cultivation. Garlic is sensitive to heat and light and its vegetative enhancement and clove development are affected by growing environment. Growing environment can be manipulated by adopting good agricultural practices to improve yield. Mulching is one of the good agricultural practices for altering the microclimate. Effect of mulching on the growth and production of plant is well known. It prevents the plants damage against loss of soil moisture caused by different agents like wind and also evaporation from soil media which further reduces the requirement for irrigating the soil. Mulches control the growth of weed and enhance soil property like fertility and structure by retaining with in nutrients, wind-borne dust (Gajri*et al.*,1994). Mulches economize use of N fertilizer, reduce the requirement of organic fertilizer and reducelabor cost (Baten*et al.*,1995). Also, yield enhancement has been contributed to the capacity of mulch to reduce soil temperature, improve nutrient availability and support root growth (Haque*et al.*,2003). In view of above points, the experiment waslaid out to observe the effect of spacing and mulch on growth and yield parameters of garlic.

Materials and methods

The experiment was conducted during 2017-2018 at Agriculture Farm, Lovely Professional University, Phagwara, and Punjab which geographically lies at latitude of 31.25 º N and longitude of 75.70 º E, 234 m above mean sea level. The experiment consisted nine treatments with different mulch and spacing in combinations *viz;* T_0 (no mulch+15x8cm), T_1 (Straw+15x15cm), T_2 (Straw + 10x5cm), T_3 (FYM+15x15cm), T_4 (FYM+10x5cm), T_5(White mulch+15x15cm), T_6(White mulch+10x5cm), T_7 (Black mulch+15x15cm), T_8 (Black

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mulch+10x5cm).The experiment was conducted in randomized block design where mulch materials were assisted in main plots and while different spacingwas allocated in sub plots. The nine treatment combinations were replicated thrice making the total of 27 plots with plot size of 1.25m^2 X 1.10m^2. The cloves were planted on 9th Oct, 2017. Observations on plant height (at 30, 60, 90, 120, 150 and at harvesting), no. of leaves (at 30, 60, 90, 120, 150 and at harvesting), bulb diameter (cm) and bulb yield (q/ha) were recorded for various growth and yield parameters and subjected to analysis of variance (ANOVA) using randomized block design.

Results and Discussion

Plant height: The findings of the present study indicated that different types of mulching materials and spacing had significant results on the growth and yield parameters of garlic *viz;*plant height (cm), number of leaves per plant, bulb diameter (cm) and bulb yield (q/ha). Data represented in table 1. Among thetreatments,plant height at 30 DAPwas maximum in T4 (34.31cm) in FYM as mulch with 10x5cm spacing and minimum T8 (29.03cm) in black mulch with 10x5cm spacing. Results were similar with Pitchai*et al*. (2001) while 60 DAP, white polyethylene mulch with 10x5cm spacing (T6) showed highest plant height (43.89cm) and minimum (40.39cm) in FYM with 10x5cm spacing (T4). Results were in conformity with Atac*et al*. (1997), Chung (1987).Likewise, 90 DAP,white mulch with 15x15cm spacing (T5) showed highest plant height (56.41cm) and minimum (48.91cm) with black mulch with 10x5cm (T8). Results were similar with Jones Mann (1963), Brewster (1994). FYM with 10x5cm spacing (T4) showed highest plant height at 120 DAP (70.29cm) and minimum (59.75cm) in straw with 10x5cm spacing (T2).Results were confirmed with Pitchai*et al.* (2001). Black Polyethylene Mulch with 10x5cm spacing (T8) showed highest plant height at 150 DAP (80.84cm) and minimum (71.71cm) in control with 15x8cm spacing without mulch application.At harvesting, straw mulch with 15x15cm spacing (T1) showed highest plant height (74.75cm) and minimum (67.10cm) in FYM with 15x15cm spacing (T3). The highest plant height was noticed with the application of FYM as mulch with 10x5cm spacing while lowest plant height was observed in black polyethylene mulch with the same spacing. Plant height was high might be due to the effect of FYM used as mulch which also act as an organic fertilizer and provided nutrients to the plant for proper growth, and nutrients released slowly in the soil & make them available to the plant while other mulch do not provide any

nutrients. Similar results were reported by Iroc*et al*. (1991), Haque *et al*. (2003), Islam*et al*. (2007) and Woldetsadik (2003).

Table1. Mean value for Plant height (cm)

Treatment	**Plant height (cm)**					
	30DAP	**60 DAP**	**90 DAP**	**120 DAP**	**150 DAP**	**At harvesting**
T0	30.84	42.32	50.28	63.33	71.71	72.93
T1	31.51	43.35	54.48	68	79.11	74.75
T2	33.13	42.90	51.25	59.75	77.83	70.05
T3	31.85	43.74	52.91	65.74	74.18	67.10
T4	34.31	40.39	52.62	70.29	79.61	73.05
T5	31.62	43.15	56.41	67.13	78.81	71.20
T6	31.76	43.89	50.77	60.12	76.91	70.61
T7	32.77	41.52	53.59	63.95	73.13	68.30
T8	29.03	41.45	48.91	62.61	80.84	74.15
CV(%)	2.73	2.76	1.77	1.63	1.50	1.26
CD(%)	1.52	2.05	1.61	0.54	2.01	1.57
S.E.(m)	0.50	0.68	0.53	1.45	0.665	0.518

***DAP- Days after planting**

T0= Control, T1= Straw+15x15cm, T2= Straw + 10x5cm, T3=FYM+15x15cm, T4=FYM+10x5cm, T5=White mulch+15x15cm, T6=White mulch +10x5cm, T7=Black mulch+15x15cm, T8=Black mulch+10x5cm

Number of leaves: Data represented in table 2 showed significant difference among all the treatments for number of leaves. Results depicted thatnumber of leaves at 30 DAP (5.07) was highest with straw mulchand 15x15cm spacing (T1) and minimum (4.27) in black mulch with 15x15cm spacing (T7).At 60 DAP, straw with 15x15cm spacing (T1) showed highest number of leaves (7.14) and minimum (6.47) in white mulch with 10x5cm spacing (T6). It was observed that highest number of leaves 90 DAP (8.67) showed in straw with 15x15cm spacing (T1)whereas minimum (8.0) in white mulch with 10x5cm spacing (T6). Results were similar with Wolde (2014), Umar *et al*. (2000), Haque *et al*. (2003) and Islam*et al.* (2007). At 120 DAP, FYM with 10x5cm spacing (T4) showed highest number of leaves (10.53) and

minimum (10.0) in black mulch with 15x15cm spacing (T7). Result was similar with **Islah (2010).**Highest number of leaves at 150 DAP (13.87) was noticed in black mulch with 15x15cm spacing and minimum (11.80) in control without mulch and 15x8cm spacingand at time of harvesting black mulch with 15x15cm spacing (T7) showed highest number of leaves (11.60) and minimum (10.13) in control without mulch and 15x8cm spacing. This finding was in agreement with Wolde (2014), Umar *et al*. (2000), Haque *et al*. (2003)and Islam*et al.* (2007). The highest number of leaves was noticed in 15x15cm spacing along with straw. Lowest number of leaves was recorded in control. No. of leaves was maximum due to addition of nutrients from straw mulch and less competition between the plants for nutrients, water and sunlight due to wider spacing.

Table 2: Mean value for Number of leaves

Treatment	**Number of leaves**					
	30DAP	**60 DAP**	**90 DAP**	**120 DAP**	**150 DAP**	**At harvesting**
T0	4.80	6.67	8.20	10.20	11.80	10.13
T1	5.07	7.14	8.67	10.40	12.80	10.33
T2	5.00	7.07	8.47	10.27	12.20	10.20
T3	4.90	7.13	8.48	10.02	12.21	10.27
T4	4.67	6.94	8.53	10.53	12.87	10.53
T5	4.53	6.93	8.40	10.33	12.47	10.60
T6	4.87	6.47	8.0	10.22	12.00	10.40
T7	4.27	6.90	8.33	10.0	13.87	11.60
T8	4.40	6.80	8.43	10.28	12.33	10.93
CV (%)	4.61	3.27	1.82	1.38	4.22	4.47
CD (%)	0.38	0.39	0.27	0.25	0.92	0.82
S.E.(m)	0.125	0.130	0.088	0.082	0.305	0.272

***DAP- Days after planting**

T0= Control, T1= Straw+15x15cm, T2= Straw + 10x5cm, T3=FYM+15x15cm, T4=FYM+10x5cm, T5=White mulch+15x15cm, T6=White mulch +10x5cm, T7=Black mulch+15x15cm, T8=Black mulch+10x5cm

Yield parameter: Data represented in table 3 showed significant variations for yield parameters. Results revealed that T3 (FYM with 15x15cm spacing) had highest diameter of bulb (5.63cm) followed by T1 (5.60cm), T5 (5.35cm) and T7 (5.13cm) while minimum

(4.84cm) in control without mulch and 15x8cm spacing. Result was similar withAzene and Worku (2015). Bulb diameter increased with increasing spacing and vice-versa because wider spacing gives less competition between the plants for photoperiod, moisture content, and available nutrients so plants grow properly with large size and quality bulbs. Among all the treatments,T6 (white mulch with 10x5cm spacing) showed highest bulb yield (170.83q/ha) followed by T4 (165.27q/ha), T8 (162.77q/ha), and T2 (154.40q/ha) while minimum in T3 (73.33cm). Results weresimilar with Darabi*et al.* (2004). Bulb yield was highest at closure spacing and lowest at wider spacing because at closure spacing plant produced more number of bulbs per unit area and yield might also be influenced by white mulch which make a balance of temperature & moisture in soil.

Table 3 mean value foryield parameters

Treatment	Bulb diameter (cm)	Bulb yield (q/ha)
T0	4.84	95.20
T1	5.60	73.27
T2	4.88	154.40
T3	5.63	70.33
T4	4.96	165.27
T5	5.35	76.37
T6	4.99	170.83
T7	5.13	80.30
T8	4.85	162.77
CV (%)	3.98	0.65
CD (%)	0.36	1.32
S.E.(m)	0.118	0.435

Conclusion

On the basis of overall findings of present investigation it was concluded that wide range of variation occurs among the treatments for different growth and yield parameters. Variability was present in different traits indicated that considerable scope existed for the improvement of garlic. Out of nine treatments,FYM and straw mulch with 10x5cm spacing for growth parameters and FYM as well as white mulch in combination with 15cm intra row spacing for yield parameters were best. So FYM and straw as mulch along with wider intra-row spacing

(15cm) during winter season may be recommended for increasing the growth and yield of garlic.

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