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Influence of Integrated Weed Management on Growth and Yield of Garlic (*Allium sativum* L.)

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Abstract

A trial was led during Rabi season 2018 at the department of agriculture, Mata Gujri College, Fatehgarh Sahib, Punjab, India. The trial was spread out in a randomized square structure with three replications. The experiment was comprised of 9 treatments combination with mannual weeding, Mulching with paddy straw and use of three herbicides Pendimethalin, Butachlor and Oxyfluorfen. The dose of N:P:K was used as recommended by Punjab Agriculture University, Ludhiana. Result of growth such as maximum plant height at 45 DAP (38.20) and 90 DAP (52.67) and number of leaves per plant at 45 DAP (5.50) and 90 DAP (7.73) were maximum in treatment T1 (weed free). Yield attributes such as Diameter of bulb (4.35 cm), Number of cloves per bulb (26.37), Weight of bulb (10.43 g), Length of bulb (4.38 cm) were maximum in treatment T_1 (weed free). These results show that treatment weed free got maximum growth and yield value rather than other treatment.

Keywords: Herbicides; Mulching; Paddy straw; Yield attributes

Introduction

Garlic (*Allium sativum* L.) is the second most widely cultivated allium species of family *Amaryllidaceae*. It originated in Central Asia and Mediterranean region and it consists of compound tunicated underground bulb and the fleshy white cloves are modified leaves on reduced stem. *A. sativum* was domesticated long ago and is mentioned in ancient Egyptian, Greek, Indian, and Chinese writings. Garlic grows in temperate and tropical regions all over the world, and many cultivars have been developed to suit of different climates. It has long been recognized all over the world as a valuable spice for foods and a popular remedy for various ailments and physiological disorders [1]. Garlic is a rich source of carbohydrates, proteins and phosphorus and is used as a spice or condiment and has good medicinal properties. Garlic contains about 0.1% volatile oils, yield reductions and the chief constituents in oil are diallyl disulphide (60%), diallyl trisulphide (20%) and allyl propyl disulphide (6%). It has antibacterial, antifungal and antiprotozoal properties. It contains at least 33 sulfur compounds, several enzymes, 17 amino acids, and minerals such as selenium. Garlic controls glycemia by means of improved insulin affectability, glucose resilience, insulin emission and improved glucose use. Garlic oils are powerful inhibitors of cholesterol amalgamation. It is utilized in dyslipidemia. Garlic is related with circulatory strain decrease in patients with raised Systolic Pulse (SBP), in spite of the fact that not in those without raised SBP [2,3].

Globally, it is cultivated in an area of 1468811 hectare and the production of 26573001 metric tonnes with average productivity of 16.86 t ha^{-1} [2]. In Punjab the total productions of garlic was improved 73.70 metric tonne horticulture weeding crop statistics. The three major garlic growing states of India are Madhya Pradesh (92,500 ha), Rajasthan (60,000 ha) and Uttar Pradesh (35,300 ha) and the highest production is seen in Madhya Pradesh (405,000 MT), followed by Rajasthan (300,000 MT). The highest productivity was marked in Punjab (12.16 t/ha), followed by West Bengal (11.94) t ha^{-1} and Maharashtra (11.43) t ha^{-1}. The long day garlic is, however, cultivated by the states of Himachal Pradesh, Uttarakhand and Jammu and Kashmir only but in very small area [4].

Weeds pose one of the most serious threats to garlic production. Garlic can tolerate weeds only upto three weeks after sowing. Weeds reduce garlic yields considerably if not managed timely. Uncontrolled weeds can bring about a yield reduction up to 60 per cent. Weeds not only compete for nutrients, water, light and space but also increase the cost of labour and render the harvesting operations difficult [5]. Garlic crop is highly vulnerable to weed infestation due to its slow initial growth, non-branching habit, sparse foliage, shallow root system, frequent irrigation and high fertilizer application. Manual weeding is very difficult due to narrow row spacing of this crop besides non availability of labor and increased cost in it.

Mechanical method of weeding is not possible as it is a closely planted crop, removal of weeds through hand weeding is laborious, costly and time consuming, and shortage of labour makes hand weeding impossible. In garlic, very close spacing and a shallow root system further makes mechanical method of weed control difficult and also causes damage to developing bulbs [6]. Pendimethalin, oxyfluorfen, metolachlor and trifluralin have been found to be effective for managing weeds in garlic. Single application of any herbicide is not sufficient to obtain yield equal to weed free treatment. Preplant treatments of butachlor and paraquat can be used before the crop is planted and it also control the emerged weeds.

Materials and Methods

The present investigation entitled influence of integrated weed management on growth and yield of Garlic (*Allium sativum* L.) was carried out at experimental farm of the department of agriculture, Mata Gujri College, Sri Fatehgarh Sahib, Punjab during winter season of 2017-18. The objectives of the present investigation were to study the effect of integrated weed management in garlic on growth and yield. The experiment was carried out at the experimental farm of department of agriculture, Mata Gujri College, Fatehgarh Sahib, Punjab during winter season 2017-18. Fatehgarh Sahib, Punjab is situated between 30°56' 11.90''N latitudes and 76°18'13.18''E longitudes and at a mean height of 279 meter above sea level [7]. The climate of Fatehgarh sahib is characterized by subtropical semi-arid type with three distinct season's namely hot and dry summer, rainy and cold winter. Composite soil tests were drawn from 0-30 cm soil profundity from the trial plot before planting the yield. Chemical analysis of the composite soil sample was carried out soil pH 7.5, Electrical conductivity (dsm^{-1}) 0.30, Available nitrogen (kg ha^{-1}) 290, available phosphorus (kg ha^{-1}) 15.14, available potassium (kg ha^{-1}) 127 [8]. All plots were kept as usual according to treatment requirement such as weed free, weed check, mulching with paddy straw, and chemical used for cleaning weed includes butachlor, pendimethaline and oxyfluorfen. All the data has been taken from entire plot for growth and yield of garlic. Growth attributes such as plant height and number of leaves has been taken during growth period. Yield attributes such as bulb diameter, number of cloves $bulb^{-1}$, weight of bulb (g), length of clove (cm), weight of clove (g), fresh bulb yield (kg $plot^{-1}$), dry bulb yield (kg $plot^{-1}$) and dry bulb yield (q ha^{-1}) has been taken after harvesting. Statistical data was analyzed by standard procedure [9].

Results and Discussion

As my data (Table 1) represent the growth attributes such as plant height and number of leaves. Where plant height (38.20 cm) DAP 45 was maximum in treatment weed free and DAP 90 plant height (52.67 cm) was maximum in treatment weed free. The maximum plant height was recorded in treatment T_1 (weed free) [10]. This due to favourable growth condition and less plant weed competition which provided better opportunity to the crop to utilize nutrients, moisture, light and space in better way for its proper growth and development in garlic.

Reports in onion reported that the plant height is increased significantly with treatments which were kept weed free till harvest due to least crop weed competition for nutrients, moisture, space and sunlight between the crop and weeds [11]. The results are close proximity with weed free growth in onion [12]. Number of leaves as per plants after 45 DAP maximum (5.50) in T1 weeds free. After 90 DAP number of leaves got maximum value in treatment weed free that is 7.73. These results are similar to the results reported [13,14].

This finding was in agreement with those reported plant treatments in onion crops [5]. The similar free results were reported and observed in garlic crop [13]. The maximum number of leaves plants under weed free conditions in the garlic crop weeds [12]. Results similar to this are crop. Results similar to this were earlier reported in onion [13].

Yield attributes weed data also represent in Table 2 which are state that the diameter of bulb (cm) from each plot after harvesting got maximum (4.35) in a treatment weed free. It might be due to less weed free plants crop competition for spacing, light, water and nutrients in garlic, [14]. The similar results recorded

The similar results in garlic crops and the possible reasons for this is less crop weed competition for light, spacing, nutrients and the water. Number of cloves per bulb was maximum 26.37 in treatment weed free [4].

Hand weeding made the soil porous due to which the growth is higher. Similar results were reported in garlic crop. Weight of bulb (g) was maximum (10.43 g) in treatment of T1 weed free. These results are in closely proximity with in garlic [4]. The lowest bulb yield was recorded in weedy check. Similar results were reported in garlic [4] Whereas the length (cm) of bulb of porous was maximum (4.38) in a treatment T weed free [15]. The similar results are $rela_1$ted to the short length of bulb was earlier recorded in garlic [1].

Treatment	Plant height (cm)		Number of leaves per plant	
	45 days	90 days	45 days	90 days
T_1 Weed free	38.2	52.67	5.5	7.73
T_2 Weedy check	30	39.97	4.33	4.83
T_3 Mulching with paddy straw at 5 t ha^{-1}	33.87	47.97	4.97	6.33
T_4 Butachlor 2 l ha^{-1}+paddy straw mulch at 3 t ha^{-1}	37.17	50.4	5.2	7.27
T_5 Pendimethalin at 3.3 l ha^{-1}+ paddy straw mulch at 5 t ha^{-1}	37.6	51.13	5.3	7.57
T_6 Hand weeding 20 DAS+ oxyfluorfen at 375 ml ha^{-1}	31.2	43.83	5.17	6.73
T_7 Butachlor after sowing at 2 l ha^{-1}	32.3	45.83	4.87	5.5
T_8 Pendimethalin at 3.3 l ha^{-1}+ oxyfluorfen at 375 ml ha^{-1}	34.33	41.16	5.05	6.57
T_9 Butachlor at 2 l ha^{-1}+ oxyfluorfen at 375 ml ha^{-1}	30.33	40.36	4.98	6.4
SE(m) ±	0.41	0.84	0.11	0.2
$CD_{(0.05)}$	1.22	2.51	0.32	0.6

Table 1: The growth attributes of plant height and number of leaves.

Treatment	Diameter of bulb (cm)	Number of cloves per bulb	Weight of bulb (g)	Length of bulb (cm)
T_1 Weed free	4.35	26.37	10.43	4.38
T_2 Weedy check	2.47	15.23	4.97	2.67
T_3 Mulching with paddy straw at 5 t ha^{-1}	3.3	17.27	6.37	3.73
T_4 Butachlor 2 l ha^{-1}+paddy straw mulch at 3 t ha^{-1}	4.2	24.2	8.87	4.1
T_5 Pendimethalin at 3.3 l ha^{-1}+ paddy straw mulch at 5 t ha^{-1}	4.27	25.7	10.23	4.23
T_6 Hand weeding 20 DAS+ oxyfluorfen at 375 ml ha^{-1}	3.79	19.07	7.07	3.9
T_7 Butachlor after sowing at 2 l ha^{-1}	2.85	17.87	6.87	3
T_8 Pendimethalin at 3.3 l ha^{-1}+ oxyfluorfen at 375 ml ha^{-1}	4.22	25.76	10.13	4.12
T_9 Butachlor at 2 l ha^{-1}+ oxyfluorfen at 375 ml ha^{-1}	3.58	20.73	7.79	3.68
SE(m) ±	0.08	0.26	0.15	0.15
$CD_{(0.05)}$	0.24	0.78	0.44	0.45

Table 2: Yield attributes data represents the diameter of bulb.

Conclusion

The results showed that influence of integrated weed management on growth and yield of garlic had significant effect. It is concluded from the study that different weed management practices significantly reduced the weed density and increased garlic bulb yield with either manual weeding or the application of different herbicides. Overall herbicide dosage applied, pendimethaline 33% (stomp) pre emergence+ oxyflurafen 23.5 EC post emergence proved to be the best weeds of control method. Results revealed that manual weeding throughout growing season had controlled all weeds, which resulted in the highest garlic bulb yield, but it is the most laborious and un-economical method to control weeds as compared to the application of herbicides, So it reduce the net income and benefit cost ratio of crop Therefore, the use of pendimethaline 33% (stomp) as pre-emergence herbicides+ oxyflurafen 23.5 EC as post emergence recommended for the farming community of the area to achieve maximum garlic bulb yield ha^{-1} and good quality of crop.

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