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Effect of spacing and levels of nitrogen on growth and yield of garlic

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ABSTRACT

An investigation was carried out for three spacing, i.e. 10cm x 10cm, 15cm x 8 cm and 15 cm x 10 cm and four level of nitrogen i.e. 50, 75, 100 and 125 kg ha^{-1} in form of urea in garlic variety Yamuna safed (G-1). The highest yield 98.23 q ha^{-1} may be obtained by sowing the cloves at closer spacing 10 cm x 10 cm and applying highest dose of nitrogen 125 kg ha^{-1}.

Key words: Garlic, spacing, nitrogen, yield.

INTRODUCTION

Garlic is one of the most important commercial bulb crops grown and used as a spice or condiment throughout India. Garlic is frost hardy bulbous perennial erect herb of 30-100cm in height with narrow flat leaves and bears small white flowers and bulbils, Janick (3). It is an herbaceous annual for bulb and a biennial for seed production. Garlic has been considered as a rich source of carbohydrates, proteins and phosphorus. Ascorbic acid content was reported to be very high in green garlic by Pradan *et al.* (4). The medicinal value of garlic is widely recognized with ages. According to the Unani and Ayurvadic systems of medicines as practiced in India. Garlic is carminative and is a gastric stimulant and thus aids in digestion and absorption of food. It is also given in flatulence. In garlic allicin, which has a hypocholesterolaemic action, is present in the aqueous extract of garlic and redperces the cholesterol concentration in human blood. The inhalation of garlic oil or garlic juice has generally been recommended by Doctors in cases of pulmonary tuberculosis, rheumatism, sterility, impotency, cough and red eyes. Spacing plays an important role in development of plants. Population of plants is dependent upon spacing. Plant spacing is very important factor in the cultivation of garlic crop. The spacing in garlic is crucial in obtaining better bulb yield without adversely affecting the quality. By spacing, the quality of bulbs, their size and shape can be improved readily but it still remains can be achieved problem as to at what distance the maximum production and more nutritive value of garlic. When the spacing is very short, the size of bulb is reduced without affecting the total yield since the total number of plants are more in per unit area. The wide spacing although permits easy cultivation in field but the plants do not utilise the available amount of soil fertility. The bulb size of garlic increases with wide spacing but the net area yield dose not. The spacing given the plants in the field varies greatly depending on the fertility of soil, the growth of variety, the method of cultivation and control of diseases & insect pests. Therefore, it is essential to find out the best suitable distance at which the plants are to be set.

Nitrogen occupies the foremost place in plant nutrition as a builder of protein in plants. It forms a necessary constituent of protoplasm, chlorophyll, amino acid, proteins and alkaloids. A deficiency if nitrogen may become evident in several different ways. The absence of sufficient nitrogen generally results in small yellow leaves, reddish bark, stunted growth and poor quality of bulb. On the other hand an excess of nitrogen produced excess vegetative growth, often delays ripening and may lead to marginal burning of leaves poor keeping quality of bulbs subjected to decay. Therefore, present investigation was undertaken to study the effect of spacing and levels of nitrogen on vegetative growth and yield of garlic.

MATERIALS AND METHODS

The experiment was conducted at Horticulture farm of P.G. College, Ghazipur (U.P.) during the year of 2006-07. The texture of experimental soil was sandy loam, poor in nitrogen, slightly rich in phosphorus and sufficient in potash with slightly alkaline in reaction. The experiment was laid out in randomized block design including three spacing (10cm x 10cm, 15cm x 8cm and 15cm x 10cm) and four level of nitrogen (50, 75, 100 and 125 kg ha^{-1}). Half dose of nitrogen as per treatment was applied as basal and remaining half in two split doses at 30 and 45 days after sowing through urea. 50 ha^{-1}phosphorus in the form of single super phosphate and 50 ha^{-1} potassium in the form of potash was applied

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basal dose as per treatment. All common cultural practices were adopted during the course of study. To determine the bulb quality and yield samples five garlic bulbs were taken from each treatment.

RESULTS AND DISCUSSION

The highest yield 98.23 q ha^{-1} of garlic cultivar Yamuna safed (G-1) was obtained by sowing the cloves at closer spacing 10cm x 10cm and applying 125 kg ha^{-1}. Bigger size of garlic bulb was obtained at the spacing 15cm x 10cm and applying 125 kg ha^{-1}.

A considerable change in various growth characters and yield per hectare was noticed due to variation in spacing between plants. The garlic plants planted at the distance of 15 cm x 10 cm keeping the lowest plant population per hectare produced highest average weight of garlic bulb. The other characters indicated by diameter of bulb or weight of whole plant were also maximum at this spacing. On the other hand highest population of plants per hectare i.e. spacing the plants 10cm x 10cm resulted the maximum yield of both bulb and whole plant. However, diameters, weight per bulb and growth characters were minimum at this spacing. On the other hand at wider spacing or lower plant population per unit area the plant could get more area for plant nutrients and open space in air for spread which gave better chance of development of growth character. As the density of plant population per unit area increased it brought about a keen competition among plants for nutrients, light and air and resulted in poor growth, ultimately causing reduced size of bulb and minimum fresh weight per bulb. The most interesting point to note was that at 15cm x 10cm spacing the better development of morphological characters and larger size of bulb could not compensate by the reduction in yield due to lower plant population per unit area. This finding is almost identical to findings of Rahman and Talukdar (5). The closest spacing have the highest yield with small bulb was reported by Xu-Kun *et al.* (7).

The application of nitrogen to the garlic plant

Table 1. Effect of spacing and different levels of nitrogen on growth and yield of garlic.

Characters	Plant height (cm)	Number of leaves	Fresh weight (g)	Dry weight (g)	Number of cloves $bulb^{-1}$	Diameter of bulb (cm)	Yield of garlic bulb q ha^{-1}
Spacing							
S_1	44.03	6.33	15.35	2.36	21.83	3.66	92.67
S_2	44.13	6.42	15.61	2.45	22.49	3.68	92.28
S_3	44.35	6.54	15.95	2.50	23.57	3.86	91.09
CD at 5%	0.24	0.07	0.19	0.17	0.249	0.072	1.030
Nitrogen							
N_1	43.25	6.11	14.19	1.88	19.66	3.55	85.76
N_2	43.77	6.36	15.21	2.08	21.77	3.62	90.28
N_3	44.30	6.49	15.97	2.71	23.44	3.74	94.28
N_4	45.36	6.77	17.17	3.09	25.66	3.83	97.74
CD at 5%	0.28	0.08	0.22	0.20	0.517	0.061	1.784
Interaction							
S_1N_1	43.10	5.97	13.69	1.78	18.66	3.50	85.87
S_1N_2	43.72	6.27	14.75	2.00	21.33	3.60	91.20
S_1N_3	44.22	6.47	15.87	2.56	22.33	3.73	95.37
S_1N_4	45.09	6.63	17.07	3.09	25.00	3.83	98.23
S_2N_1	43.33	6.13	14.10	1.91	19.66	3.60	86.20
S_2N_2	43.76	6.37	15.23	2.05	21.66	3.60	90.70
S_2N_3	44.10	6.47	16.00	2.65	23.33	3.73	94.32
S_2N_4	45.42	6.74	17.13	3.22	25.33	3.80	97.92
S_3N_1	43.41	6.23	14.77	1.94	20.66	3.56	85.20
S_3N_2	43.82	6.43	15.66	2.19	22.23	3.66	88.94
S_3N_3	44.59	6.53	16.05	2.92	24.66	3.76	93.14
S_3N_4	45.56	6.97	17.33	2.96	26.66	3.83	97.07
CD at 5%	0.48	0.13	0.37	0.34	0.896	0.107	1.780

increased the yield of both bulbs and whole plant. The number of cloves and other morphological characters also increased significantly and increase in the level of nitrogen upto 125 kg ha^{-1} produced a corresponding significant increase in yield. This increase in yield and other growth characters might and have been due to availability of nitrogen in greater amount. At lower fertility i.e. 50kg or 75 kg ha^{-1} the plants did not get enough nitrogen for their growth and development thus smaller yield was obtained at lower nitrogen amount. All the growth characters gave poor performance. Sotomayor (6) also obtained higher yield by increasing the nitrogen rates and plant population but bulb size of 15 cm^2 with 265 kg N ha^{-1}. Ferrari and Churata (2) found that the rates of nitrogen from 25 to 50 kg ha^{-1} were optimum for bulb size and yield while application of 67-90 kg ha^{-1} gave better yield. In an investigation on nitrogen levels and plant population, Aljaro *et al.* (1) obtained high yields and optimum bulb size from a population of 10^6 plants ha^{-1} at treatment 150 kg N ha^{-1} treatment.

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