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The influence of nitrogen levels on growth and bulb yield of two garlic cultivars

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ABSTRACT

Garlic belongs to family Alliaceae is one of the oldest cultivated vegetables and important medicinal plant. Fertilization of this plant has a critical role in growth and bulb yield. The investigation was carried out by application of nitrogen (0, 25, 50, 75, 100 and 125 kg/h) as main factor and garlic cultivar ("Hamedan" and "Violet") as minor factor in a split plot experiment based on randomized complete block design (RCBD) with three replications in Firoozabad, Fars Province, Iran. The results revealed that nitrogen levels and type of the cultivar altered growth characteristics and bulb yield. Bulb yield was maximum at 100 Kg N/ha which was not significantly different when compared to 50, 75 and 125 Kg N/ha. The bulb yield was the maximum in cultivar "Violet".

Keywords: *Allium sativum*, fertilization, medicinal plants, bulb.

INTRODUCTION

Garlic (*Allium sativum* L.) from the family Alliaceae is the most important bulb crops after onion [1]. The cell wall of some bacteria is the target of attack by active substances of garlic [2]. Garlic can be used as food preservative [3]. This plant is one of the oldest cultivated vegetables. The edible parts of garlic known as garlic cloves contain proteins, lipids, carbohydrates, fibre, and vitamins. Garlic contains essential oils and also antibiotic substances known as garlicin and allistatin. This plant has positive effect on human organism [4, 5].

Favorable yield and quality of garlic need to fertilize this plant by essential elements since garlic shows high demand of nutrients [5]. Availability of nitrogen is important for growing plants. It is a main constituent of protein and nucleic acid molecules. It is also a part of chlorophyll molecules. It is well known that the use of fertilizer helps in production and is a quick method resulted in the best yields [6, 7].

The aim of this study was evaluation of the effects of nitrogen levels on growth characteristics and yield of two cultivars of garlic.

MATERIALS AND METHODS

Plant materials and experimental conditions

The field study was conducted by using nitrogen (0, 25, 50, 75, 100 and 125 kg/h) as main factor and garlic cultivar (Hamedan and Violet) as minor factor in a split plot experiment based on randomized complete block design (RCBD) with three replications in Firoozabad, Fars Province, Iran. Each minor plot contained 5 rows with 2 m long and spacing of 10 cm between plants within row and 20 cm between rows. The soil of the field was tested before planting and showed PH=7.79, N=0.1%, available P=5.5 mg/kg, available K=184 mg/kg, organic C=1.14 and

EC=0.7 ds/m. The source of nitrogen was urea and applied as three equal doses. Finally, the plants of 1 m^2 of each replication were harvested and subjected to measurement of growth and yield.

Statistical analysis

Data from the experiment were subjected to analysis of variance (ANOVA) using SAS computer software at $P < 0.05$ and means compared with Duncan's new multiple range test (DNMRT).

RESULTS AND DISCUSSION

Our data showed that the nitrogen levels altered growth characteristics and yield significantly (Table 1). The maximum values of plant height, shoot fresh and dry weights and leaf number were achieved on 125 Kg N/ha which were significantly different when compared to other nitrogen levels. The highest clove number was obtained at 125 Kg N/ha which was not significantly different when compared to 75 and 100 Kg N/ha. Bulb yield was maximum at 100 Kg N/ha which was not significantly different when compared to 50, 75 and 125 Kg N/ha.

The type of cultivar influenced on growth characteristics and yield of garlic (Table 2). Plant height, shoot fresh and dry weights and leaf number of cultivar "Hamedan" were higher than "Violet" whereas clove number and bulb yield were maximum in "Violet".

Table 1. The effect of nitrogen rates on growth and yield of the garlic

nitrogen rate (kg/h)	plant height (cm)	shoot fresh weight (g)	shoot dry weight (g)	leaf no	clove no per bulb	bulb yield (g)
0	83.27 e	12.38 f	3.41 e	7.83 c	9.83 c	81.33 c
25	86.59 e	15.32 e	4.20 d	8.17 c	10.00 c	84.83 bc
50	90.45 d	19.37 d	4.82 cd	8.67 c	11.33 bc	89.50 ab
75	95.16 c	23.02 c	5.54 c	8.83 c	12.50 ab	92.83 a
100	100.52 b	25.86 b	6.26 b	9.83 b	13.33 a	96.50 a
125	105.65 a	30.24 a	7.01 a	10.83 a	13.67 a	95.00 a

Pandey et al. applied different treatment combinations of NPK and indicated that dose of NPK 120:80:60 was the best for garlic yield [1]. Nori et al. applied 100-300 kg N/ha and revealed that 200 kg N/ha resulted in the highest value of garlic yield [8]. Nitrogen at 100 pounds per acre significantly increased total solids in three experiments and above 100 pounds per acre tended to reduce total solids [9]. Cantwell et al. applied nitrogen (100-400) and revealed that weight per bulb was notably reduced with the lowest N rate [10]. Islam et al. reported that the highest yield of bulbs was obtained at moderate application of nitrogen (120 kg N/ha) [11]. Farooqui et al. illustrated that significantly higher yield of garlic was obtained by combination of 200 kg N/ha + 60 kg S/ha [7]. Gaviola and Lipinski indicated that 225 kg N/ha resulted in the largest yield of red *A. sativum* ecotype heads [12]. A Jordanian experiment indicated that the yield of garlic increased by fertigation of 120 kg N/ha in the first season and by the lower rate (75 kg N/ha) in the second season [13]. Kesik et al. showed that the weight of bear garlic leaves increased along with the increase of nitrogen nutrition rate. The highest leaf yield was harvested by application of 150 kg N/ha [14].

Some differences between present study and literature data can be due to differences in climatic conditions, chemical and physical properties of the soil, nitrogen sources, genotype, etc.

In each column, means with the same letters are not significantly different at 5% level of Duncan's new multiple range test.

Table 2. The effect of cultivar on growth and yield of the garlic

cultivar	Plant height (cm)	Shoot fresh weight (g)	shoot dry weight (g)	leaf no	clove no per bulb	bulb yield (g)
Hamedan	97.59 a	24.81 a	6.38 a	9.67 a	10.61 b	77.61 b
Violet	89.62 b	17.26 b	4.03 b	8.39 b	12.94 a	102.39 a

In each column, means with the same letters are not significantly different at 5% level of Duncan's new multiple range test.

CONCLUSION

It is important for growers to determine the optimum nitrogen level and use the best cultivar. Under present experimental conditions the cultivar "Violet" resulted in the best yield. There wasn't significant difference between 50-125 kg N/ha regarding the bulb yield. Therefore, 50 kg N/ha can be recommended as a suitable rate for good bulb yield.

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