



The Effect of Type and Application Method of Fertilizer Treatments on Growth and Yield of Medicinal Garlic

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Introduction

Garlic is the second and the most commonly used plant after onion from allium which is very important according to the food value because of its medical and mineral properties. On the other hand, macro nutrients such as nitrogen can cause better accumulation of dry matter with the development of leaf area and the efficient use of solar radiation and distribute it in the leaves and shoots. The usage of organic fertilizers such as cow manure is one of the most important nutritional strategies in the sustainable management in agricultural ecosystems.

Materials and Methods

The experiment was carried out in a randomized complete block design with three replications, at the research farm of agricultural college of Shahrekord University in 2015. Treatments consisted of N₁₀₀P, N₁₅₀P, and N₂₀₀P (100, 150, and 200 kg N/ha in the form of urea + phosphorus requirement, respectively); N₁₀₀PS, N₁₅₀PS, and N₂₀₀PS (100, 150, and 200 kg N/ha in the form of urea + phosphorus requirement + sulfur requirement, respectively); BCM₁₀₀, BCM₁₅₀, and BCM₂₀₀ ((100, 150, and 200 kg N/ha in the form of cow manure as broadcast application); SCM₁₀₀, SCM₁₅₀, and SCM₂₀₀ ((100, 150, and 200 kg N/ha in the form of cow manure as subsurface application). In this experiment, chlorophyll a, chlorophyll b, total chlorophyll, carotenoids, dry weight of leaf, plant height (38, 68 and 98 days after planting), number clove per plant, clove weight and garlic yield were measured. All analyses were performed based as randomized complete block design. The data was analyzed using one-way ANOVA and mean comparison was performed by LSD test. The F-test was considered significant at $p < 0.05$ between treatments for fertilizer treatment.

Results and Discussion

The results showed that the effects of fertilization treatments on chlorophyll a, chlorophyll b, total chlorophyll, carotenoids, dry weight of leaf, plant height (38, 68 and 98 days after planting), number of clove plant and clove weight were significant. Treatment of 150 kg N/ha in the form of urea plus sulfur with an average of 3.66 mg/g was the highest amount of chlorophyll a but it did not have significant difference with BCM₁₀₀ treatment. Additionally, the formation of chlorophyll b in garlic with the use of organic fertilizer (BCM₁₀₀ treatment) is similar to those of which 50 kg per hectare more nitrogen was used in the form urea fertilizer. Total chlorophyll of whole plots receiving organic manures decreased by 10.5% compared with chemical fertilizers, also organic treatments BCM₂₀₀ and SCM₂₀₀ did not have significant difference for total chlorophyll. Based on these comparisons, the amount of total chlorophyll of sulfur treatments was by 5.81 higher than treatments with lack of sulfur. Carotenoids in cow manure treatment (SCM₁₀₀ and SCM₁₅₀) with 100 kg N/ha in the form of urea did not have significant difference. But the amount of carotenoids of other organic and chemical treatments compared with these treatments significantly decreased. For plant height (38 days after planting) in BCM₁₀₀ (10.86 cm) and BCM₂₀₀ (11.83 cm) treatment did not show a significant difference with the SCM₁₀₀ and SCM₂₀₀ treatments. The plant height (68 days after planting) in N₁₀₀PS with an average of 34.3 cm had a significant increase compared with other fertilizing treatments. Differences of receiving plots of organic fertilizers compared with chemical fertilizers for leaf dry weight has a decrease of 16.3%. Chemical treatments (N₂₀₀P and N₂₀₀PS with the average of 9965 and 9715 kg per hectare, respectively) had the highest yield, as well as subsurface application could increase the mean of yield by 5.63 percent in compared with the broadcast application.

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Conclusions

In general it can be concluded which the subsurface application of cow manures in compared to broadcast application had the highest amount of garlic production. Also, in the highest level of nitrogen fertilizer (200 kg nitrogen per hectare), the highest yield was obtained with treatments of chemical fertilizers. However at the level of 150 kg nitrogen per hectare, manure particularly subsurface application was superior to other nitrogen resources. Thus, in order to reduce the use of chemical fertilizers in agricultural ecosystems, subsurface application of manure is recommended to suitable produce garlic plant, but if the goal is to achieve the maximum yield of garlic bulb at least 200 kg N ha⁻¹ in the form of chemical fertilizer is required.

Keywords: Cow manure, Photosynthetic pigment, Subsurface application, Sustainable management