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THE EFFECT OF INCREASING DOSES OF NITROGEN (N) APPLICATION FOR SOME NUTRIENT ELEMENTS, VITAMIN C AND PROTEIN CONTENTS OF KOMATSUNA (*BRASSICA RAPA* VAR. *PERVIRIDIS*) PLANT

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Abstract

ACIKGOZ, F. E., A. ADILOGLU, F. DAGLIOGLU, S. ADILOGLU, G. CELIKYURT and O. KARAKAS, 2014. The effect of increasing doses of nitrogen (N) application for some nutrient elements, vitamin C and protein contents of komatsuna (*Brassica rapa* var. *perviridis*) plant. *Bulg. J. Agric. Sci.*, 20: 321-324

This study was conducted to determine the effect of increasing nitrogen (N) application on macro-micro elements, vitamin C, and protein contents of komatsuna. Four doses of N (N0: 0 kg da^{-1}, N1: 10 kg da^{-1}, N2: 15 kg da^{-1} and N3: 20 kg da^{-1}) were applied as NH_4NO_3 fertilizer in greenhouse conditions.

The content of Vitamin C decreased in the increasing doses of N. Vitamin C, for N0 dose was obtained as 29.28 mg $100g^{-1}$, for N2 as 21.54 mg $100g^{-1}$, increased with N fertilization. Protein content was positively affected of N fertilization and the protein content was found 32.97 % for N2 dose. K, Ca, Mg, Fe and Cu nutrient elements were found statistically insignificant, for N2 dose under increasing doses of N application; N found as 5.85 %, P 0.81 %, Zn 50 ppm.

Key words: komatsuna, increasing doses nitrogen, macro-micro elements, vitamin C and protein

Introductıon

Komatsuna, *Brassica rapa* var. *perviridis* or *Brassica rapa* var. *komatsuna* is recognized by the scientific name of the group cabbage vegetable or Japanese mustard spinach as also known worldwide. As well as other members of *Cruciferae* family, Komatsuna is rich in nutritional value. Some *Brassica* vegetables such as cauliflower, kale, and cabbage have great demand for consumption and are widely grown in Turkey, however komatsuna is not well known and cultivated as it is in east countries. Generally, the vegetables are grown to achieve higher efficiency (Stewart et al., 2005), reach a maximum value of growth (Badr and Fekry, 1998; Arisha and Bardisi, 1999; Dauda et al., 2008) the amount of inorganic fertilizers and plant nutrients as the main source are used and excessive emphasis is given on the intensity (Adediran et al., 2004; Naeem et al., 2006). Nitrogen application up to a certain point in a positive way is known to affect the efficiency of the plant. Nitrogen fertilization increased the content of some macro and micro nutrient elements, vitamin C and protein may affect the amount and quality of the product positively or negatively. Yield limits in the lack of nitrogen for plant growth. However, the risk of accumulation of nitrate in plants is taken by excessive use of nitrogen fertilization in order to increase efficiency (Addiscott, 2005). Most importantly, especially for green leafy vegetables, nitrogen (N) fertilization has a major influence on plant growth. Thus, the nutrient content, the effect of vitamin C and protein of komatsuna plant and the impact of those features are examined in this study under increasing amounts of nitrogen fertilizer application.

Materials and Methods

The experiment was carried out during successive crop seasons: late spring-early summer in UV consisting of PE unheated greenhouse in Corlu, Turkey (41°11’ N, 27°49’ E) in

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2010-2011. Seeds of cv. Torasan F_1 (Chilternseeds Co.) were sown in multicelled trays filled with peat (Klasmann-Deilmann, Potground H, Germany) (Acikgoz and Altintas, 2011). Some properties of peat are 160-260 mg L^{-1} N, 180-280 mg L^{-1} P_2O_5, 200-150 mg L^{-1} K_2O_5, 80-150 mg L^{-1} Mg, pH 6, % 0.8 N, % 70 organic materials, % 35 C. The experiment was conducted according to random blocks experimental design with three replications. Plants, 45 days after seeding 0.50 m x 1.25 m: 6.25 m^2 plots were transplanted to greenhouse soil at the 2-3 true leaf stage with 3 replicates and with border plant on their sides. In the total experiment area of 6.25 m^2 x 3 repeated doses of x 4 N: 75 m^2 were used. Four doses of nitrogen fertilizer as NH_4NO_3 form (N0: 0 kg ha^{-1}, N1: 10 kg ha^{-1}, N2: 15 kg ha^{-1}, N3: 20 kg ha^{-1}) were applied to komatsuna plant. These fertilizers were applied as a single dose 60 days after sowing of the seed plants. A total of 10 plots each of 120 plants were grown in the field trial. Plants were harvested after 75 days of seed sowing. Measurements were made preventing the lost for the biological characteristics of post-harvest plants and then were passed through two times the pure water of 65^0C until reaching at a weight in an oven-drier, and ground to be ready for the required analysis. Chemical properties of the soil used in the experiment are given in Table 1 and climate data in unheated greenhouse during the experiments are given in Figure 1.

Soil samples were analyzed for pH (Saglam, 2008); organic matter (Nelson and Sommers, 1982); total nitrogen (Kacar, 1995); available phosphorus, exchangeable potassium, exchangeable calcium and magnesium (Saglam, 2008); available trace elements (Fe, Cu, Zn, and Mn) (Lindsay and Norvell, 1978), and texture (Gee and Bauder, 1986). Leaf samples were analyzed for total nitrogen, phosphorus, potassium, calcium, magnesium and trace elements (Fe, Cu, Zn, and Mn) in each plant leaf sample (Kacar, 1995). Ascorbic acid content of the leaf samples were estimated with titrimetric method (Anonymous, 1983). The crude protein was calculated using a nitrogen conversion factor of 6.25 (Aoac, 1990). Neither extra fertilization nor pesticide application of any kind was carried out during the experiment. Pests and disease incidences were not observed and weeding was carried out when needs arises during the growing period. All data obtained from this experiment was statistically analyzed by using the MSTAT-C software. The statistical significance of differences among the mean values was determined by least significant difference (LSD) test at 5 % and 1 % probability (Duzgunes et al., 1987).

Table 1
Chemical properties of the soil sample

Parameter/ Unit	Value
pH (1:2,5 soil/water)	8.01
EC (%)	0.07
$CaCO_3$ (%)	2.74
Organic matter (%)	1.35
Ca (%)	0.54
P (ppm)	36.40
K (ppm)	253.80
Mg (ppm)	473.10
Mn (ppm)	5.68
Cu (ppm)	0.81
Fe (ppm)	7.43
Zn (ppm)	0.97

Results and Discussion

The effect of increasing Nitrogen application on some macro nutrient element contents of komatsuna plant is given in Figure 2.

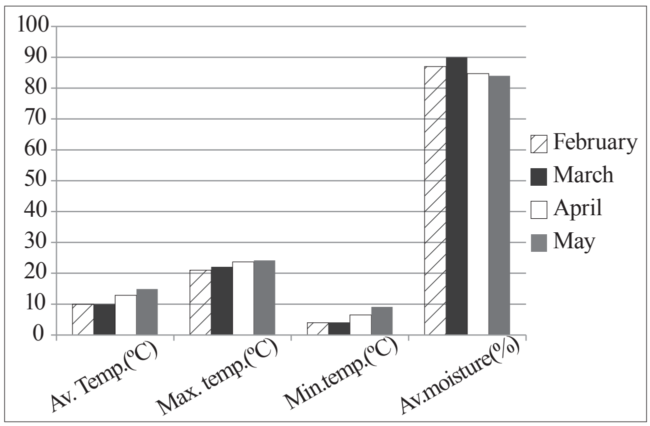

Fig. 1. Average climate data in unheated greenhouse during the months of the experiment

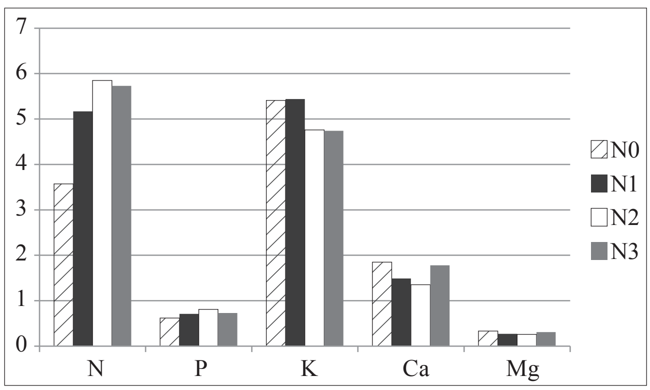

Fig. 2. The effect of increasing Nitrogen fertilizer application on some of the macro nutrient element contents of komatsuna plant (%)

Nitrogen content of komatsuna increased (Figure 2) and was statistically significant at the level of 1 %. Phosphorus content of komatsuna increased with N application (Figure 2) and was statistically significant at the level of 5 %. Similarly, K, Ca, and Mg content of plant increased with N application, but these increases were not found statistically significant. In this research, increasing amounts of nitrogen fertilizer application to the plant increased N and P contents, which are expected to be a result. Vegetative growing with N and P contents of plants are increased by application of increasing amounts of N to plants (Adiloglu, 2007; Adiloglu and Adiloglu, 2009). Potassium, Ca and Mg contents of plants generally increased with increasing amounts of N fertilizer application, but it is not applicable for all plants (Kacar and Katkat, 2007). This study, increasing N application to the plants reduced K, Ca and Mg content, but this result was not significant statistically.

The effects of increasing nitrogen application on some microelement contents of komatsuna plant are given in Figure 3.

Iron and Cu contents of plant increased with N application but these increases were not found statistically significant. However, Zn and Mn contents of komatsuna increased with N application (Figure 3) and these results were found statistically significant at the level of 5 %. Same results were determined earlier researchers (Cimrin et al., 2000; Kavak et al., 2003). Plant growth develops with increasing N application to the plants and some trace element uptake from the soil of plants increased as well (Kacar and Katkat, 2007). In this study, some trace elements contents of plant increased with N application. However, these increases were not significant statistically for Fe and Cu contents of plant.

The effect of increasing N application on Vitamin C content of komatsuna plant is given in Figure 4.

Vitamin C contents of komatsuna plant decreased with increasing N application (Figure 4). These decreases were found statistically significant at the level of 5 %. Some earlier researchers for different vegetables (Mozafar, 1993; Wunderlich et al., 2008) determined same results.

Excess nitrogen fertilizer applications to some green leafy vegetables decrease Vitamin C content (Lee and Kader, 2000; Staugaitis et al., 2008). Vitamin C content of plants are affected by many different biotic and abiotic factors (plant genotype, light, temperature, fertilization, irrigation prior to harvest) (Lee and Kader, 2000; Hancock and Viola, 2005). Kurilich et al. (1999) determined Vitamin C content of five different fresh weights of cabbage as between 32.9 and 22.6 mg $100g^{-1}$.

The effect of increasing N application on Protein content of komatsuna plant is given in Figure 5.

Protein content of komatsuna plant increased with N application for N2 dose and decreased for N3 dose (Figure 5). These results were found significant statistically at the level of 1 %.

Protein in plants accumulated in young tissues by convenient N application (Salisbury and Ross, 1992). Nitrogen application to the plants is very important for protein contents. Nitrogen deficiency causes protein deficiency in plants (Everaarts, 1994). The highest protein content of plant was determined with N2 dose. This result shows that, excess N application to the plants cause low protein content in plants (Figure 5).

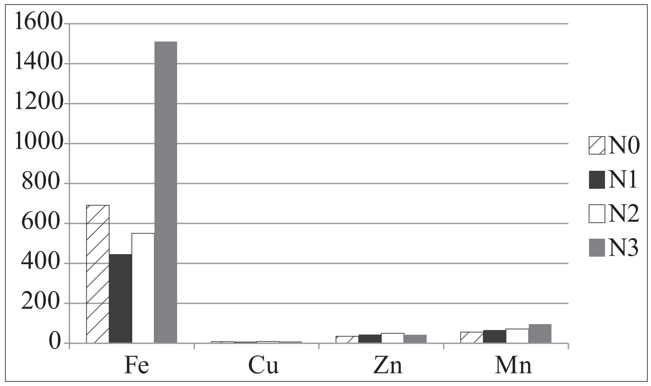

Fig. 3. The effects of increasing nitrogen application on some micro element contents of komatsuna plant (ppm)

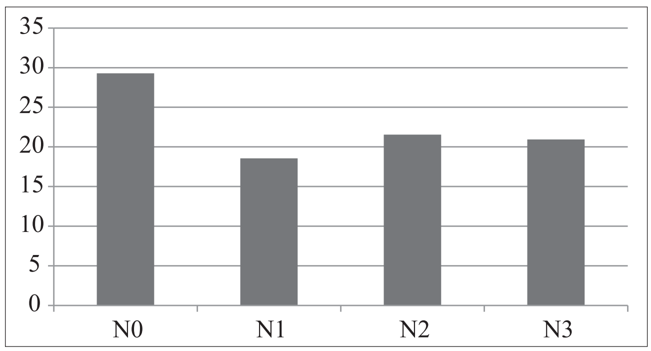

Fig. 4. The effects of increasing nitrogen fertilizer application on vitamin C content of komatsuna plant (mg $100g^{-1}$)

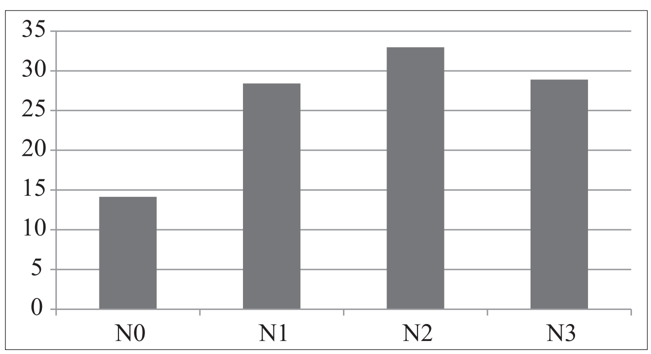

Fig. 5. The effect of increasing nitrogen fertilizer application on protein content komatsuna plant (%)

Conclusion

Consequently, N_2 (15 kg ha^{-1}) dose of nitrogen is enough for the highest Vitamin C and protein contents of komatsuna plant. Rich antioxidant property of vitamin C in komatsuna plant can reduce the risk of cancer for human health. Komatsuna consumption should be increased for preventing of harmful free radicals in human body. N2 dose of Nitrogen (15 kg ha^{-1}) should rather be applied to komatsuna; because of the highest Vitamin C content was determined in these doses except N0 dose. On the other hand, World Health Organization (WHO) advices 45 mg of vitamin C for daily consumption.

K, Ca, Mg, Fe, Cu, Zn, and Mn contents of komatsuna plant increased with increasing N application to the plant. These increases were found statistically insignificant for K, Ca, Mg, Fe and Cu content of plant. On the other hand, nitrogen fertilizer should be applied for increasing the quality and quantity of komatsuna plant.

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