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Effect of Integrated Organic and Chemical Fertilizer on Growth Indices of Roselle (*Hibiscus sabdariffa* L.) as a Medicinal Plant in Mashhad Condition

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Introduction

These days, using different chemical fertilizers has different negative effects such as imbalance soil nutrient, soil, water and air pollution and decrease quantitative and qualitative yield of crops, which increase environmental hazardous and production costs. Organic fertilizers providing the plants nutritional requirements and stabilizing soil fertility without having undesirable impact on the environment and crop quality. It has been reported that integrated organic and chemical fertilizer consumption in agro ecosystems increase chemical fertilizers efficiency and also decrease environmental impacts. Roselle is one of the most important medicinal plants of the Malvaceae family which is cultivated in southern parts of Iran. Roselle has been using as a folk remedy for abscesses, dyspepsia, cancer, debility since ancient times. Roselle is grown mainly for its calyces which contain vitamin C, anthocyanin, antioxidants, calcium, phosphorus and iron. Improved soil nutrients by using organic and chemical fertilizer together could improve the quality of the secondary metabolite content of Roselle. The present study was conducted to better understand the effect of integrated organic and chemical fertilizer on growth indices of Roselle in Mashhad, Iran condition.

Materials and Methods

In order to study the effects of integrated organic and chemical fertilizers on growth indices of Roselle (*Hibiscus sabdariffa*), a field experiment was conducted with 11 treatments based on a randomized complete block design with three replications at the research station of faculty of agriculture, Ferdowsi university of Mashhad, Iran, during year 2013-2014. The experimental treatments were including: 1- Mycorrhiza (*Glomus intraradices*), 2- Cow manure, 3- Chemical fertilizer, 4- Vermi-compost, 5- Chemical fertilizer+ Cow manure, 6- Chemical fertilizer+ Vermi-compost, 7- Chemical fertilizer + Mycorrhiza, 8- Cow manure+ Mycorrhiza, 9- Vermi-compost+ Mycorrhiza, 10- Cow manure+ Vermi-compost +Mycorrhiza, and Control. The seeds were sown at greenhouse and then seedlings were transplanted to the farm at two mounts age. The land lied fallow for two years before year of the experiment. Seed bed was prepared using plough and disk in autumn 2014. Plots were designed with 4 m long and 3.75 m width, 1 m apart each other. Between blocks, 2 m alley was kept. The seedling sowing was performed by hand on the middle of furrows. Growth analysis samples were taken from 75 x 125 cm quadrates from middle of each plots in five times. The trend of Roselle plant dry matter (DM), leaf area index (LAI) and crop growth rate (CGR) were recorded through the growing season. For analysis of data and drawing shapes, Minitab Ver. 16 and Sigma Plot Ver. 11 softwares were used.

Results and Discussion

The results indicated that the highest LAI (5.89) was obtained in chemical fertilizer treatment. Integrated cow manure+chemical fertilizer treatment produced the highest dry matter (9887.23 kg. ha^{-1}) compared with other treatments. The highest CGR (23.47 g / m^2. day^{-1}) was achieved in mycorrhiza + chemical fertilizer treatment. The lowest LAI (3.4), DM (7618 $kg.ha^{-1}$) and CGR (16.48 g. m^{-2}. day^{-1}) were shown in control, cow manure+ Vermi-compost +Mycorrhiza and cow manure treatments, respectively. The highest LAI, DM and CGR were obtained at 156 days after transplanting to the farm. There was a significant correlation between plant height and calyx yield. Our results are in agreement with some experiments which use of organic and inorganic

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fertilizer on Roselle.

Conclusion

The result of this experiment revealed that using of chemical and organic fertilizer in integrated form instead of individual application has a beneficial effect on improving the growth indices of Roselle. Based on the results of this experiment it can be concluded that the age of seedlings for transplanting to the farm should be at least three mounts and the direct sowing Roselle at Mashhad condition would not be recommended.

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Keywords: Biological Fertilizer, Calyx Yield, CGR, LAI