

Evaluation of Vermicompost and Nitrogen Biofertilizer Effects on Flowering Shoot Yield, Essential Oil and Mineral Uptake (N, P and K) in Summer Savory (*Satureja hortensis* L.)

M.R. Haj Seyed Hadi^{1*} and M.T. Darzi¹

Haj Seyed Hadi, M.R., and Darzi, M.T. 2017. Evaluation of vermicompost and nitrogen biofertilizer effects on flowering shoot yield, essential oil and mineral uptake (N, P and K) in summer savory (*Satureja hortensis* L.). Journal of Agroecology 9(4):

Introduction

Summer Savory (*Satureia hortensis* L.) is the representative plants of Lamiaceae family, which has high significant nutritional and taste values. Its pharmacopoeial raw material is herb (*Satureiae herba*), which contains many different biologically active compounds beside essential oil and minerals like calcium, potassium, magnesium, iron, and zinc. Sustainable agricultural systems has become an important issue throughout the world. It is obvious that intensive cultivation has led to a rapid decline in organic matter and nutrient levels as well as affecting the physical soil properties. The biofertilizers practice (such as vermicompost and biological nitrogen fixing bacteria) has been recognized for a long time as an effective means of improving the structure and fertility of the soil, increasing the microbial diversity, activity and population, improving the water storage capacity of soils and crop yield.

Materials and Methods

This investigation was conducted at agricultural research fields of RAN Company at Firouzkuh, Iran during 2015. Factorial experiment based on randomized complete blocks design with two factors and three replications were chosen as an experimental design. The factors were biological nitrogen fertilizer at three levels of Control, Nitroxine and Supernitroplus, and vermicompost at four levels 0, 5, 10 and 15 t.ha⁻¹. Measured traits consisted of fresh and dry plant weight, flowering shoot yield, essential oil content, nitrogen, phosphorus and potassium percentage in aboveground shoots. All data were subjected to statistical analysis (one-way ANOVA) using SAS software. Duncan's multiple range test (DMRT) at 5% probability level were performed to calculate means of comparison. Data were transformed when necessary before analysis to satisfy the assumptions of normality.

Results and Discussion

Results showed that the highest fresh and dry plant weight (41.10 and 12.93g.plant⁻¹, respectively) and essential oil content (2.01%) were obtained by using 10 ton per hectare of vermicompost. Applying 15 ton per hectare of vermicompost caused maximum flowering shoot yield (2237.82kg.ha⁻¹), nitrogen (2.21%) and phosphorus (0.52%) content in the aboveground shoot. Mean comparison indicated that seed inoculation with Supernitroplus had significant effects on all measured traits except for nitrogen content in aboveground shoot. The maximum fresh and dry plant weight (40.21 and 14.42g.plant⁻¹), flowering shoot yield (2406.21kg.ha⁻¹), essential oil (2.05%), phosphorus (0.49%) and potassium (1.34%) were obtained by applying Supernitroplus. The maximum nitrogen content (2.23%) was obtained by using Nitroxine. Results of interaction effects showed that using supernitroplus and 15 ton per hectare of vermicompost caused maximum potassium content (1.50%) in Savory shoots.

Several types of studies have shown a beneficial effect on crop plants by inoculation of seeds with *Azospirillum* and *Azotobacter* strains. Inoculation of plants with *Azospirillum* and *Azotobacter* can results in significant changes in various plant growth parameters. Positive effects of inoculation have been demonstrated on including increase in root length and nutrition (NO₃⁻, NH₄⁺, PO₄²⁻, K⁺, Rb⁺ and Fe⁺⁺) uptake. Nitrogen and phosphorus are the two major plant nutrients and combined inoculation of nitrogen fixers and PSM may benefit the plants better than either group of organisms alone. Interaction studies have been done both *in vitro* and *in*

1- Associate Professor, Department of Agronomy, Roudehen Branch, Islamic Azad University, Roudehen, Iran.

(*- Corresponding author Email: hhadi@riau.ac.ir)

DOI:10.22067/JAG.V9I4.54711

vivo. Nitrogen fixers and PSM when inoculated together colonized the rhizosphere and enhanced the growth of crops by providing it with nitrogen and phosphate, respectively. Vermicompost contains most of the plant nutrients such as nitrate, phosphates, exchangeable calcium and soluble potassium, and microelements which result in improved plant growth and development and is responsible for increased qualitative and quantitative yield of many crops.

Conclusion

The results of current experiment showed that vermicompost and nitrogen fixing bacteria have stimulatory effects on the yield, essential oil and mineral elements (N, P and K) uptake by summer Savory and have thus considerable potential for providing nutritional elements in Savory production, especially for the sustainable production systems.

Keywords: Biofertilizer, Nitroxine, Summer Savory, Supernitroplus

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