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A Study and Evaluation in organic Fertilizers' Effects on Seed Yield and Some Main Agricultural Characteristics on Cumin plant Ardabil Region Conditions

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ABSTRACT

To study the effects of organic fertilizers' of compost and vermicompost on seed yield and some main agricultural characteristics in Cumin plant in Ardabil region conditions, a research was conducted in the form of complete randomized blocks design in three replications at Ardabil IAU Research Station, in 2010, which included three treatments of control, compost and vermicompost. Data ANOVA results suggested that there is an organic fertilizers' effect on all traits at 1percent. Mean comparison indicated that seed yield, plant height, seed weight, biological yield and harvest index had the highest values in compost bio-fertilizer treatment while the lowest values were related to the control treatment.

Keywords: Cumin plant, compost, vermicompost, seed yield

INTRODUCTION

Cumin plant (*Cuminum cyminum*) is among the oldest crops in south Mediterranean Sea, parts of Africa and the Middle East. There are records of planting this plant in pre-Islamic era in translations of books from Sassanid era, in ancient Iran. Cumin plant is among the main exports and has the second position after saffron, economically. The plant has a 2.5 - 4 percent essence. It is also one of medicinal plants which are cited in both ancient and modern sources in various eras. This plant is compatible with various environmental conditions. Some other specifications such as planting and harvesting dates, low water and fertilizer consumption, lack of compatibility with other crops planting and harvesting time, high economic value and high investment in this crop indicates the importance of planting this plant in crop rotation [1]. The main part of this plant is the fruit which includes oil (7%), resin (13%), and essence (2.5-4%). Its sticky essence is produced from distillation of pounded fruits and has a transparent to yellowish color [2]. Its yield in irrigated agriculture is highly variable within the range of 243 to 873 kg per hectare. The average water yield for each hectare is reported to be 558kg and the essence percentage in this plant is between 2.3-5.7 percent [3]. Organic agriculture is an integrated system of agriculture based on ecological principles [4]. Chemical fertilizers, pesticides and growth regulators are not applied in this system and crop rotation with legume family of plants, plant debris, manure, rocks containing mineral nutrients, organic fertilizers and biological pest control are applied, instead, so that along with biodiversity development in farms, [4,5] the nutrients in the soil are deposited, the soil fertility is increased and weeds, insects and pests are controlled [6]. Compost and organic fertilizers are applied for improving soil fertility and also prevention and control of plant pests and diseases, in many agricultural systems [7,8].

Due to their high porosity, high mineral absorption and retention, gradual release, and high water-retention capacity, vermicompost is among other organics which are commonly applied in sustainable agriculture to improve crop and horticultural products quality [9,10].

MATERIALS AND METHODS

This experiment was conducted on research farm of Islamic Azad University of Ardabil in 2010 (Ardabil West 5 km). The climate is semi-arid and cold, winter temperatures were often sub-zero. Altitude was 1350 meters and latitude and longitude were 38.15 norths and 48.2 east, respectively. Average annual minimum and maximum temperature and maximum absolute temperature were -1.98, 15.18 and 21.8 ° C, respectively, and mean annual precipitation have been reported 310.9 mm. The experiment soil was clay *alluvial* soils; its acidity varies between 8.2-7.8.

The research was conducted in randomized complete block design with 3 replications including control, compost and vermicompost treatments. In fall, after agricultural operations, a land with a width of 5.5 m and a length of 7 m was prepared for planting Cumin plant. Blocks width was 1.5 m and the length was 2 m. Also, there was a half meter distance between each block and replications. There was a 30 cm distance between planting rows and they were planted linearly in 5 rows in each plot. Compost and vermicompost fertilizers were applied in rows near to the seeds. During crop ripening, 10 bushes were harvested randomly from each experimental unit effective level and bush height and seed weights were calculated. Subsequently, all seeds were harvested; straws and grains were collected in paper pockets and put in oven of 70 °C for 24 hours so they are dried. Afterwards, dry weight and biological yield per unit was calculated. By omitting the two sides rows and the half meter of the margin from the beginning and end of each planting row, 1 meter from each plot from middle rows were planted. After determining the biologic and economic yields, the harvesting indices for each of experimental units were calculated from the following equation:

$$\text{Equation: Index harvest} = \text{Economic Yield (gr/m}^2\text{)} / \text{Biologic Yield (gr/m}^2\text{)} \times 100$$

The statistical calculations and mean comparisons were carried out by SPSS software. Multi-range Duncan test was used to compare the means, at 5%.

RESULTS AND DISCUSSION

Considering variance analysis results table (Table 1), it was observed that there is a significant difference between seed yields at 1 percent. Data mean comparison table suggests that among bio-fertilizer treatments, compost had the highest seed yield and the lowest yield was on control treatment (Table 2). Also, in organic planting of basil, compost increased the qualitative and quantitative yield [11].

Results to the variance analysis (Table 1) indicates that there is a significant difference between treatments on plant height at 1 percent, so that, data mean comparison (Table 2) suggests that compost bio-fertilizer had the highest height and the lowest height were related to the control treatment. There was no difference between control and vermicompost treatments. Yadaw et al. (2003) reported increase in ovata medicinal plant growth using manure [12]. Also, Norman and Trancon (2006) reported increase in strawberries vegetative growth and plant height due to the manure application [13].

Table 1 suggests that there is a significant difference between treatments on seeds weight at 1 percent. Data mean comparison between the three treatments indicates a difference so that the highest values are related to compost treatment and the lowest is related to control treatment. In a research, Sa'idnejad and Rezvani Moghaddam (2010) reported that compost had the highest seeds weight and after vermicompost treatment, sheep manure and cow manure had the highest seeds weight [3].

Results suggest that there was a significant difference between the fertilizer treatment biologic yields at 1 percent (Table 1). Data mean comparison indicated the highest values were related to compost and vermicompost, respectively and control treatment had the lowest value (Table 2). Rezvani Moghaddam et al., (2007) reported an increase in produced biomass amount according to organic fertilizers in yarrow [3].

Variance analysis results (Table 1) indicates that there is a significant difference between treatments harvesting index at 1 percent. Data mean comparison results shows that there is no difference between compost and vermicompost and the lowest values on harvesting index was related to control treatment (Table 2).

Table 1 -Analysis of variance for the evaluated traits at organic fertilizers

S.O.V	DF	Seed weight	Plant height	Seed yield	Biological yield	Harvest Index
Block	2	0.008*	1.77 ^{ns}	10.11**	11.13 ^{ns}	0.011 ^{ns}
Treatments	2	0.62**	25.44**	188.77**	360/11**	0.003**
Error	4	0.001	1.27	0.44	4.94	0.001
CV		1.32	4.75	1.4	2.32	6.08

ns: non- significant *and , ** : significant at the 5% and 1% levels of probability, respectively

Table 2- Comparison of Means of the traits at organic fertilizers

Treatments	Biological yield(gr/m ²)	Seed weight(gr)	Plant height (cm)	Seed yield (gr/m ²)	Harvest Index
Control	83.67a	2.03a	21.33a	36.67a	0.43a
Vermicompost	97.33b	2.24b	23a	46.47b	0.47b
Compost	105.33c	2.90c	27b	52.33c	0.49b

Means with the same letters in each column are not significantly different

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