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The Effect of Solopotasse Fertilizer on Yield and Essential Oil of Cumin (*Cuminum Cyminum* L.)

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ABSTRACT

Objective: In order to study the effect of solopotasse fertilizer on yield and essential oil of cumin medicinal plant. **Methods:** A experiment in randomized complete block design with three replications conducted in kermam city, Iran, in 2013. solopotasse fertilizer in four levels (0, 50, 100 and 150 kg/h) investigated. Plant height, number of umbrella per plant, number of seed per umbrella, 1000 seed weight and essential oil percentage were measured. **Results:** Effect of solopotasse fertilizer on plant height, number of umbrella per plant, number of seed per umbrella and 1000 seed weight was significant ($p < 0.01$). The highest evaluation on the plant height, number of seed per umbrella and 1000 seed weight was obtained in the application of 150 kg/h solopotasse fertilizer with averages of 30.51cm, 19.32 and 2.38g. Increasing concentrations of solopotasse fertilizer, resulted in increased evaluations on the plant height, number of seed per umbrella and 1000 seed weight. The highest evaluation on the essential oil percentage was obtained in the application of 0, 150, 50 and 100 kg/h solopotasse fertilizer with averages of 2.05, 2.03, 2.02 and 2.01%. solopotasse fertilizer had significant ($P < 0.01$) positive effects on plant height, number of seed per umbrella and 1000 seed weight compared with control treatment.

1. INTRODUCTION

Medicinal plants are used to cure many ailments that are either non-curable or seldomly cured through modern systems of medicine. Approximately 80% of the world population depends on medicinal plants for their health and healing [Aliyu, 2003]. Societal motivations to use herbs are increasing due to concern about the side effects of synthetic drugs. Many botanicals and some dietary supplements are good sources of antioxidants and anti-inflammatory compounds [Balasubramanian and Palaniappan, 2001]. Quality in medicinal plants is more

important than other plant products. Environmental factors have an important role on plant growth. Some of these factors such as irrigation and manure can be controlled by human. Both of them are essential to increase yield and quality of plants (Singh and Goswami, 2000). Water deficit is the major limiting factor in agricultural production (Aminpoor and Musavi, 1995). Drought stress may change the mineral elements absorption from soil (El-Fouly, 1983). Therefore, we can control accessibility of water and minerals in roots medium in order to increase the quality of medicinal plants produced in these soils. Usage of manure is more

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important and beneficial than chemical fertilizers (Loecke, 2004). Chemical fertilizers just provide one or some essential elements for plants, while organic fertilizer provides more micro and macro nutrients (Saboor bilandi 2004). Furthermore, it can be improved by the physiochemical property of soil and yield quality (Loecke, 2004). Essential oil in medicinal plants is affected by some nutritional elements (Shaath and Azzo, 1993). Therefore, using manure could be a reliable method for growing medicinal plants. Cumin (*Cuminum cyminum* L.) is a member of Umbelliferae and annual a plant which is widely cultivated in arid and semi-arid regions (Tuncturk and Tuncturk, 2006). Iran is one of the main producers of this plant (Kafi, 2002). Plant essential oils have many applications such as changing the smell of some medicines, equipping the product antiseptic associated with the mouth, sterilization of surgical operation fiber, product of some veterinary and agricultural medicine, industry perfumery, coloring, soap, detergent and plastic (Yilmaz and Arslan, 1991). Leaf shape, short leaves, color and surface cover of plant parts are representative adaptation of cumin to drought conditions (Kizil et al,

2003). Furthermore, the plant is relatively salt resistant and has no much needs of soil fertility (El-Fouly, 1983). Therefore, the main objective of the present field experiment was to investigate the effects of solopotasse fertilizer on quantity and quality of essential oil of cumin (*Cuminum cyminum* L.).

2. MATERIALS AND METHODS

In order to study the effect of solopotasse fertilizer on yield and essential oil of cumin medicinal plant, a experiment in randomized complete block design with three replications conducted in kermam city, Iran, in 2013. Solopotasse fertilizer in four levels (0, 50, 100 and 150 kg/h) investigated. Plant height, number of umbrella per plant, number of seed per umbrella, 1000 seed weight and essential oil percentage were measured. The control was conducted as cut terraces, in terms of complete random blocks in three replications in kerman Province, 2013 year. Results from the chemical analysis of soil showed that the soil had electric conduction of the saturation EC =1.9 and PH=7.4. The physical and chemical properties of farm soil are presented in Table 1.

Table 1.

The chemical properties of farm soil in depth 0-30 cm

Anions (meq/l)						Cations (meq/l)					
PH	EC	Co	Hco ³⁻	Cl	So	Mg	Ca	K	Na	Fe	Mn
7.6	4.1	-	9.4	7.35	34	4.13	4.11	-	64	067.0	012.0

3. RESULTS AND DISCUSSION

Effect of solopotasse fertilizer on plant height was significant ($p < 0.01$) (Table 1). In view of the results shown on Table (2), the highest evaluation on the Plant height was recorded in the application of 150, 100, 50 and 0 kg/h solopotasse fertilizer with averages of 30.51, 29.11, 26.31 and 22.81 cm. Increasing concentrations of solopotasse fertilizer, resulted in increased evaluations on the Plant height. These results were documented by many researches done in this field e.g. Mahfouz and Sharaf-Eldin (2007) on *Foeniculum vulgare* and Abbas and Ali (2011) on *Hibiscus sabdariffa*.

The increase in plant height due to NPK treatments could be due to the role of nitrogen in nucleic acids and protein synthesis, and phosphorus as an essential component of the energy compounds (ATP and ADP) and phosphoprotein in addition to the role of potassium as an activator of many enzymes (Helgi and Rolf, 2005).

Table 2.

Analysis of variance for the effects of Solopotasse Fertilizer on Quantity and Quality of Essential Oil of Cumin (*Cuminum cyminum* L.).

SOV	df	Plant height	Number of umbrella per plant	Number of seed per umbrella	1000 seed weight	Essential oil percentage
Replication	2	17.68	52.72	11.95	0.25	0.086
solopotasse fertilizer	3	123.60**	1.81**	502**	0.056 ^{ns}	0.017**
Error	6	0.58	1.06	0.62	0.01	0.006

^{ns} Non Significant at 0.05 probability level and *, ** Significant at 0.05 and 0.01 probability levels, respectively.

Table 3.

Effect of Concentration of Solopotasse Fertilizer on Quantity and Quality of Essential Oil of Cumin (*Cuminum cyminum* L.).

solopotasse fertilizer	Plant height (cm)	number of umbrella per plant	number of seed per umbrella	1000 seed weight (g)	Essential oil percentage
0	22/81b	22/31c	18/24b	2/15b	2/05a
50	26/31c	21/41b	19/23a	2/29ab	2/02a
100	29/11b	22/05b	19/28a	2/35a	2/01a
150	30/51a	22/21a	19/32a	2/38a	2/03a

*Means separated by Duncans multiple ranges test at the P< 0.05 level

Effect of solopotasse fertilizer on number of umbrella per plant was significant ($p < 0.01$) (Table 1). In view of the results shown on Table (2), the highest evaluation on the number of umbrella per plant was recorded in the application of 0, 150, 100 and 50 kg/h solopotasse fertilizer with averages of 22.31, 22.21, 22.05 and 21.41. Similar results were reported by Babatunde *et al.* (2002) and Abdel hamid *et al.*, (2011) they reported that application of K alone or in combination with humic substances improved plant growth and weights on cow pea and cumin plants respectively. The positive effect of K fertilizers in the fresh and dry weights of cumin plants may be due to the overall promotion effect on general metabolic activities and photosynthesis (Abbas and Ali, 2011).

Effect of solopotasse fertilizer on number of seed per umbrella was significant ($p < 0.01$) (Table 1). In view of

the results shown on Table (2), the highest evaluation on the number of seed per umbrella was recorded in the application of 150, 100, 50 and 0 kg/h solopotasse fertilizer with averages of 19.32, 19.28, 19.23 and 18.24. Increasing concentrations of solopotasse fertilizer, resulted in increased evaluations on the number of seed per umbrella. Similar effects of fertilizers on yield weights were reported by several investigators such as Saboor (2004), Tuncturk and Tuncturk (2006), Said-Al Ahl *et al.* (2009) and Ahmadian *et al.* (2011). Such increase may be due to the good performance and growth of plants under this treatment. Effect of solopotasse fertilizer on 1000 seed weight was or non significant (Table 1). In view of the results shown on Table (2), the highest evaluation on the 1000 seed weight was recorded in the application of 150, 100, 50 and 0 kg/h solopotasse fertilizer with averages of 2.38, 2.35, 2.29 and 2.15g. Increasing concentrations of solopotasse

fertilizer, resulted in increased evaluations on the 1000 seed weight. These findings are in accordance with the observations by Tehlan et al., [2004] on *Foeniculum vulgare*, Migahed et al., [2004] on *Apium graveolens*, Shaalan [2005] on *Nigella sativa* and Darzi et al., [2001] on *Coriandrum sativum*.

Effect of solopotasse fertilizer on essential oil percentage was significant ($p < 0.01$) (Table 1). In view of the results shown on Table (2), the highest evaluation on the Essential oil percentage was recorded in the application of 0, 150, 50 and 100 kg/h solopotasse fertilizer with averages of 2.05, 2.03, 2.02 and 2.01%. Plant ecotype differences in regional environmental, soil, and climatic conditions, growing techniques, irrigation, as well as fertilization affected the content and composition of secondary metabolites in medicinal and aromatic plants. There are studies that support the notion that nitrogen fertilization affects content and composition of secondary metabolites in medicinal plants [Ashraf et al., 2006; Tehlan et al., 2004].

CONCLUSION

Application of solopotasse fertilizer has effect on the yield and yield components. It also appears that solopotasse fertilizer application led to achieve the best yield and quality of cumin.

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