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Effect of Non-chemical Procedures of Weed Management on Growth Characteristics and Yield of Cumin (*Cuminnum cyminum* L.)

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Introduction

Medicinal and aromatic plants are major crops of domestic and industrial interest. The essential oil yield, seed yield and biomass of medicinal and aromatic plants are seriously affected by interspecific competition, meaning proper weed management becomes crucial. Competition with weeds is detrimental for medicinal and aromatic plants production for two main reasons. The first reason is that, in acting as an important stress factor, the interference of weeds is supposed to generate variations in photosynthesis rate and direction, pushing plants to allocate more carbon to roots (competition for nutrients or water) or shoots (competition for light). These plants are increasingly organically grown to improve profitability. However, the presence of weeds may lead to a decline in both yield and quality. Therefore, nonchemical methods of weed management are needed. More attention has been paid worldwide about the technical means for weeding, generally addressed to a removal of weeds as complete as possible, and sometimes to the effects of weeds on medicinal and aromatic plants yields and quality.Cumin (*Cuminum cyminum* L.) is an herbaceous and annual plant belonging to Apiaceae family which is planted in arid and semi-arid regions of Iran as medicinal plant. About 26% of the total area under cultivation of medicinal plants in Iran is allocated to cumin cultivation. This paper studied the methods of non-chemical weed control on yield components and quantitative and qualitative yield of cumin.

Materials and Methods

In order to study weed management methods, an experiment was conducted based on a randomized complete block design with nine treatments and three replications at the Agricultural Research Station, Ferdowsi University of Mashhad during growing season 2012-2013. Treatments included tillage at night, false seed bed, three cover crops such as hairy vetch, chuckling vetch and fenugreek, crop residues of sunflower, barley and garlic and weed infested control. Operation of tillage at night performed with moon light. Seed bed prepared, irrigated and weed removed at 28th February by using surface cultivation for false seed bed treatment. Cover crops removed and added to the soil at 5th March. After land preparation, 2.5 t.ha^{-1} crop residues of each species added to the soil. Cover crops planted as dense at 5th November then all plots irrigated and then seeding operation was done. Plant height, yield components, biological yield, seed yield, essential oil content and essential oil yield of cumin were measured accordingly. The treatments were run as an analysis of variance (ANOVA) to determine if significant differences existed among treatments means. Multiple comparison tests were conducted for significant effects using the LSD test.

Results and Discussion

The results showed that the growth characteristics, yield components, biological yield, seed yield and essential oil yield of cumin were significantly affected by non-chemical management procedures ($p\leq0.01$). The maximum biological and seed yield were observed in hairy vetch with 220.7 and 103.1 g. m^{-2} and these minimum were for control with 72.4 and 28.6 g. m^{-2}, respectively. These traits enhanced more than 100% for all management treatments compared to control. The highest essential oil yield of cumin was recorded in hairy vetch (2.8 g. m^{-2}) and the lowest was for control (0.6 g.m^{-2}).

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Conclusion

Non-chemical weed management strategies had significantly effect on plant height, yield components and yield of cumin. Cover crops and crop residues enhanced cumin yield due to physical and chemical soil characteristics, moisture conservation and cell swelling improvement that they increased growth and production of photosynthetic matters. Generally, cover crop is a safe and effective technique for weed control that may decrease the necessity for chemical approaches to crop and soil.

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Keywords: Allelopathy, Cover crop, Crop residue, Photocontrol of weed, Tillage at night