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The investigation of the effect of planting date on agronomic characteristics Cumin (*Cuminum cyminum* L.) ecotypes in sistan conditions

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ABSTRACT: One of the medicinal plants which can be placed in the cultivation pattern of dry and semi-dry zones under water shortage conditions is cumin. Cumin with scientific name *Cuminum cyminum* is an annual plant of Umbelliferae. Since environmental factors explicitly influence growth and development and yield of medicinal herbs, studying the effect of these factors, e.g. sowing date and plant density, on medicinal herbs is crucially important. Planting date management not only has a large effect on crop growth, development, and yield but it also impacts insect pest management. These research investigations were planned in agricultural research center of Zahak located in eastern part of Zabol in 2011-2012. The investigation was consisted of date of planting as the main factor in five levels (Nov.15th,Dec. 5th, Dec. 25th, Jan. 15th,Feb. 5h) and different ecotypes of cumin as the subordinate factor in three levels (Zabol, Birjand, Kerman). Analysis of variance showed that the effect of planting date on all characteristics was significant.

Key words: Plant height, Harvest Index, Seed yield, Biological yield

INTRODUCTION

Cumin (*Cuminum cyminum* L.), a member of Apiaceae, is an annual plant which is originated from Egypt and East Mediterranean. But it is widely cultivated in Iran, Japan, China and Turkey. At the present, Iran is an important cumin exporter in the world market and cumin production of Iran is approximately 20- 40% of world market (Kafi, M. 2003). One of the medicinal plants which can be placed in the cultivation pattern of dry and semi-dry zones under water shortage conditions is cumin. Cumin with scientific name *Cuminum cyminum* is an annual plant of Umbelliferae. Shape of leaves, plantes, color, and cover of plant organs all indicate the adaptability of the plants to dry conditions. The depth of root of the plant is between 12 and 15cm showing that the water required for the plant growth is not provided from the soil depth rather the main part of it is supplied from the shallow soil alternatively got wetted by the light precipitations (Kafi, 2002). Cumin has a long history of use as food flavors, perfumes and medicinal values. Essential oil has been used for bring smell to some medicines, for sterilizing of surgical operation fiber, for producing of some veterinary and agricultural medicines and plastic. Cumin has a long history of use as food flavours, perfumes and medicine. Its essential oil is used for bactericidal applications, giving smell to some medicines, sterilizing of surgical operation fiber and producing some veterinary and agricultural medicines (Bakkali, 2008; Simon, 1984). The seeds of cumin have an aromatic odor and bitter taste. They are used as an essential ingredient in soup, sausages, cheese, cakes and candies (Behera, 2004). Cumin is one of the most monetary valuable herbs for the export in second rank after saffron in arid and semi -arid country that is grown (Ehtramyan *et al.*, 2007). Cumin on traditional medicine and modern is used for the treatment for diarrhea, indigestion, fever, sore mouth and throat antiseptic, carminative, reduced nausea in pregnant women, to relieve hiccups, relieve muscle tension, stimulation in the secretion of milk in women, strengthen the heart muscles and uterine. About 85 to 90 percent of our production of cumin is related to the Khorasan province (Mazandary, 2004). Since environmental factors explicitly influence growth and development and yield of medicinal herbs (Omidbeigi, 1997), studying the effect of these factors, e.g. sowing date and plant density, on medicinal herbs is crucially important. Planting date management not only has a large effect on crop growth, development, and yield but it also impacts insect pest management (Brown et al. 1992, 1993, 1994, 1995, 1996, 1997, and 1998). Reduced season management, of which early planting plays a major role, has become increasingly important in recent years. The ability to plant and establish a crop early, carry it through the primary fruiting cycle in a timely and efficient manner, followed by early termination; has become increasingly important with increased late-season insect pressures in Arizona.

This approach to earliness management has also been important in terms of avoiding inclement weather conditions commonly associated with the summer monsoon season, which creates higher humidity (higher dew point temperatures) and higher night temperatures, resulting in accelerated rates of fruit loss and abortion (Brown and Zeiher, 1997). Bhadkariya *et al.* (2007) studied the planting dates of October 25, November 5, November 25 and December 5 and Pan et al. (2003) studied the planting dates of November 5, November 20 and December 5 on coriander and November 5, November 25 and December 5 concluded that the highest plant height and branch number per main stem was obtained under the treatment of sowing date of November 5. In study of the effects of planting dat, Rassam *et al.* (2007) found that with the delay in sowing from March 30 to April 29, plant height of coriander decreased, significantly. Tonce *et al.* (1998) reported that the highest essential oil percent (0.34%) belonged to sowing date of November 15 while in a study on four sowing dates of coriander include October 1, October 16, November 1, November 16, and December 1, Maurya (1990) reported that the sowing date of October 1 had the highest essential oil percent. Nonetheless, this researcher stated that the highest essential oil yield (10.27 l/ha) obtained in the sowing date of October 1 treatment. Date of planting plays an important role in regulating growth and quality of gladiolus (Khan *et al.* 2008.). Vegetative growth and quality of gladiolus is improved by proper planting times which also satisfies the consumer's demands (Zubair *et al.* 2006). Planting schedule vary because of differences in photoperiods, temperatures and light intensity (Susan *et al.* 1991). Talia and Traversa (1986) mentioned that better size gladiolus corms were obtained from February and March plantings. Maximum spikes per plant were obtained from April to May plantings while highest number of corms per plant in tuberose was obtained from March and April plantings (Mukhopadhyay and Banker, 1981). Zahtab Salmasi *et al.* (2003) studied the effect of three sowing date (March-May) on *Pimpinella anisum* and concluded that delayed sowing decreased plant height and fruit yield. In a study on the effect of plant density on coriander, Kumar (2007) stated that density of 25 plants m-2 had the highest plant height while the highest branch number per main stem was belonged to density of 10 plants m^{-2} treatment. Also, the study of Khorshidi *et al.* (2009) showed that with increase in inter-plants space significantly increased branch number per main stem. Sadeghi *et al.*, (2009) reported that maximum of caraway biomass obtained in the first planting date (3March). In the present study, the highest dry matter yield was achieved on the last planting date (2 January) and application of 60 kg of nitrogen fertilizer.

MATERIAL AND METHODS

Location of experiment. These research investigations were planned in agricultural research center of Zahak located in eastern part of Zabol in 2011-2012, which is situated between 30° North latitude and 61° East longitude.

Composite soil sampling. Composite soil sampling was made in the experimental area before the imposition of treatments and was analyzed for physical and chemical characteristics.

Field experiment. The field experiment was laid out split plot with factorial design with three replications.

Treatments. The investigation was consisted of date of planting as the main factor in five levels (Nov. 15th, Dec. 5th, Dec. 25th, Jan.15th, Feb.5h) and different ecotypes of cumin as the subordinate factor in three levels (Zabol, Birjand, Kerman).

Data collect. Data collected were subjected to statistical analysis by using a computer program MSTATC. Least Significant Difference test (LSD) at 5 % probability level was applied to compare the differences among treatments` means.

RESULTS AND DISCUSSION

A. Plant height

Analysis of variance showed that the effect of planting date on plant height was significant (Table 1). The maximum of Plant height of treatments Nov15th was obtained (Table 2). The minimum of Plant height of treatments Feb5h was obtained (Table 2). Analysis of variance showed that the effect of ecotypes on Plant height was not significant (Table 1). The maximum of Plant height of treatments Birjand ecotype was obtained (Table 2). The minimum of Plant height of treatments Kerman ecotype was obtained (Table 2).Morin and Dormency (1993) and Imhotep and Carte (1987) reported that delay of sowing caused a decline in plant height which are agreement with results of this study. Pan et al. (2003) studied the planting dates of November 5, November 20 and December 5 on coriander and November 5, November 25 and December 5 concluded that the highest plant height and branch number per main stem was obtained under the treatment of sowing date of November 5. In study of the effects of planting date, Rassam *et al.* (2007) found that with the delay in sowing from March 30 to April 29, plant height of coriander decreased, significantly.

B. Harvest Index

Analysis of variance showed that the effect of planting date on harvest index was significant (Table 1). The maximum of harvest index of treatments Nov15th was obtained (Table 2). The minimum of harvest index of treatments Feb5h was obtained (Table 2). Analysis of variance showed that the effect of ecotypes on harvest index was not significant (Table 1).

The maximum of harvest index of treatments Zabol ecotype was obtained (Table 2). The minimum of harvest index of treatments Birjand ecotype was obtained (Table 2).Date of planting plays an important role in regulating growth and quality of gladiolus (Khan *et al.* 2008.). The effect of planting dates (April and May) concluded on *Pimpinella anisum*, seed yield, harvest index, and finally reduced with delay in planting (Gupta, 1982).

Table 1: Anova analysis of the cumin affected by planting date and ecotypes.

S.O.V	df	Plant height	Harvest Index	Seed yield	Biological yield	Number of seeds in umbrella
R	2	8.165^{ns}	69.436^{*}	17856.200^{ns}	12218.422^{ns}	7.489^{ns}
planting date	4	795.937^{**}	88.100^{**}	271866.778^{**}	229817.189^{**}	126.144^{**}
Error a	8	11.766	12.941	4578.061	3466.756	2.211
ecotypes	2	3.336^{ns}	4.163^{ns}	1722.200^{ns}	598.422^{ns}	0.356^{ns}
Ecotypes * planting date	8	1.823^{ns}	3.956^{ns}	1222.311^{ns}	235.006^{ns}	0.828^{ns}
Error b	20	2.726	1.686	1016.456	610.256	0.567
CV (%)	-	18.5	4.33	4.20	2.06	5.72

*, **, ns: significant at $p<0.05$ and $p<0.01$ and non-significant, respectively.

C. Seed yield

Analysis of variance showed that the effect of planting date on seed yield was significant (Table 1). The maximum of seed yield of treatments Nov15th was obtained (Table 2). The minimum of seed yield of treatments Feb5h was obtained (Table 2).

Analysis of variance showed that the effect of ecotypes on seed yield was not significant (Table 1). The maximum of seed yield of treatments Zabol ecotype was obtained (Table 2). The minimum of seed yield of treatments Birjand ecotype was obtained (Table 2).The effect of planting dates (April and May) concluded on Pimpinellaanisum, seed yield, harvest index, and finally reduced with delay in planting (Gupta, 1982). Research conducted on autumn sowing some plants such as Ammi showed that production and operation of these plants is often more than the spring crops (borumand, 2008).

D. Biological yield

Analysis of variance showed that the effect of planting date on biological yield was significant (Table 1). The maximum of biological yield of treatments Nov15th was obtained (Table 2). The minimum of biological yield of treatments Feb5h was obtained (Table 2). Analysis of variance showed that the effect of ecotypes on biological yield was not significant (Table 1). The maximum of biological yield of treatments Zabol ecotype was obtained (Table 2). The minimum of biological yield of treatments Kerman ecotype was obtained (Table 2).Delayed sowing also significantly reduced biological yield (Kumar and Sharma,2003).High temperature and desiccating winds during the month of April might caused forced maturity of late sown wheat, thus resulting in reduction of biological yield (Singh and Dhaliwal,2000).

E. Number of seeds in umbrella

Analysis of variance showed that the effect of planting date on number of seeds in umbrella was significant (Table 1). The maximum of number of seeds in umbrella of treatments Nov15th was obtained (Table 2). The minimum of number of seeds in umbrella of treatments Feb. 5h was obtained (Table 2). Analysis of variance showed that the effect of ecotypes on number of seeds in umbrella was not significant (Table 1). The maximum of number of seeds in umbrella of treatments Zabol ecotype was obtained (Table 2). The minimum of number of seeds in umbrella of treatments Kerman ecotype was obtained (Table 2).

Date of planting plays an important role in regulating growth and quality of gladiolus (Khan et al. 2008.). Vegetative growth and quality of gladiolus is improved by proper planting times which also satisfies the consumer's demands (Zubair *et al.* 2006).

Table 2: Comparison of different traits affected by planting date and ecotypes.

Treatment	Plant height	Harvest Index	Seed yield	Biological yield	Number of seeds in umbrella
planting date					
Nov15th	44.767a	32.716a	959.556a	1408.333a	18.444a
Dec5th	37.344b	33.429a	913.667a	1314.333b	15.000b
Dec25th	29.844c	29.840 ab	723.444b	1163.667c	12.556c
Jan15th	26.989c	27.518 b	641.889c	1107.333c	11.111c
Feb5h	20.489d	26.279b	554.778d	1010.889d	8.667d
ecotypes					
Zabol ecotype	31.767a	30.502a	770.400a	1199.733a	13.333a
Birjand ecotype	32.407a	29.451a	749.400a	1207.733a	13.067a
Kerman ecotype	31.487a	29.916a	756.200a	1195.267a	13.067a

Any two means not sharing a common letter differ significantly from each other at 5% probability

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