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Effect of Planting Date and Plant Density on Yield and Yield Components of Green Cumin (*Cuminum cyminum* L.)

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Abstract: In order to evaluate the effect of sowing date and plant density on yield and yield components of green cumin (*Cuminum cyminum* L.) a factorial arrangement of a randomized complete block design with three replications in Kerman (Iran) was conducted. First factor was planting date in four levels (4, 19 February and 6, 20 March) and second factor was plant density in three levels (44,96 and 148 plants m^2). The results showed that effect of planting date, plant density and their interaction on seed yield and biological yield were significant ($p>0.01$). Also straw yield significantly affected by sowing date and plant density. The highest seed yield obtained from the first planting date and third density (148 plant m^2). All of yield components, except 1000-seed weight significantly affected by sowing date and plant density. Sowing date just had significant effect on 1000-seed weight.

Key words: Planting Date · Plant density · Green cumin · Yield components

INTRODUCTION

Green cumin (*Cuminum cyminum* L.) is an annual and delicate plant and is a member of the Apiaceae family [1]. Seed and straw of green cumin are used in medicine, food and also in making perfume and soap [2]. Ovary of green cumin is bicarpella which produces a schizocarp biachene fruit that contains two mericarps [3]. Seeds of green cumin are used for induction of appetite, improvement of amoeba diarrhea (amebiasis) [2], increase of milk in cattle industries or mothers who are in lactating period [4], it is also used for improvement of inflation and edema of paunch [2]. In semiarid areas such as Iran in which water is a restrictive factor for farming, because of low water requirement, cultivation of cumin can be suitable. Yield components of green cumin include the number of plant per area unit, the number of umbel per plant, the number of seed per umbel and 1000-seed weight [5]. Yield loss due to undesirable planting date and plant density has been reported in many crops. Rasam *et al*. [6] reported that delaying in planting date caused significant reduction in number of umbel per plant, number of umbelet per umbel, number of seed per umbelet, seed yield, plant height and biological yield in Anise and as density increased, seed yield, biological yield, plant height and 1000-seed weight were increased. Sadeghi *et al*. [7] evaluated effect of planting date and plant density on yield and yield components of black cumin under dry farming and reported that earlier sowing date was followed by higher seed yield. They also reported that 1000-seed weight and harvest index were not affected by planting date and plant density. Yadwar and Dahama [8] reported that seed yield of green cumin in 15th November was significantly higher than that in 30th November.

MATERIALS AND METHODS

The experiment was conducted in 2008-2009 at Research field of Agricultural investigations center of Kerman (Iran) (latitude 31° 7 N, longitude 57° 14 E) and 1749 m altitude. Minimum and Maximum temperature in this region were -24°C and 40°C respectively. Range of precipitation was between 175-200 mm. The soil texture at the experimental area was sand-loam.

Design Characteristics and Cultural Practices: The experiment was conducted as a factorial arrangement of randomized complete block design with three replications. Four planting dates (4, 19 February and 6, 20 March) and

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three plant densities (44, 96 and 148 plants m^2) were applied. The field was divided to 36 plot. On the other hand 12 treatments at three replications. Each plot was 3m×4m. Per $1m^2$ was divided to 4 planting lines and row spacing was 20 cm. In order to arrange the first (44 plant m^2), the second (96 plant m^2) and third (148 plant m^2) densities, spaces on the rows were 7, 4 and 2.6 cm respectively. Before planting, the seeds was leached in water for 48 hours and then seed treatment was conducted by Benomyl solution (1/1000 lit) for 1 hours. Plants was thinned at 3-4 leaves stage, in order to achieving of mentioned densities. The measured traits include seed yield, biological yield, straw yield, harvest index, 1000-seed weight, the number of umbel per plant, the number of umbelet per plant and the number of seed per umbel.

Plant Determinations and Statistical Analysis: In order to determinate the yield and other characters, a number of plant samples were taken by 1 m^2 quadrate [9]. Up to 50 cm primer and edge lines were discarded. In order to measure the seed yield and total dry matter, plants after cutting dried on oven at 70°C, 48 hours. Then was weighed. 5 plants randomly were selected in each plot to measure the number of umbel per plant, the number of umbelet and number of seed per plant. Harvest index was computed as the ratio of the seed yield to above ground dry matter. Analyses of variance was used to determine significant differences. The Multiple Range Test of Duncan performed the separation of means when the *F*-test revealed the error probability to justify the difference minor. Correlation coefficients were calculated for the relationship between seed yield and several crop parameters. All statistics were performed with the program SAS and SPSS.

RESULTS AND DISCUSSION

Effect of planting date, plant density and their interaction on number of umbel per plant, number of seed in umbel and number of umbelet per umbel were significant (Table 2). Mean comparisons (Table 3) showed that the most number of umbel, umbelet and seed in umbel obtained from the first planting date and number of them was decreased by delaying in planting date. Results showed that there was a positive and significant correlation between seed yield and yield components. This decrease can be due to in later planting dates increase in temperature during growth period and long days cause that plants immediately response to photoperiod, therefore these lead to shorter vegetative growth period, reduction of leaf area and photosynthetic areas and finally cause to decrease production of reproductive organs such as number of umbel, umbelet and seed. These results were comparable with findings of Sadeghi *et al*. [7] on black cumin, Ghorbani *et al*. [10] and Mirshekari [11] on green cumin. Also mean comparisons [12] showed that as density increases, number of umbel and umbelet per plant and seed in umbel will be decreased. Most number of umbel and umbelet per plant and seed in umbel was obtained from the first level of density (44 plant m^2). The reduction in number of umbel, umbelet and seed per umbel, as increase density per area unit (m^2) can be due to in high densities compare to lower densities, plant would have less space and possibilities. This problem causes interplant competition to increase and so that cause yield components to decrease. On the other hand, number of seed per umbel is dependent on plant density in m^2 and number of umbel per plant and also is relative to environmental conditions of pollination period in primary stages of seed formation. Regulation of seed number depends on supplying adequate nutrition and environmental conditions in a stage that plant enters to reproductive phase from vegetative phase and subsequent stage. These results are consistent with finding of Share [13] and Kafi [12] on green cumin. Evaluation of interaction between two factors showed that the highest number of umbel and umbelet per plant and seed per umbel was obtained from planted treatment in the first date with 44 plant in m^2. The lowest number was related to the fourth date and 148 plants in m^2. Results of analysis of variance showed that 1000-seed weight significantly was affected by planting date (Table 3). Mean comparisons (Table 4) showed that delaying in sowing date of green cumin decreased the 1000-seed weight. The highest 1000-seed weight was observed in the first planting date. These finding are comparable with results of Rahimian [14], Mirshekari [11], while are not consistent with findings of Sadeghi [2]. 1000-seed weight is one of the yield components that are more dependent on genetic factors than environmental factors. On the other hand, environmental stresses and agronomic factors are not able to decrease the 1000-seed weight from certain amount, because plants due to decrease of seed number, supply the least of needed nutrition for developed seeds. The effect of plant density on 1000-seed weight was not statistically significant. These results are consistent with findings of Sadeghi *et al*. [7] and Share [13] but are not comparable with findings of Rasam *et al*. [6]. Results showed that

Table 1: Analysis of variance results (Mean of Square) for different traits of Green cumin under varying sowing dates and plant densities

Source of Variations	Seed Yield	Biological Yield	Straw Yield	Harvest Index
Block	78.00^{ns}	2243.32^{ns}	1495.62^{ns}	0.0007^{ns}
Sowing date	391112.76**	1497610.36**	358790.87**	0.0021^{ns}
Plant density	71633.46**	203946.64**	34364.42*	0.0044^{ns}
Sowing date× Plant density	15426.23**	52468.77**	11264.73^{ns}	0.0001^{ns}
Experimental Error	149.83	7711.13	6471.96	0.0014
CV%	3.21	11.30	20.33	7.698

Table 2: Mean comparisons for different traits of Green cumin under varying sowing dates and plant densities

Treatment	Seed Yield	Harvest Index	Straw Yield	Harvest Index
T_1D_1	444.93e	916.95d	472.02b	0.48a
T_1D_2	580.83c	1157.73bc	576.89b	0.5a
T_1D_3	787.86a	1535.075a	747.20a	0.5a
T_2D_1	425.33e	925.071d	499.73b	0.46a
T_2D_2	505.66d	1011.41cd	505.74b	0.5a
T_2D_3	608.33b	1207.67b	599.33b	0.51a
T_3D_1	175.93i	375.58e	199.65c	0.47a
T_3D_2	202.96gh	413.61e	210.64c	0.49a
T_3D_3	231f	463.34e	232.34c	0.5a
T_4D_1	185.33hi	418.081e	232.74c	0.44a
T_4D_2	206gh	435.302e	229.3c	0.47a
T_4D_3	220.33fg	461.101e	240.76c	0.48a

Table 3: Analysis of variance results (Mean of Square) for different traits of Green cumin under varying sowing dates and plant densities

Source of Variations	Number of umbel per plant	1000-Seed weight	Number of umbelelet per plant	Number of seeds per umbel
Block	1.747^{ns}	0.00018^{ns}	19.24^{ns}	0.0077^{ns}
Sowing date	402.943**	10.1352**	19862.41**	75.429**
Plant density	235.243**	0.00214^{ns}	1786.12**	25.682**
Sowing date× Plant density	8.703*	0.000137^{ns}	228.85**	0.642**
Experimental Error	3.316	0.00417	19.35	0.026
CV%	7.427	1.75	4.63	1.284

Table 4: Mean comparisons for different traits of Green cumin under varying sowing dates and plant densities

Treatment	Number of umbel per plant	1000-Seed weight	Number of umbelelet per plant	Number of seed per umbel
T_1D_1	42.13a	5a	141.93a	16.4a
T_1D_2	32.23c	4.98a	135.4abc	16.1b
T_1D_3	29.36cd	4.96a	129.43bcd	14.63c
T_2D_1	37.23b	4b	136.33ab	16.13ab
T_2D_2	30.36cd	3.95b	127.66cd	14.26d
T_2D_3	28.4d	3.94b	123.33d	12.96e
T_3D_1	31.93c	3.17c	106e	12 f
T_3D_2	27.66de	3.16c	76.33f	10.03g
T_3D_3	25.06ef	3.14c	56.66j	8.63h
T_4D_1	22.5f	2.56d	46.63h	11.86f
T_4D_2	18.63g	2.54d	34.66i	9.9g
T_4D_3	16.7g	2.52d	24.33j	8.46h

T: Planting date (4,19 February and 6,20 March), D: Plant density (44,96 and 148 plants m^2)

effect of sowing date, plant density and interaction between them was significant on seed yield, biological yield and straw yield. Mean comparisons showed that the highest seed yield was obtained from the first date and the third density (148 plant in m^2) and the lowest seed yield was related to the third date and 44 plants in m^2. Therefore if planting date is delayed, the density in m^2 should be increased in order to compensate yield reduction. Analysis of variance showed that effect of sowing date on biological yield was significant (Table 1). Mean comparisons according to Duncan Multiple Rang Test, showed that the highest biological yield were obtained from the First date and decreased by delaying in planting date. There was no significant difference between the third and fourth planting dates regarding this trait. This result is comparable with findings of Molafilabi [15] and Rasam *et al*. [6]. It can be explain this finding, due to this reason that by delaying in planting date, will be decreased number of umbel per plant, umbelet per umbel, plant height and 1000-seed weight. With increase of plant density, seed yield of *Cuminum cyminum* L. was increased. The highest seed yield is belonged to the third density (148 plant / m^2). The reason can be, that although with increase of density, weight and size of one plant will be reduced and subsequently will be decreased the seed production, but increase in number of plants / m^2, compensates yield reduction of one plant up to a certain range of density. As a result seed yield / m^2 will be decreased and this finding was reported by other researches too. Interactive effect of planting date and plant density was significant on seed yield. The highest seed yield was obtained from the first planting date and the third density. Effect of plant density/m^2 on biological yield was significant. Mean comparisons showed that the highest and the lowest biological yields were obtained from the third and the first densities, respectively (Table….??/). Although in high densities, competition among plants leads to decrease of weight in one plant but in this situation, large number of plants, compensates decrease of weight and so that with increase of density/ m^2, the biological yield was increased. These results are comparable with finding of Share [13]. Mean comparisons showed that straw yield had a decreasing trend with delaying in planting date and increased with increasing of density of plants. Since the vegetative growth has been limited by delaying in sowing date and warm weather, the plant is not able to foliages shoots completely and therefore it rapidly enters to reproductive phase. Results showed that no factors (sowing date, plant density and interaction between them) had significant effect on harvest index. The reason of this finding is that changing of plant density or sowing date, changes equally in vegetative and reproductive parts of plant. On the other hand, with change in planting date or plant density, increase or decrease in biological yield of one plant is proportionate with increase or decrease in seed yield of one plant.

REFERENCES

1. Omidbeyghi, R., 1997. Approarches to production and processing of Medicinal plants. (3) 1. Publication of Astan Ghods Razavi. (In Persian).
2. Sadeghi, B., 1991. Effect of different levels of nitrogen fertilizer and irrigation in production of green cumin. Iranian Research Organization for Science and Technology. Khorasan Reseach Center. Khorasan, Iran.
3. Omidbeyghi, R., 1995. Approarches to production and processing of Medicinal Plants, 2: 60-68. Publication of Astan Ghods Razavi. (In Persian).
4. Atayi, M., 1077. Agronomy. Tehran University Publication.
5. Kafi, M., 2003. Black Cumin-Production and Processing. Ferdowsi Univ. Mashhad Publication. Mashhad, Iran, pp: 195.
6. Rasam, G.H., M. Ndaf and F. Sefidkan, 2005. Effect of planting date and plant density on seed yield and yield components of Anise. J. Res. and Development, 75: 128-133.
7. Sadeghi, S., A. Rahnavard and Z. Ashrafi, 2005. Effect of planting date and plant density on yield of black cumin. International J. Biological Res., 2(2): 94-98.
8. Yadavar, S. and K. Dahama, 1998. EFFect of planting date, Irrigation and weed-Control method on yield and water use efficiency of cumin (*Cnminum cyminum*). In: www.cat.inist.fr.
9. Latond, G.P., 1994. Effect of row spacing, seeding rate and nitrogen on yield of barely and wheat under zero-till management. Can. J. Plant Sci., 74: 703-711.
10. Ghorbani, R., A. Koochaki, M. Jahani, A. Hoseini, A. Mohamadabadi and M. Sabet Teymoori, 2007. Effect of planting date, time and methods of weed management at growth stages on yield and yield components of *Cuminum cyminum* L. J. Agronomic Researches of Iran, 1(1): 145-153.

11. Mirshekari, B., 2002. Effect of planting date and plant density on seed yield and essence of *Cuminum cyminum* L. in Tabriz. J. Agric. Sci., 2(10): 145-157.
12. Kafi, M. and M. Rashed Mohasel, 1992. Effect of weed control number and row spacing and density on growth and yield of *Cuminum cyminum* L. J. Agric. Sci. and Industries, 6(2): 151-158.
13. Share, M., 2007. Effect of plant density and weed control number on yield and yield components of Anise. Master of Science Thesis of Agronomy, Ferdowsi Univ. Mshhad. Mashhad, Iran, pp: 112.
14. Rahimian Mashhadi, H., 1991. Effect of sowing date and irrigation regime on growth and yield of Black Cumin. Iranian Research Organization for Science and Technology. Khorasan Research Center. Khorasan, Iran.
15. Molafilabi, A., 1992. Effect of planting date and distances between rows on yield of *Cuminum cyminum* L. under dry and water farming. Iranian Research Organization for Science and Technology. Khorasan Research Center. Khorasan, Iran.