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Effects of Planting Date and Irrigation Date on Qualitative and Quantitative Characteristics of Cumin (*Cuminum cyminum* L.)

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Abstract: Cumin is one of the most important drug plants that had many uses in food and drug technology. In order to investigate its drought resistance and determine the best date of planting, this experiment has been conducted in the form of split plot RCB design with 3 replications. Treatments were date of planting (main plot) at 4 levels (25th Numberv.-D1, 27th Dec. D2, 19th Feb. D3 and 19th Mar. D4) and date of irrigation (sub plot) at 4 levels (complete irrigation) I1, twice irrigation (seed germination and stem elongation) I2, twice irrigation (seed germination and flowering) I3 and twice irrigation (seed germination and seed formation) I4 in 2007-2008. Traits under study were percent of essential oil, 1000 seed weight and number of umbels per plant, seed number per umbels, lateral shoots, final height, biological yield, seed yield and harvest index. Date of planting had significant effect on essential oil percent, 1000 seeds weight, number of seed per umbels, number of umbels per plant and final height at 1% level. Also, irrigation date had significant effect on number. umbels per plant, number of lateral shoots, biological yield and seed yield at 5% level. Interaction of planting date and irrigation date were significant for number of lateral shoots, biological yield, seed yield and biomass at 5% level. Mean comparison had been done by Duncan's test that showed there were significant differences among means of traits at different planting date treatments, except harvest index at 5% level. Also, there were significant differences among means of traits at different date of irrigation treatments for essence percent, 1000 seeds weight and number of umbels per plant, final height and harvest index. Also, there were significant differences among interaction of date of planting and date of irrigation for all traits at 5% level. The highest essential oil percent was related to D2I2 treatment equal to 1.8%. Also, the highest seed yield and biological yield occurred at D2I1 treatment. Then the best treatment was 27th December planting date with complete irrigation.

Key words: Cumin date of planting · Irrigation · Essential oil

INTRODUCTION

Human being has been used medicinal plants as long as his life. And with rapid improvement of science some chemical drug was synthesized and used by human after while their side effects were appeared. Today, medicinal plants are economical plants that used in traditional and modern medicine [1, 2].

Many of the drug plants are related to *Apiaceae (Umbellifereae)* family. One of them is cumin (*Cuminum cyminum* L.). Cumin genus contains aromatic plants, with out hair (except is fruit), with 10 to 50 cm height. Cumin seeds contain 2 to 5 percent of essential oil that obtains from distillation of rubbed cumin steam and its composition contains cumin aldehyde or cuminul, dihydrocumi aldehyde and cumin alcohol [3, 4]. Cumin is important crop for Iran because of its trade aspects. This plant is one of the most valuable medicinal plants that are cultivated in arid and semi-arid area. Main producers of cumin are Iran, India, Turkish, Egypt and Pakistan and main producers of Iran provinces are Khorasan, Eastern Azarbaijan, Yazd, Semnan, Isfahan and Kerman. Area of cumin cultivation in Iran is more than 50000 ha and its average production is more than

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Table 1: Physicochemical analysis of soil of the experiment field

Row	Kind of experiment	Result of the experiment	Optimum range
1	pH	8.11	-
2	EC(Ms/cm)	8.41	-
3	SP (saturation percent)	22.4	30-44
4	Organic Carbon (OC %)	0.04	>1.6
5	Sand (%)	62	20-45
6	Silt (%)	32.5	20-55
7	Clay (%)	5.5	15-35
8	Texture	loamy sand	L-CL
9	N(total)	0.016	0.1-0.15
10	P(ava) ppm	6.7	15
11	K(ava) ppm	249	300

Table 2: P-value of measured traits

	Traits								
Treatment	Number of seeds per umbel	Number of umbels per plant	Final height	Lateral shoots	Essential oil (%)	1000 seeds weight	Biological yield	Seed yield	Harvest index
Date of planting	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Irrigation	0.1604	0.0396	0.4209	0.0001	0.2486	0.5555	0.0001	0.0001	0.1584
D*I	0.1966	0.0512	0.8390	0.0371	0.1262	0.2700	0.0001	0.001	0.7622

D*I: Interaction between Date of Planting and IrrigationValues lower than 0.01 and 0.05 shows significant effect of treatment at 1% and 5%, respectively.

12000 ton. Factors of agronomy like; date of planting, density, irrigation, nitrogen fertilizer, weeds control and other management and production factors, time of harvesting and their interaction at different climates can affect on quantitative and qualitative components of cumin [5-7]. Also, rate of seed for planting depend on soil type, moisture and fertility of soil, culturing region, type and method of culturing, date of culturing, germination rate, 1000 seeds weight, seed purity and agronomical managements is different [8-10]. So, goals of this experiment are investigation on Effects of planting date and irrigation date on qualitative and quantitative characteristics of cumin in Birjand- Iran.

MATERIALS AND METHODS

This experiment has been conducted in Birjand, Iran with arid and semiarid climate and 1491 elevation from sea level. Its latitude is 53°, 32' and its longitude is 59°, 13'.

After soil preparation, in order to investigate its drought resistance and determine the best date of planting, this experiment has been conducted in the form of split plot RCB design with 3 replications. Treatments were date of planting (main plot) at 4 levels (25^{th} Numberv.-D1, 27^{th} Dec. D2, 19^{th} Feb. D3 and 19^{th} Mar. D4) and date of irrigation (sub plot) at 4 levels (complete irrigation I1, twice irrigation (seed germination and stem elongation) I2, twice irrigation (seed germination and flowering) I3 and twice irrigation (seed germination and seed formation) I4 in 2007-2008. [11, 12].

Each plot were contain of 5 lines with 4 m length, distances between rows were 50 cm and distances between plots were 1 m. Seeds of this experiment was selected from Sabzevar, Iran landrace and seed rate was 20 Kg/ha [13-15]. They were disinfecting anted by Vitavax fungicide[16]. All treatments were irrigated twice (first one after planting and second one after 10 days). Complete irrigation has been done each 10 days. Weeding, fertilizing and thinning were done by hand. Traits under study were percent of essential oil, 1000 seeds weight and number of umbels per plant, number of seed per umbel, lateral shoots, final height, biological yield, seed yield, harvest index and biomass. Data were analyzed by SAS soft ware and means were comprised by sue of Duncan's test at 5% level.

RESULTS AND DISCUSSION

Date of planting had significant effect on all measured traits (Table 1). Also, irrigation treatment had significant effect on lateral shoots; biological yield and seed yield at 1% level and had significant effect on Number of umbels per plant at 5% level (Table 2). Interactions between treatments were significant for seed and biological yield at 1% level and lateral shoots at 5% level (Table 2).

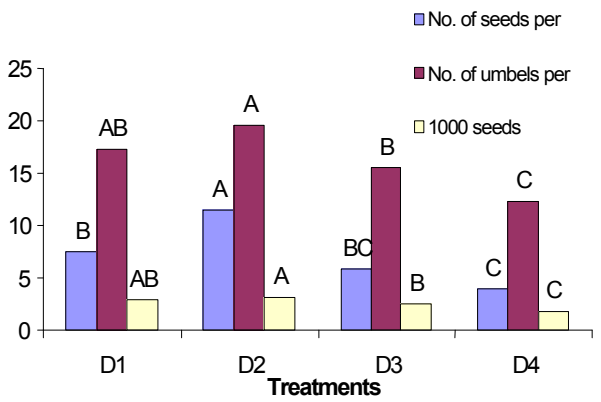

Fig. 1: Effect of date of planting on yield components cumin

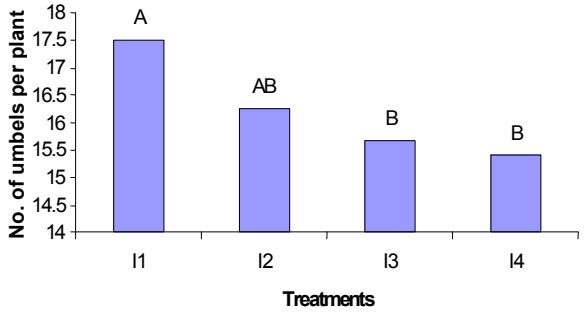

Fig. 2: Effect of irrigation on Na of umbels per plant

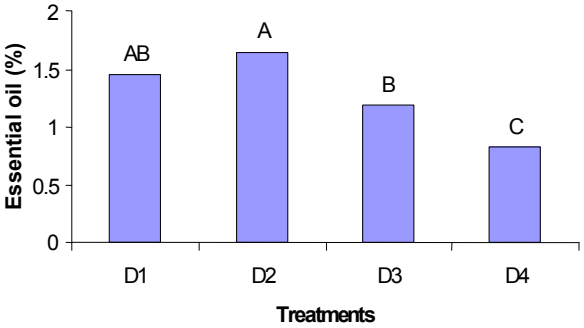

Fig. 3: Effect of date of planting on essential oil percent

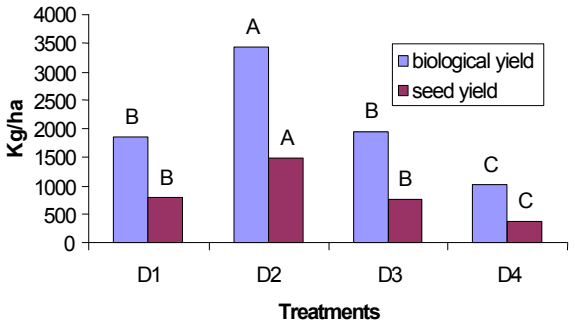

Fig. 4: Effect of date of planting on yeild and bilogical yeild

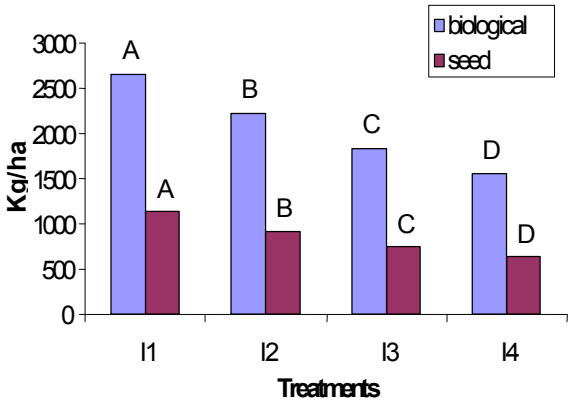

Fig. 5: Effect of irrigation on yeild and bilogical yeild

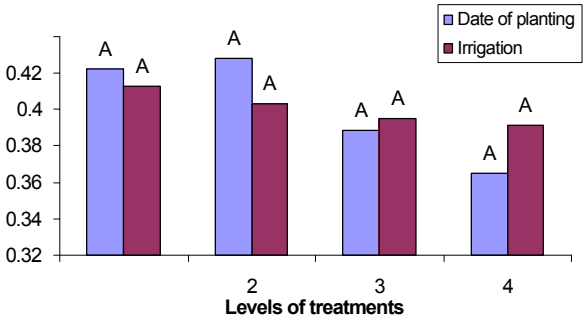

Fig. 6: Effect of irrigation and date of planting Level on harvest index

These results show that appropriate date of planting and proper irrigation had significant effect on cumin yield and cumin yield will increased by selecting the best ones. These results agree with Rahimian results that show the highest yield was obtained from complete irrigation for cumin [17, 18].

Improvement of cumin yield components is doing to enhance seed yield [19, 20]. Number of seeds per umbel, Number of umbels per plant and 1000 seeds weight traits are components of yield of cumin that their highest values were obtained from D2 treatment (Figure 1). So, in order to get the highest yield date of planting at December is advised. Also, there was number difference between treatments of date of planting and irrigation on harvest index (Figure 6). These results agree with Tavossi results [8] that show the lowest 1000 seeds weight and harvest index obtained from complete irrigation. Harvest index is one of the most important components of yield and calculated by dividing economical yield (cumin seed) by biological yield [20, 8].

Irrigation treatment had significant effect on Number. of umbels per plant that I2 and I1 were the highest ones and placed in one group (Figure 2). These results agree with Aminpoor and Mosavi [8] results that showed the highest seed yield and number of umbels per plant were obtained from complete irrigation (After planting irrigation, plant establishment irrigation, pollination irrigation and grain formation).

Figure 3 shows that D2 planting date has the highest essential oil percent and also had the highest yield. So, D2 planting date has the highest essential oil yield. These results disagree with Ehtramian [20] results that reported the best date of planting is mid-March.

CONCLUSION

According to experimental conditions the highest seed yield between different dates of seed planting was obtained from D2 (27th December) treatment equal to 1487.9 Kg/ha, also the highest one between different levels of irrigation was obtained from complete irrigation (I1 treatment) equal to 1128.43 kg/ha. Also, according to interaction effects, the highest seed yield was obtained from D2I1 treatment (planting date of 27th December and complete irrigation) equal to 1876.26 kg/ha. So, according to the results of this experiment planting at end of each year and complete irrigation led to high performance of cumin plant.

ACKNOWLEDGEMENTS

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