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Influence of planting date on Phenological Characteristics of Cumin (*Cuminum cyminum* L.) Ecotypes in Sistan conditions

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ABSTRACT: Cumin (*Cuminum cyminum* L.) is an annual plant belongs to family apiaceae and it is grown for production of the dry ripe fruits. It was known to the ancient Egyptian as a spice and medicinal plant. In addition to its common use as spice in our daily life, recent studies have indicated its pharmaceutical and medicinal importance. Planting date is one of the most important agronomic factors involved in producing high yielding small grain cereal crops, which affects the timing and duration of the vegetative and reproductive stages. The field experiment was laid out split plot with factorial design with three replications. The investigation was consisted of date of planting as the main factor in five levels 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 characteristic (except during the flowering period) was significant.

Key words: germination, flowering, physiological maturity

INTRODUCTION

Medicinal plants play a major role in the provision of health care around the world (Timmermans, 2003). Production of medicinal plants are confronting with climatic limitations such as, drought, salinity in arid and semiarid regions. *Psyllium* plant known as *Plantago* psyllium has gained importance as herbal medicine around the world due to its medicinal properties. Recently it has obtained agricultural importance because of its wide use in pharmaceutical and food grade industries worldwide (Li *et al.,* 2005). Cumin (*Cuminum cyminum* L.) is an annual plant belongs to Family Apiaceae and it is grown for production of the dry ripe fruits. It was known to the ancient Egyptian as a spice and medicinal plant. In addition to its common use as spice in our daily life, recent studies have indicated its pharmaceutical and medicinal importance (Aruna and Sivaramakrishnan, 1996). 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, 2003). 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). Today, cumin is the second most popular spice in the world after black pepper and Iran is one of the main producers of this plant in the world (Ahmadian *et al.,* 2011; Kafi, 2002; Tunctunk and Tunkturk, 2006). Cultivation of cumin requires a long, hot summer of 3-4 months with day time temperature around 30°C. It is drought tolerant and is mostly grown in Mediterranean climates. It is grown from seed, sown in spring and needs fertile, well- drained soil (Hajlaoui, *et al.,* 2010). 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 produced in the warm regions of the world, mainly in India, China and southern Egypt. There has been a recent increased demand on cumin while its production is limited and decreased (Abu-Nahoul and Ismail, 1995). Significant lose in cumin yield can be attributed to the adverse effects caused by biotic stresses of which the *Fusarium* wilt disease is the most serious one (Omar *et al.,* 1997). Planting date is one of the most important agronomic factors involved in producing high yielding small grain cereal crops, which affects the timing and duration of the vegetative and reproductive stages. In Egypt, wheat sowing dates varied among different location. The variation in sowing dates plays an important role in the variation of wheat yield per unit area. There are several studies that documented the effects of planting date on winter cereals (McLeod, 1992). In Punjab wheat sowing is normally delayed. The best planting time is up to 15th November while most of the sowing is accomplished during end November and first fortnight of December. Early sown wheat had higher grain yield (Qamar, 2004). Many investigators studied that effect of sowing dates on growth of sweet fennel plants (Abdallah *et al.,* 1978; Yadav *et al.,* 2000; Sudeep *et al.,* 2006; Abd El-Wahab *et al.,* 2009). Baruah (2004) on fennel found that fennel seeds should be sown from 15 September to 1 October for higher vegetative growth.

Very little information is available on the specific requirements of sweet fennel fertilization in Egypt, especially in newly reclaimed land. So, this investigation carried out on potassium requirements for improving green yield and qualities of sweet fennel bulbs, grown in sandy soil are discussed. The detrimental effect of delayed sowing on grain yield was maximum with reduction in 1000-grain weight (Singh and Pal, 2000; Subhan, 2004). Delayed sowing also significantly reduced test weight (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 test weight (Singh and Dhaliwal, 2000). Crude protein content increased with delayed sowing (Reents, 1997; Schemitt and Dewes, 1997; Yadava and Singh, 2003). Effects of late sowing on milling yield were statistically significant and bread quality was not badly affected (Flood, 1996). Higher grain crude protein content but lower grain sizes were obtained with delayed sowing (Patil, 2000). Under the environmental conditions of Egypt, there is a general agreement that early planting of sugar beet (September-October) produced the highest sucrose percentage as well as root and sugar yields per unit area (Badawi *et al.*, 1995; Ghonema, 1998 and Ramadan and Hassanin, 1999). Other studies found that planting sugar beet during October markedly increased diameter, length and weight of roots, sugar content as well as root and sugar yields, compared with the late sowing of November (El-Kassaby and Leilah, 1992a; Leilah and Nasr, 1992 and Badawi *et al.*, 1995). In studying best planting time of safflower in southern Iran, Motelipour (2001) expressed that the highest seed yields (1276 kg/ha) and oil (330 kg/ha) were obtained when it was planted in Oct.22. The sooner the planting time, the more rapidly it emerged and plant height increased. Jelali (2001) showed that double row planting had higher seeds per head and consequently increased seed yield.

MATERIAL AND METHODS

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 was made in the experimental area before the imposition of treatments and was analyzed for physical and chemical characteristics. The field experiment was laid out split plot with factorial design with three replications. 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 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. Days to germination

Analysis of variance showed that the effect of planting date on days to germination was significant (Table 1). The maximum of days to germination of treatments Feb5h was obtained (Table 2). The minimum of days to germination of treatments Dec5th was obtained (Table 2). Analysis of variance showed that the effect of ecotypes on days to germination was not significant (Table 1). The maximum of days to germination of treatments zabol ecotype was obtained (Table 2). The minimum of days to germination of treatments birjand ecotype was obtained (Table 2). Planting date is one of the most important agronomic factors involved in producing high yielding small grain cereal crops, which affects the timing and duration of the vegetative and reproductive stages. In Egypt, wheat sowing dates varied among different location. Probably due to the length of days from planting to emergence of plants on planting five, the cooling air and supply air temperature to the temperature for germination and emergence Basic cumin seeds that led to the end of the second planting green plants February delayed and expected to become culture. The investigation of soheily *et al* (2010) Phenological stages tested cumin, including planting to emergence was significantly affected by sowing date.

B. Days to flowering

Analysis of variance showed that the effect of planting date on days to flowering was significant (Table 1). The maximum of days to flowering of treatments Nov15th was obtained (Table 2). The minimum of days to flowering of treatments Feb5h was obtained (Table 2). Analysis of variance showed that the effect of ecotypes on days to flowering was not significant (Table 1). The maximum of days to flowering of treatments kerman ecotype was obtained (Table 2). The minimum of days to flowering of treatments birjand ecotype was obtained (Table 2).*Kafi et al (2002) stated that planting early plant growth is adequate much of this is due to the prolonged period of vegetative and reproductive period is not enough time to spend as a result of its high yield.*

C. During the flowering period

Analysis of variance showed that the effect of planting date on during the flowering period was significant (Table 1). The maximum of during the flowering period of treatments Jan15th was obtained (Table 2). The minimum of during the flowering period of treatments Feb5h was obtained (Table 2). Analysis of variance showed that the effect of ecotypes on during the flowering period was not significant (Table 1). The maximum of during the flowering period of treatments kerman ecotype was obtained (Table 2). The minimum of during the flowering period of treatments zabol ecotype was obtained (Table 2). Result of soheily et al (2010) the cumin showed that the flowering period was significantly affected by sowing date. The longest flowering period to maturity of the second planting date (21 November), respectively.

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

S.O.V	df	Days to germination	Days to flowering	During the flowering period	Days to physiological maturity	Number of branches per plant
R	2	3.622^{*}	6.756^{ns}	73.889^{*}	1.867^{ns}	6.956^{ns}
Planting date	4	195.189^{**}	5038.700^{**}	23.856^{ns}	6520.800^{**}	88.078^{**}
Error a	8	0.789	15.367	10.889	2.867	1.761
ecotypes	2	0.422^{ns}	0.289^{ns}	1.356^{ns}	1.867^{ns}	5.489^{ns}
Ecotypes * planting date	8	0.756^{ns}	1.817^{ns}	2.189^{ns}	1.950^{ns}	1.961^{ns}
Error b	20	0.856	0.878	1.556	1.300	2.300
CV (%)	-	5.52	1.56	2.81	0.99	12.21

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

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

Treatment	Days to germination	Days to flowering	During the flowering period	Days to physiological maturity	Number of branches per plant
Planting date					
Nov.15th	20.222b	89.556a	43.778ab	149.556a	17.000a
Dec.5th	11.222e	74.889b	45.222ab	132.222b	14.000a
Dec.25th	13.000d	61.778c	44.778ab	116.000c	11.778c
Jan.15th	17.111c	43.444d	46.000a	98.000d	9.444d
Feb.5h	22.222a	30.556e	41.778b	81.556e	9.889d
Ecotypes					
Zabol ecotype	20.222b	60.000 a	44.000 a	115.067 a	13.067a
Birjand ecotype	11.222e	59.933 a	44.333 a	115.733 a	12.333a
Kerman ecotype	13.000d	60.200 a	44.600 a	115.600 a	11.867a

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

Due to the long period of planting to emergence in the second planting date, cold weather and not reaching temperature for germination and emergence temperature based cumin seeds was noted that the second planting green plants by the end of February postponed culture is expected to be converted.

D. Days to physiological maturity

Analysis of variance showed that the effect of planting date on days to physiological maturity was not significant (Table 1). The maximum of days to physiological maturity of treatments Nov15th was obtained (Table 2). The minimum of days to physiological maturity of treatments Feb5h was obtained (Table 2). Analysis of variance showed that the effect of ecotypes on days to physiological maturity was not significant (Table 1). The maximum of days to physiological maturity of treatments Birjand ecotype was obtained (Table 2). The minimum of days to physiological maturity of treatments zabol ecotype was obtained (Table 2). Result of soheily et al (2010) the cumin showed that all tested phenological stages such as flowering to maturity and planting to maturity was significantly affected by sowing date.

E. Number of branches per plant

Analysis of variance showed that the effect of planting date on number of branches per plant was not significant (Table 1). The maximum of number of branches per plant of treatments Nov15th was obtained (Table 2). The minimum of number of branches per plant of treatments Jan15th was obtained (Table 2). Analysis of variance showed that the effect of ecotypes on number of branches per plant was not significant (Table 1). The maximum of number of branches per plant of treatments zabol ecotype was obtained (Table 2). The minimum of number of branches per plant of treatments kerman ecotype was obtained (Table 2). Pezeshkpour *et al* (2009) state that to increase the number of branches per plant with an early emphasis on culture and suggests that early planting due to wet conditions in the early to late season drought at the beginning of the season could be increasing the number of branches and number of seeds per plant.

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