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Research Article

IMPACT OF PLANTING DATE AND CULTIVAR ON YIELD AND YIELD COMPONENTS OF RAPESEED

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ABSTRACT
A field experiment was carried out using planting date (Oct 22, Oct 31, Nov 10 and Nov 20, 2012) as main plot factor and rapeseed cultivar (Talayeh, Zarfam, Rustica and ES Betty) as subplot factor in a split plot experiment based on randomized complete block design (RCBD) with three replications in Firoozabad, State of Fars, Iran. The results revealed that the planting date and cultivar altered yield and most of yield components of rapeseed significantly. The highest value of pods per plant was obtained at Oct 22. Seeds per pod did not show any significant difference between the treatments and was the maximum at Oct 22. The 1000-seed weight was the maximum at Oct 22. The highest value of grain yield (4016.7 kg/ha) was achieved on Oct 22 which was not significantly different when compared to Oct 31. The cultivar Zarfam resulted in the highest value of grain yield (3926.7 kg/ha) which was significantly different when compared to other cultivars.

Keywords: *Brassica napus, Oil Plant, Sowing Date, Canola, Genotype, Grain Yield*

INTRODUCTION
Rapeseed or canola (*Brassica napus* L.) is a member of the Brassicaceae family that is cultivated for the production of animal feed and vegetable oil for human consumption (Aminpanah, 2013). In ranking, rapeseed oil is third behind soybean and oil palm showing the importance of this product. It is one of the most important annual oil and protein crops in temperate climates. Apart from direct human and animal consumption, industrial uses include the manufacture of rapeseed oil or use as a source of bio-diesel fuel production have been developed in the recent years in world (Ofori and Becker, 2008; Kandil *et al.*, 2012). Rapeseed has high value of oil (40-45%) and protein (39%) (Eskandari and Kazemi, 2012). Rapeseed oil contains a desirable profile of saturated fatty acids (7%) and high level of unsaturated fatty oleic acids (about 61%) and medium level of unsaturated fatty linoleic acids (21%) and linoleic acid (11%) (Molazem *et al.*, 2013).
Planting date is an important factor that determines the length of growing season and then the yield. Appropriate planting dates are based upon environmental conditions stated that planting date is one of the most important production decisions (Hokmalipour *et al.*, 2011). Researchers indicated that planting date can affect on yield and yield components of rapeseed (Asgari *et al.*, 2008; Ozer, 2003; Hocking, 2001; Miralles *et al.*, 2001; Nanda *et al.*, 1999). Kirkland and Johnson (2000) reported that grain yield of the rapeseed was greater in the early sowing dates and smaller in the later sowing dates. Taylor and Smith (1992) illustrated that seed yield decreased when sowing date was delayed.
Genotype is one of the most important factors affecting growth and yield of crops. A Romanian investigation with 50 rapeseed cultivars showed significant differences regarding the grain yields (Gheorghe *et al.*, 2013). The aim of this study was evaluation of the influence of planting date and cultivar on yield and yield components of rapeseed.

MATERIALS AND METHODS
Plant materials and experimental conditions
The study was carried out using planting date (Oct 22, Oct 31, Nov 10 and Nov 20, 2012) as main plot factor and rapeseed cultivar (Talayeh, Zarfam, Rustica and ES Betty) as subplot factor in a split plot

experiment based on randomized complete block design (RCBD) with three replications at a field in Firoozabad, State of Fars, Iran. Each subplot (3×2 m) contained rows with spacing of 4 cm between plants within row and 45 cm between rows. At the end of the growth, eight plants were randomly harvested from each subplot for measurement of growth and yield components. The plants of 1 m^2 of each subplot were harvested for measurement of grain yield.

Statistical analysis

Data from the experiment were subjected to analysis of variance (ANOVA) using SAS computer software and the means compared with Duncan's new multiple range test (DNMRT) at $P < 0.05$.

RESULTS AND DISCUSSION

The results showed that the planting date altered yield and yield components of rapeseed significantly (Table 1). The highest value of plant height (168.50 cm) was obtained at Nov 20 which was not significantly different when compared to Oct 31. The maximum number of lateral shoots (5.42) was achieved on Oct 22 which was not significantly different when compared to Oct 31 and Nov 10. The highest value of pods per plant was obtained at Oct 22. Seeds per pod did not show any significant difference between the treatments and was the maximum (26.25) at Oct 22. The 1000-seed weight was the maximum (4.03) at Oct 22. The highest value of grain yield (4016.7 kg/ha) was achieved on Oct 22 which was not significantly different when compared to Oct 31.

Table 1: Effect of planting date on yield and yield components of rapeseed

Planting date	Plant height (cm)	Number of lateral shoots	Pods per plant	Seeds per pod	1000-seed weight (g)	Grain yield (Kg/ha)
Oct 22	157.42 b	5.42 a	290.42 a	26.25 a	4.03 a	4016.7 a
Oct 31	160.50 ab	5.08 ab	279.83 a	24.25 a	4.00 a	3855.0 a
Nov 10	154.08 b	4.75 ab	226.42 b	25.08 a	3.92 b	3288.3 b
Nov 20	168.50 a	4.42 b	203.33 b	24.75 a	3.97 ab	2863.3 c

In each column, means with the same letters are not significantly different at 5% level of Duncan's new multiple range test

The cultivar influenced on plant height, pods per plant and grain yield significantly (Table 2). Plant height showed the maximum value (167.58) by using Talayeh which was not significantly different when compared to Zarfam. The highest value of pods per plant (289.67) was obtained at Zarfam which was not significantly different when compared to Rustica. The highest value of grain yield (3926.7 kg/ha) was achieved by using Zarfam which was significantly different when compared to other cultivars.

Table 2: Effect of cultivar on yield and yield components of rapeseed

cultivar	Plant height (cm)	Number of lateral shoots	Pods per plant	Seeds per pod	1000-seed weight (g)	Grain yield (Kg/ha)
Talayeh	167.58 a	5.00 a	235.25 b	25.33 a	3.98 a	3271.7 b
Zarfam	162.08 ab	4.92 a	289.67 a	23.92 a	4.00 a	3926.7 a
Rustica	155.42 b	4.75 a	275.67 a	25.50 a	3.95 a	3406.7 b
ES Betty	155.42 b	5.00 a	199.42 c	25.58 a	3.98 a	3418.3 b

In each column, means with the same letters are not significantly different at 5% level of Duncan's new multiple range test

Our results are in agreement with previous studies reported by researchers. Hokmalipour *et al.*, (2011) revealed that planting dates (March 30, April 14, April 29 and May 14) and rapeseed cultivars (Hayola 410, RDF003 and Sarigol) altered yield and yield components of the plants. Molazem *et al.*, (2013) indicated that yield and yield components of the rapeseed were affected by planting date (two dates on Oct) and cultivar (Falcon, PF7045, Jerriss and Global). Miri and Bagheri (2013) reported that the highest value of grain yield of rapeseed cultivar Opera was achieved on the 25 September planting date and it was

significantly different when compared to other planting dates. A research in Iranshahr, Sistan and Baloochestan province, Iran showed that planting on November resulted in the higher values of grain yield and some of yield components when compared to planting on December or January (Shahraki *et al.*, 2012). Saberi *et al.,* (2008) revealed that planting dates on October had no significant influence on grain yield in Birjand region.

Conclusion

Under present experimental conditions, planting at Oct 22 or Oct 31 can be recommended as an appropriate date for obtaining the highest grain yield. The cultivar Zarfam can be recommended in the present study.

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