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RESEARCH OPINIONS IN ANIMAL & VETERINARY SCIENCES

# Grain yield and components of rapeseed cultivars as affected by planting date and nitrogen fertilizer

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## Abstract

The aim of this research work was to find out optimum planting time for the newly selected genotype ORS 3150-3008. An experiment was conducted at the Agriculture farm Station, Karaj, Iran during spring season of 2007-2008. There were five planting dates i.e. April 15, April 25, May 5, May 15 and May 25. Significant variations due to different planting dates were observed in days to flowering, days to maturity, plant height, number of primary branches/plant, pod/plant, seeds/pod, 1000 seed weight and seed yield ( per ha). Results showed that the highest seed yield (2.54 t/ha) was obtained from the second planting (April 25) and it was significantly different from the yields of all other planting dates. All other yield attributes were also found higher in the plants of second planting. The seed yield (2.57 t/ha) of last planting (May 25) was also satisfactory because of the prolong winter season prevails in the northern part of the country.

**Keywords:** Rapeseed; planting date; agronomy traits; nitrogen fertilizer rate

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## Introduction

The production of oil seed in Iran is not high; about 80% of Iran's necessary oil is imported from foreign countries. Planting dates obviously affect canola yield and yield components. In this regard, it has been reported that at the early planting date, seed yield and straw yields were greater than late planting (Daly et al., 1988). Taylor and Smith (1992) reported that yields of seed and oil declined when sowing was delayed beyond May (the optimum period of canola sowing in Australia) (Taylor, 1992). A number of studies have shown yield decline in canola with delay in sowing (Hocking et al., 2001). Yield response of rapeseed to increasing N rate varies with different environmental variables, including weather, soil type, residual fertility (especially nitrate), soil moisture and cultivar. Nitrogen increases yield by influencing a number of growth parameters such as branches per plant and flowers per plant and by producing more vigorous growth and development (Allen and Morgan, 1972; Taylor et al., 1991). Wright et al. (1988) working on rapeseed in Australia, reported that N prolongs the life of leaves, improves leaf area duration after flowering and increases overall crop assimilation, thus contributing to increased seed yield. On the other hand, excessive use of N fertilizer can increase lodging with yield and quality reductions (Sheppard and Bates, 1980; Bailey, 1990). Since early frosts are common and cool conditions prevail in the late summer, planting date can play a major role in determining the seed yield and quality in regions with short growing season. Numerous research studies for different climates have shown that planting date influences the growth, seed yield and quality of rapeseed (Miralles et al., 2001).

## Materials and Methods

This experiment was carried out at Karaj farm in Iran, during the seasons 2007 and 2008. In this study, two spring rapeseed cultivars, Amica and Sarigol were used. The study involve a randomized complete block design with four replicates, was conducted at two years and consisted of a factorial combination of two

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rapeseed cultivars, four planting dates and four nitrogen rates. Cultivars were sown on four dates each year: 21 Mar, 31 Mar, 11 Apr, and 21 Apr 2007; and 31 Mar, 11 Apr, 20 Apr and 29 Apr 2008. First planting following plantings were delayed by about 10 days in 2008 when compared with 2007. Nitrogen rates of 0, 60, 140 and 220 N (kg/ha) were tested. Nitrogen was applied as split in two applications half with planting and the remaining half at the beginning of stem elongation. N fertilizer applied as ammonium sulphate [$(NH_4)2SO_4$] form. All plots received phosphorus at 85 (kg/ha) as triple superphosphate at planting in both years. The area of each plot was 14 $m^2$ consisting of four rows, 6 m long and 50 cm apart. Seed yields were taken at maturity by harvesting the centre two rows of each plot for grain yield determination. Seed yield was adjusted to a 12% moisture basis. Fifteen plants were collected randomly from the central two rows and the following growth and yield component variables were recorded for each plot; plant height, primary branches per plant, pod number per plant. Seed oil content was determined by the Soxhlet apparatus. All data were analyzed with the SPSS. Results for each year were analyzed separately because planting dates differed between the two seasons and were presented by individual year. For statistical analyses, planting date, cultivar, and nitrogen rate effects were considered fixed. When the F -test indicated statistical significance at the P= 0.05 level, the protected least significant difference (Protected LSD) was used to separate the means.

## Results and Discussion

### Grain Yield

Averaged across the planting dates, cultivars and nitrogen rates, yields in 2007 and 2008 were 1982 and 2143 (kg/ha), respectively. In general, the low yields from this study were probably due to the short growing season and high altitude. Significant yield differences occurred between cultivars in both years. In 2007, Amica had higher seed yield than Sarigol (Table 1). This trend was not evident in 2008 when seed yield of the cultivars was similar (Table 2). Yield response of the cultivars to planting date or nitrogen rate was consistent across the two years, as indicated by the lack of a significant planting date x cultivar or cultivar x nitrogen rate interaction for seed yield (Tables 1 and 2). With delaying planting, yield generally tended to decrease in the two years, except the first planting (21 Mar) of the 2007 growing season. In 2007, the lower seed yield of first planting compared with the second and third plantings apparently relates to low vegetative stage temperatures and unfavourable cool conditions for pollination and pod set during the flowering in 21 Mar planting. This reduction in seed yield with delaying planting has been verified in early field studies (Johnson et al., 2006). The late planting usually causes a decline in growth, leaf area, and a faster maturation (Mckay and Schneiter, 1990) thus, decreasing seed yield. In 2008, seed yield increased in the first and second planting date in response to each increment of added N, but decreased with additional N from 140 to 220 N (kg/ha) in the third and fourth planting dates (Table 2). Maximum seed yields were approximately 2233 (kg/ha) in 2007 and 2518 (kg/ha) in 2008, obtained at N rate of 140 and 220 (kg/ha) in 2007 and 2008, respectively, which clearly suggest the importance of nitrogen for higher seed production in rapeseed crops. However, significant yield increases with application of nitrogen up to only 140 (kg/ha) were observed in both seasons (Tables 1 and 2).

### 1000-seed weight

Pod number responses to increasing levels of nitrogen were similar in the second year of the study. These results agree with the findings by Allen ad Morgan (1972), who found that an increase in nitrogen uptake by plants contributed to pod set. Cheema et al. (2001) also showed that the number of pods per plant increased with increasing rates of N. As can be seen in Table 1, there were statistical differences between rapeseed cultivars for 1000 seed weight in 2007. Tower tended to be higher in seed weight than Lira well, which is a genotype dependent characteristic. However, the characteristic have been shown differ due to various growing conditions (Scott et al., 1973a; Clarke 1979). In 2007, cultivars had a lower 1000- seed weight than 2008 (Table 1). The results from Tables 1 and 2 revealed that delaying planting resulted in a decrease in mean seed weight in both years. The reduction in the 1000-seed weights of the late sown rapeseed can be attributed to increasing temperature (Hocking and Stapper, 2001) and a decrease in the magnitude of leaf area (data not shown), which is considered a factor of practical importance in terms of seed growth and development of rapeseed. A steady and progressive increase in 1000-seed weight was observed with each increment in applied nitrogen rates up to 240 (kg/ha), suggesting the role of nitrogen for seed formation in rapeseed. This can be explained by increased leaf growth with higher N rates (Ogunlela et al., 1990).

### Seed N concentration

Averaged over cultivars and nitrogen rates, effects of planting date varied with the study years. This effect was significant in 2007. Seed N concentrations were not affected by planting dates in 2008 (Tables 1 and 2). However, the observed responses to planting date were not consistent in both years. In 2008, the two rapeseed cultivars differed in their response to planting dates. Seed N concentrations were affected significantly by cultivars and nitrogen rates (Tables 1 and 2). Increasing

**Table 1: Effected of planting date, cultivar, and nitrogen rate on agnominal traits of canola cultivar, karaj in Iran**

| Treatments | df | Seed yield (kg.ha$^{-1}$) | Days to maturity(d) | 1000-Seed weight (g) | Seed N concentration (g.kg$^{-1}$) |
|---|---|---|---|---|---|
| Planting date (D) | | | | | |
| 11 Mar | | 1906$^{a}$ | 131.50$^{a}$ | 4.7$^{a}$ | 47.5$^{b}$ |
| 31 Mar | | 2217$^{c}$ | 137.75$^{b}$ | 4.6$^{a}$ | 46.4$^{c}$ |
| 11 Apr | | 2061$^{b}$ | 122.91$^{c}$ | 4.6$^{a}$ | 48.8$^{a}$ |
| 20 Apr | | 1744$^{d}$ | 117.03$^{b}$ | 4.4$^{b}$ | 47.9$^{b}$ |
| Cultivar (C) | | | | | |
| Amica | | 2060$^{a}$ | 122.08$^{b}$ | 4.7$^{a}$ | 48.6$^{a}$ |
| Sarigol | | 1902$^{b}$ | 117.52$^{a}$ | 4.5$^{b}$ | 46.7$^{b}$ |
| Nitrogen rate (N) | | | | | |
| 0 | | 1519$^{c}$ | 123.6$^{d}$ | 4.3$^{c}$ | 45.4$^{b}$ |
| 60 | | 1965$^{b}$ | 124.40$^{c}$ | 4.5$^{b}$ | 46.5$^{c}$ |
| 140 | | 2233$^{a}$ | 125.5$^{b}$ | 4.6$^{b}$ | 48.8$^{b}$ |
| 220 | | 2209$^{a}$ | 125.75$^{a}$ | 4.8$^{a}$ | 49.9$^{a}$ |
| CV (%) | | 14.5 | 0.66 | 8.3 | 6.32 |
| D | 3 | ** | ** | * | ** |
| C | 1 | ** | ** | ** | ** |
| N | 3 | ** | ** | ** | ** |
| D * C | 3 | NS | ** | ** | ** |
| D * N | 9 | NS | NS | NS | NS |
| C * N | 3 | NS | NS | NS | NS |
| D * C * N | 9 | NS | ** | NS | * |

*, ** significant at the 0.05 and 0.01 level, respectively. For each main effect, values within columns followed by the same letter are not significantly at P＝0.05. CV, coefficient of variation; NS, nonsignificant.

**Table 2: Effected of planting date, cultivar, and nitrogen rate on agnominal traits of canola cultivar, karaj in Iran**

| Treatments | df | Seed yield (kg.ha$^{-1}$) | Days to maturity(d) | 1000-Seed weight (g) | Seed N concentration (g.kg$^{-1}$) |
|---|---|---|---|---|---|
| Planting date (D) | | | | | |
| 31 Mar | | 140.3$^{a}$ | 123.4$^{a}$ | 4.25$^{a}$ | 45.1$^{a}$ |
| 11 Apr | | 138.5$^{a}$ | 120.3$^{b}$ | 4.22$^{ab}$ | 45.1$^{a}$ |
| 20 Apr | | 133.6$^{b}$ | 115.5$^{c}$ | 4.09$^{b}$ | 45.0$^{a}$ |
| 29 Apr | | 126.8$^{c}$ | 111.1$^{d}$ | 3.87$^{c}$ | 45.6$^{a}$ |
| Cultivar (C) | | | | | |
| Amica | | 131.5$^{a}$ | 114.9$^{a}$ | 4.44 | 46.2$^{a}$ |
| Sarigol | | 138.0$^{b}$ | 120.2$^{b}$ | 4.61 | 44.2$^{b}$ |
| Nitrogen rate (N) (N) | | | | | |
| 0 | | 127.7$^{b}$ | 116.6$^{c}$ | 4.05$^{c}$ | 42.9$^{d}$ |
| 60 | | 134.5$^{a}$ | 117.8$^{b}$ | 4.25$^{b}$ | 44.1$^{c}$ |
| 140 | | 137.0$^{a}$ | 117.7$^{b}$ | 4.56$^{ab}$ | 46.1$^{b}$ |
| 220 | | 139.9$^{c}$ | 118.1$^{a}$ | 4.37$^{a}$ | 47.7$^{a}$ |
| CV (%) | | 5.2 | 2.23 | 6.8 | 7.87 |
| D | 3 | ** | | | |
| C | 1 | ** | | | |
| N | 3 | ** | ** | ** | NS |
| D * C | 3 | NS | ** | NS | ** |
| D * N | 9 | * | ** | ** | ** |
| C * N | 3 | * | ** | ** | ** |
| D * C * N | 9 | NS | ** | NS | NS |

*, ** significant at the 0.05 and 0.01 level, respectively. For each main effect, values within columns followed by the same letter are not significantly at P＝0.05. CV, coefficient of variation; NS, nonsignificant.

N rates resulted in significantly higher seed N concentrations in rapeseed. The observations support Ogunlela et al. (1990) who reported that nitrogen concentrations in seeds of rapeseed increased with N supply. The highest N concentration was obtained in the treatment receiving 220 N (kg/ha) (Tables 1 and 2).

### Conclusions

The two rapeseed cultivars (Amino and Sarigol) showed differences for nearly all variables measured. Rapeseed's yield performance in regard to planting date was distinctive for each year of this study and was largely attributed to seasonal weather differences. In general, planting rapeseed from 31 Mar to 11 Apr was optimal for Karaj.

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