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Effect of different sowing date on yield and yield components seed of spring rapeseed cultivars

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ABSTRACT: In order to determine the grain yield and other characters of spring rapeseed cultivars under varying sowing dates, an experiment was conducted at cultural experiment and research center, faculty of agriculture, Islamic Azad University, Khorasghan Branch, Isfahan. (latitude 32^{o} 40$^{/}$ N, longitude 51^{o} 58$^{/}$ E, and 1570 m elevation). The experimental design was a split plot in completely randomized block lay out with three replications. Four sowing dates (27 Feb, 9 Mar, 19 Mar and 28 mar) and four rapeseed cultivars (RGS003, PF7045-91, Option 500 and Hyola 401) as subplots. Results showed that the effect of sowing date on all experimental factors, was significant. Also, effect of cultivars number of grain per main silieques and oil seed rate, was significant. The interaction between sowing date and cultivar has significant effects on the number of grain per main silique, a thousand grain weight and oil percentage. In the view of the sensitivity of rapeseed to climatic factors especially to photoperiod and temperature, it is essential that sowing should be done on time, so that there have enough time for vegetative growth. According to the results obtained during two years, RGS003 cultivar at the first planting date recommended for sowing in Isfahan province.

***Keywords*:** Sowing date, Spring rapeseed, Yield and Yield components

INTRODUCTION

In many parts of the world, many species of the genus Brassica are consumed as vegetable (Ahmad et al., 2007), or use up as for its oil (Pass and Pierce, 2001). Yield response of rapeseed cultivar varies with different environmental variables, including planting dates, cultivars, planting density and N fertilizer. Ozer (2003) concluded that the yield differences measured for sowing dates were primarily due to the changes in branch numbers, pod numbers per plant, and 1000 seed weights. A demand for cultivars better suited to environmental condition and low input management systems, is necessary. Degenhardt and Kondra (1981) also suggested that delayed seeding resulted in a significant decrease in seed yield, harvest index, racemes per plant and racemes per unit area. Ghjobadi et al. (2006) concluded that Hyola-308 and Heros produced the highest (327.74 g.m^{-2}) and the lowest (203.26 g.m^{-2}) seed yields, respectively. In Isfahan province, because of lack knowledge about the best sowing date and cultivars of rape seed, more research is needed for better adaptation of new cultivars for developing genotypes and management systems combinations leading to high productivity. The key objectives of the present study were to determine the suitable sowing date to optimize cultivation criteria for production of new spring rape seed cultivars.

MATERIALS AND METHODS

In order to determine the grain yield and other characters of spring rapeseed cultivars under varying sowing dates, an experiment was conducted at cultural experiment and research center, faculty of agriculture, Islamic Azad University, Khorasghan Branch, Isfahan. (latitude 32^{o} 40$^{/}$ N, longitude 51^{o} 58$^{/}$ E, and 1570 m elevation). The

experimental design was a split plot in completely randomized block lay out with three replications. Four sowing dates (27 Feb, 9 Mar, 19 Mar and 28 mar) and four rapeseed cultivars (RGS003, PF7045-91, Option 500 and Hyola 401) as subplots. Long term average precipitation was 150 mm. Soil analysis was done at 0-30 cm, before plantation. On the basis of soil analysis, sand, silt and clay was 24%, 49% and 27%, respectively. Electerical conductivity (EC), pH and nitrogen was 1 dS/m, 7.65 and 0.09%. Available phosphorus and potassium was 40.2 ppm and 398 ppm, respectively. The soil preparation consisted of mouldboard ploughing (20-25 cm) followed by discing and smoothing with a land leveler. On the basis of soil analysis, the field was fertilized with 50 kg N per ha from urea. Top dressed urea was also applied at the rate of 50 kg N per ha at the beginning of the stem elongation stage of canola. Trifloralin (2.5 lit per ha) was used as pre-planting herbicide for control weeds. This herbicide was mixed with soil and fertilizer by low discing. The nitrogen fertilizer was used from urea (50 percent before planting and 50 percent in the beginning of reproductive phase). Each experimental plot had 8 planting rows with 30 cm space between rows, 5 meter length and seed distance in each row was 5 cm.The distance for main plots in order to fertilizer treatment were 2 m. Seed plantation was done by skillful workers on the basis of determinate sowing dates. Ten plants randomly were selected in each plot to measure experimental parameters. For evaluating the number of grain per main siliques, 10 siliques were selected from main stem. For calculation of a thousand grain weight after harvesting, 8 samples of 100 seeds in each plots was selected randomly and then the average of a thousand grain weight was multiple with 10. The crop was harvested manually when seed moisture reduced to 12%. Oil percentage was determined by nuclear magnetic resonance analyzer (NMR) (Omidi et al., 2010). Analysis of variance (ANOVA) was used to determine the significant differences. The Multiple Range Test of Duncan performed the separation means. All statistics was performed with MSTAT-C program (version 2.10).

RESULTS AND DISCUSSION

The effects of sowing date were significant on all traits, namely, the number of grain per silieques, 1000 grain weight, grain yield and oil percentage ($P<0.01$) (Table 1). The highest number of grain per main silieques was related to 28 Mar (17.61). The second sowing date (9 Mar) had the highest a thousand grain weight (3.59 g). The lowest a thousand grain weight was related to 28 Mar (2.13 g). However, the 1000 grain weight at 27 Feb was no significant difference compared to 19 Mar. With changing sowing date, each plant changed grain yield, expect the first and second sowing date, namely 27 Feb and 9 Mar. Under the first sowing date (27 Feb), the maximum grain yield was obtained, and there was no significant difference between 27 Feb and 9 Mar. The grain yield in 19 and 28 Mar, was 2058 kg and 1867 kg, respectively (Table 2). Early sowing dates resulted in higher grain yields that can be explained by higher number of grain per main silieques and a thousand grain weight. The highest and lowest oil percentage was related to 28 Mar (41.62%) and 19 Mar (36.89%), respectively. In the view of the sensitivity of rapeseed to climatic factors especially to photoperiod and temperature, it is essential that sowing should be done on time, so that there have enough time for vegetative growth. Cultivars had significant effects on the number of grain per main silieques and oil percentage ($P<0.01$). The effects of sowing date and cultivar on the number of grain per main silieques, a thousand grain weight and oil percentage were significant ($P<0.01$) (Table 1). The highest number of grain per main silieques was related to Hyola 401 (19.53). The maximum grain yield and minimum one was related to RGS003 and PF7045-91, respectively, but the difference between these cultivars was not significant (Table 2). Ghjobadi et al. (2006) reported that seed yield and yield components were significantly different among cultivars, so results obtained by this experiment contrary to those of Ghjobadi et al. (2006). The highest oil percentage was related to RGS003 (41.47%), and the lowest one was obtained by Option 500. The results indicated no significant differences in oil percentage between experimental cultivars (Table 2). On the basis of results, late sowing dates could produce high oil percentage despite of low grain yield, it maybe because of negative correlation between qualitative and quantitative seed parameters. The maximum grain yield and oil percentage was related to 27 Feb and PF7045-91, 28 Mar and Hyola 401, respectively (Table 2).

Table 1. Analysis of variance of different spring rapeseed cultivars

S.O.V	d.f	The number of grain per main silieques	A thousand grain weight	Grain yield	oil percentage
Replication	2	9.93	0.08	148397.52	4.62
Sowing date	3	27.98**	4.39**	1615205.63**	52.26**
Error (a)	6	0.21	0.04	44121.41	1.56
Cultivar	3	130.58**	0.14	46852.91	48.43**
Sowing date×Cultivar	9	32.83**	0.54**	15712.17	45.91**
Error (b)	24	0.20	0.07	35996.04	2.26

^{ns} non significant, *significant at 0.05 significance in F-tests, **significant at 0.01 significance in F-tests

Table 2. Mean comparison of different spring rapeseed cultivars

Treatment	The number of grain per main silieques	A thousand grain weight (g)	Grain yield (kg/ha)	oil percentage (%)
Sowing date (A)				
27 Feb (A1)	15.50b	2.87b	2686a	37.58b
9 Mar (A2)	17.13a	3.59a	2424a	38.51b
19 Mar (A3)	14.29c	2.65b	2058b	36.89b
28 Mar (A4)	17.61a	2.13c	1867b	41.62a
Cultivar (B)				
RGS003 (B1)	17.48b	2.88a	2340a	41.47a
PF7045-91 (B2)	15.77c	2.93a	2209a	38.24b
Option 500 (B3)	11.75d	2.79a	2211a	36.70b
Hyola 401 (B4)	19.53a	2.73a	2276a	38.19b
Sowing date×Cultivar(AB)				
A1B1	20.27b	3.94a	2877a	40.96abc
A1B2	12.17i	3.15abc	2645ab	37.29cde
A1B3	9.36j	2.73bc	2543abc	39.28bcde
A1B4	20.21b	2.02de	2679ab	32.78f
A2B1	16.18d	3.66a	2517abcd	42.17ab
A2B2	18.37c	3.30ab	2290bcdef	35.60ef
A2B3	14.36fg	3.85a	2433abcde	40.01bcd
A2B4	21.53a	3.56a	2457abcde	36.27def
A3B1	13.53gh	1.66e	2100cdef	39.94bcd
A3B2	19.50b	2.66bcd	2033def	39.88bcd
A3B3	8.26k	2.47cd	2000ef	27.95g
A3B4	15.85de	3.80a	2100cdef	39.80bcd
A4B1	19.94b	2.60cd	1867f	42.79ab
A4B2	13.06hi	2.63bcd	1867f	40.21abc
A4B3	15.02ef	1.76e	1867f	39.56bcd
A4B4	20.51b	1.55e	1867f	43.91a

Common letters within each column do not differ significantly

CONCLUSION

In suitable planting date, plants are completely use in environmental conditions. Rape seed exhibits a considerable variation in chemical and yield composition, that can be related to genotype as well as environmental parameters. Delayed planting maybe limits the size to which the crop grows before the change from vegetative to reproductive development. So, on the basis results, it seems that RGS003 had higher grain yield than other cultivars at the first sowing date (27 Feb) under climatic condition of Isfahan. The information provided by this experiment may be helpful for the recommendation of optimum sowing date and appropriate cultivar in rape seed production in similar climatic condition.

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