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The Study of Agronomical Traits of Spring Rapeseed Cultivars in Condition of Different Plantings Dates (Karaj region in Iran)

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ABSTRACT

The aim study of spring rapeseed cultivars reaction to autumn and winter plantings in mild cold area , a research was performed during 2005 and 2007 growing seasons in the l split plot experiment on the bases of Randomized Complete Block Design (RCBD) with four replications in Seed and Plant Improvement institute, Karaj, Iran. Treatments were included:

1-Planting season in two levels as main plots such as common planting dates autumn planting(7 October) and winter planting(6March).

2-Varieties as sub plots in 24 levels, including of RGS 003, Amica, Sarigol, Option 500, Hyola 401, Hyola 42, Hyola 60, Hyola 420, Hyola 330, Hyola 308, Kimberly, RGS 006, 19-H, Syn-3, PR-401.16, pp-401.15E, pp 308.8, pp 308.3, ORS 3150-3006, ORS 3150-3008, RG 4403, RG 405.03, RGAS 0324, RG 405.02.

The results showed that simple effects of planting season and variety and also interaction effect on seed yield was significant (P<0.01). Hyola 401 in common planting date (4178 kg/ha) had the highest seed yield .But RG405.03 in winter planting (2385 and 901.1 kg/ha) had the highest seed yield respectively.

Keywords: Rapeseed, Planting Season, Seed yield and its Components, Variety

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INTRODUCTION

Rapeseed (*Brassica napus* L., and *Brassica campestris* L.) are the important oilseed crops throughout the world which rank third among the oilseed crops after soybean and oil palm in production of vegetable oils, while fifth in the production of oilseed proteins [1]. Rapeseed is also important oilseed crops of Iran. The national requirement of edible oil is going to increase even further in the coming years due to high population growth rate and increase in per capita consumption. This huge import bill can only be reduced by increasing the domestic oilseed production. The production of oil seed in Iran is not high; about 80% of Iran's necessary oil is imported from foreign countries [2]. 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 [3]. Sowing time is an important factor that determines the length of growing season and hence yields. If planted in spring, they can be grown as summer crop but the seed yield would be decreased due to short growing season and lack of enough water at the end of growing season, thus, winter cropping is preferred. Early spring sowing of oil canola delayed flowering and reduced reflection of radiation during flowering which were important factors leading to the highest yields achieved by late sowing [4]. Planting time is one of the most important factors for maximizing canola yield especially in those areas where temperature, day length, rainfall and humidity vary throughout the year. Robertson *et al*., (1999) observed that yield declined with delay in sowing date i.e., the linear regression slope coefficient between sowing date and grain yield was negative and the average relative yield loss per week was -5.1 % [5]. A number of studies

have shown yield decline in canola with delay in sowing [6,7]. In addition, canola oil content has been found to de cline with later sowing [6]. Horton(2006), found that highest yield of canola was observed from earlier sowings [8]. Growth and yield are functions of a large number of metabolic processes, which are affected by environmental and genetic factors. Number of pod per plant recorded higher in 14 October sowing compared to 29th October, 13 November and 28 November sowing [9]. Seeding earlier than normal incorporates operational diversity into a cropping system that diversifies weed management systems [10]. The detrimental effects of insects and diseases on canola yields, as well as the effect of delayed sowing on production cost, have been reported [11].

MATERIALS AND METHODS

In order to investigation of spring rapeseed cultivars reaction to autumn and winter plantings in mild cold area , a research was performed during 2005 and 2007 growing seasons in the l split plot experiment on the bases of Randomized Complete Block Design (RCBD) with four replications in Seed and Plant Improvement institute, Karaj, Iran. Treatments were included:

1-Planting season in two levels as main plots such as common planting dates autumn planting (7 October) and winter planting (6March).

2-Varieties as sub plots in 24 levels, including of RGS 003, Amica, Sarigol, Option 500, Hyola 401, Hyola 42, Hyola 60, Hyola 420, Hyola 330, Hyola 308, Kimberly, RGS 006, 19-H, Syn-3, PR-401.16, pp-401.15E, pp 308.8, pp 308.3, ORS 3150-3006, ORS 3150-3008, RG 4403, RG 405.03, RGAS 0324, RG 405.02.

Each experimental plot consisted of four lines with line spacing of 4 meters, 30 cm and plant spacing on the line was 5 cm the two lateral lines are considered as marginal and 2, the middle line, to determine all the agronomical stages and different characteristics: seed number per pod, seed yield, content oil, oil yield, biological yield and harvest index were used. Also after the second year experiment combined analysis of variance was performed for the traits. Before the beginning of experiment, soil samples were taken in order to determine the physical and chemical properties. A composite soil sample was collected from depth of 0-30 and 30-60 cm. It was air dried, crushed, and tested for physical and chemical properties. The research field had a clay loam soil. The first top dressing distribution at 4-6 true leaf stage (135 urea $kg.ha^{-1}$) and the second was conducted at the time of reproductive organs appearance . Hand weeding was done at 4-6 true leaf stage as well as mid- stem elongation stage. At the end of growing season and prior to crop harvest, 10 plants were chosen randomly from each experimental unit and were cut from the surface. At physiological maturity stage, for determining the seed yield, the crop was harvested from a 4.8 m2 area per each plot and was left in the field for drying until constant weight (up to 12% moisture). In order to separate seeds form pod, a Trashing combine harvester was used. The harvested seeds from each experimental unit individually weighed with a precision scale and thereafter seed yield expressed as kg/ha. Finally, eight samples of 100 seeds were taken from each seed lot of the experimental units and then weighed. Their average multiplied by 10 recorded 1000-seed weight (g). In order to measure the seed oil percentage of each experimental plot, about 3 grams of seed was prepared and using an NMR apparatus, the oil percentage was measured. The said apparatus works based on the magnetic induction of hydrogen nucleus which is a spectrometry method. One of the advantages of this method is its being destructive which accelerates the speed and accuracy of measuring the seed oil content. Processed by the combined analysis of variance using MSTAT-C statistical software. Means comparison of the data was done by Duncan's multi-range test (DMRT) ($P<0.05$).

RESULTS AND DISCUSSION

Seed yield

This in study of Simple effects of planting season and varieties and also the interaction effect of planting season and varieties on seed yield, were significant ($P<0.01$)(Table 1). Fall planting (7 October) with mean 3355($kg.ha^{-1}$) towards the cultivation of winter (6 March) with an average of 1620($kg.ha^{-1}$), had a significant advantage. Varieties of this trait in the test groups were statistically different, so that variety of Syn-3 with mean 2982($kg.ha^{-1}$), maximum and variety of Sarigol with an average 1842($kg.ha^{-1}$) , allocated to the lowest number of seed yield (Table 2). The mean comparison of the interaction effect of planting season and varieties, Showed that the tested varieties planted in different seasons, different groups were compared in terms of the character. So that Hyola401 hybrid in autumn planting (7 October) with an average of 4178($kg.ha^{-1}$), the highest and varieties of Sarigol in winter planting (6 March)with an averaging 1064($kg.ha^{-1}$) ,the lowest number of oil yield was produced. Different researches indicate that through the delay in the sowing date, there occurs a decline in the seed yield [12]. Also in the autumn planting season (7 October), Hyola401 hybrid and in the winter planting season (6 March), varieties of RG405.03 , allocated to maximum the oil yield (Table 3). Jasinska *et al*., reported that seed yield decreased with delay in sowing date

[13]. In the study of Morrison and Stewart as well as genetic differences among the four varieties of canola seed yield has been reported [14,15].

Table (1). Mean squares of traits in the combined analysis of 24 varieties of spring rapeseed (2005-2007)

S.O.V	df	(MS)				
		Seed yield(Kg/ha)	Seed/Pod	Oil Content (%)	Biological yield(Kg/ha)	Harvest Index (%)
Year	1	**	**	**	**	**
Error	6	8792.4	3.14	3.8	927322.1	2.08
Planting Season	1	**	**	**	**	**
Year * Planting Season	1	ns	**	ns	**	**
Error	6	84020.7	1.56	4.1	618764.8	4.8
Variety	23	**	**	**	**	**
Year*Variety	23	**	**	**	**	**
Planting Season *Variety	23	**	**	ns	**	**
Year* Planting Season*Variety	23	**	**	**	**	**
Error	276	35940.1	0.88	1.45	731703.2	2.47
C.V. %	--	5.9	4.39	2.94	6.17	8.9

ns,,** respectively: non- significant , significance in level of 5 and 1 %*

Seed number in pod

This in study of Simple effects of planting season and varieties and also the interaction effect of planting season and varieties on seed number in pod , were significant (P<0.01)(Table 1). Fall planting (7 October) with mean 22 towards the cultivation of winter (6 March) with an average of 19.8, had a significant advantage. Varieties of this trait in the test groups were statistically different, so that variety of Kimberly with mean 24.15, maximum and variety of RG 405.03 with an average 17.05 , allocated to the lowest seed number in pod (Table 2). The mean comparison of the interaction effect of planting season and varieties, Showed that the tested varieties planted in different seasons, different groups were compared in terms of the character. So that Amica variety in autumn planting (7 October) with an average of 26.38, the highest and varieties of RG 405.03 in winter planting (6 March) with an averaging 14.8 ,the lowest number of seed number in pod was produced. Also in the autumn planting season (7 October), Amica variety and in the winter planting season (6 March), varieties of PP-401.15E, allocated to maximum the seed number in pod (Table 3). In this regard, Rao *et al*, (1991) reported that the ability of different cultivars of rapeseed seeds inside the pod is different and number of seeds per pod, the risk factors and determinants of seed yield in canola [16].

Oil content

This in study of Simple effects of planting season and varieties (P<0.01) but ,the interaction effect of planting season and varieties on oil content, were non-significant (Table 1). Fall planting (7 October) with mean 45.81 towards the cultivation of winter (6 March) with an average of 42.04, had a significant advantage. Varieties of this trait in the test groups were statistically different, so that variety of Option 500 with mean 45.59, maximum and hybrid of Kimberly with an average 41.43 , allocated to the lowest oil content (Table 2). The mean comparison of the interaction effect of planting season and varieties, Showed that the tested varieties planted in different seasons, different groups were compared in terms of the character. So that Option 500 variety in autumn planting (7 October) with an average of 47.33, the highest and varieties of Kimberly variety in winter planting (6 March) with an averaging 38.44 ,the lowest number of oil content was produced. Also in the autumn planting season (7 October), Option 500 variety and in the winter planting season (6 March), varieties of RGS003, allocated to maximum the oil content (Table 3). M. R. I. Mondal *et al*.(2011) reported oil percentages in seeds were higher in the seeds of early plantings but it was reduced due to delayed planting. The highest oil content in seed was recorded from November 01 planting and the lowest oil content in seed was recorded from November 30 planting [17].

Biological yield

This in study of Simple effects of planting season and varieties and also the interaction effect of planting season and varieties on biological yield, were significant (P<0.01) (Table 1). Fall planting (7 October) with mean 16990(kg) towards the cultivation of winter (6 March) with an average of 7988(kg), had a significant advantage. Varieties of this trait in the test groups were statistically different, so that variety of of Syn-3 with mean 13870 (kg), maximum and hybrid of Hyola 42 with an average 9638(kg) , allocated to the lowest oil content (Table 2). That is, delayed planting dates lead to a reduction in seed yield by decreasing assimilate transition efficiency to economical sinks (grains) [18]. The mean comparison of the interaction effect of planting season and varieties, Showed that the tested varieties planted in different seasons, different groups were compared in terms of the character. So that Syn-3 variety in autumn planting (7 October) with an average of 20250 (kg), the highest and varieties of Hyola42 variety in winter planting (6 March) with an averaging 3958(kg) ,the lowest number of oil content was produced. Also in the autumn planting season (7 October), Syn-3 variety and in the winter planting season (6 March), varieties of PP-

401.15E, allocated to maximum the oil content (Table 3).

Harvest index

This in study of Simple effects of planting season was non-significant but, Simple effects of varieties and the interaction effect of planting season and varieties on harvest index, were significant (P<0.01) (Table 1). Fall planting (7 October) with mean 19.23 towards the cultivation of winter (6 March) with an average of 18.43, had a significant advantage. Varieties of this trait in the test groups were statistically different, so that variety of of PP-401.15E with mean 20.73, maximum and Sarigol variety with an average 15.64 , allocated to the lowest harvest index (Table 2). The mean comparison of the interaction effect of planting season and varieties, showed that the tested varieties planted in different seasons, different groups were compared in terms of the character. So that RG405.02 variety in autumn planting (7 October) with an average of 26.69, the highest and varieties of Option 500 variety in winter planting (6 March) with an averaging 14.71 ,the lowest number of harvest index was produced. Also in the autumn planting season (7 October), RGS 3150-3008 variety and in the winter planting season (6 March), varieties of RG405.02, allocated to maximum the oil content (Table 3). Johnson *et al*., compared the various sowing dates of canola and reached the conclusion that the delay in sowing decreases the harvest index considerably [19]. Stapper & Fischer reported that late sowing date resulted in a shortening of the per-flowering period and decreases in seed yield, harvest index and yield component [20].

Table (2).Main Comparison of Studied Traits in Spring Rapeseed Cultivars (2005-2007 years)

Treatment	**Seed yield (Kg.ha^{-1})**	**Seed/Pod**	**Oil Content (%)**	**Biological yield(Kg/ha)**	**Harvest Index (%)**
Planting Date					
Autumn (7Oct.)	3355a	23.1a	42.8a	17501a	19.16a
Winter (6 *March*)	1620b	19.8b	39.2b	10241b	16.16b
Cultivar					
RGS 003	2382f	22.1ef	40.9d-k	13140jkl	17.8c-f
Amica	2254fg	24.4a	41.1c-j	13990fgh	16.04gh
Sarigol	1842h	19.6j	40.2h-l	12650klm	14.38i
Option 500	2373f	21.6e-i	42.8a	13430g-h	17.26d-g
Hyola 401	2677d	23.4bc	41.6b-e	13390g-j	18.83bc
Hyola 42	2371f	23.1bc	40.5g-l	12200m	19.24ab
Hyola 60	2241fg	18.1k	41.9a-d	13330hij	16.08gh
Hyola 420	2532e	21.4f-i	42abc	13930f-i	18.52bcd
Hyola 330	2727cd	23.6b	42.1ab	14060fg	18.23b-e
Hyola 308	2188g	21.9efg	41.1b-h	12560lm	17.5def
Kimberly	2396f	23.7ab	40.1jkl	13240ijk	17.79c-f
RGS 006	2781cd	20.1j	41.2b-h	14900de	18.49b-e
19-H	2373f	22.3de	40.4g-l	14320ef	15.86h
Syn-3	2982a	21.8e-h	41.1b-i	16270a	18.14b-e
PR-401.16	2320fg	22.8cd	41.3b-g	13390g-j	16.76fgh
PP-401.15E	2821bcd	22.1hi	40.6e-l	15020cd	18.88bc
PP 308.8	2315fg	22.2de	40.5f-l	13890f-i	16.16gh
PP 308.3	2868abc	21.3ghi	41.5b-f	15860ab	17.98b-f
ORS 3150-3006	2238fg	21.6e-i	39.8l	13400g-j	16.17gh
ORS 3150-3008	2960ab	18.1k	40.46g-l	14420def	20.13a
RG 4403	2253fg	21.1i	41.35b-g	12560lm	17.87c-f
RG 405.03	2786cd	17.3l	40.1i-l	15590bc	18.41b-e
RGAS 0324	2281fg	23.2bc	41.3b-g	13040jkl	17.19efg
RG 405.02	2735cd	18.3k	39.9kl	14300ef	20.12a

For a given means within each column of each section followed by the same letter are not significantly different (p < 0.05).

Table(3).The means Comparison of Interaction Effects of Planting Date and Cultivars(2005 2007 years)

Cultivar	Seed yield (Kg.ha^{-1})		Seed/Pod		Oil Content (%)		Biological yield(Kg/ha)		Harvest Index (%)	
	Autumn	Winter	Autumn	Winter	Autumn	Winter	Autumn	Winter	Autumn	Winter
RGS 003	3318e-h	1446rst	23.45de	20.75m-q	42.53b-e	32.3k-p	17550e-h	8734v	18.92d-j	16.68m-q
Amica	2642k	1865nop	27.08a	21.8h-m	42.65b-e	39.4k-p	16090gkl	11900op	1649n-q	15.59pqr
Sarigol	2620k	1064v	20.73m-q	18.51s	42.27b-g	38.28n-q	16450ijk	8844uv	16opq	12.76t
Option 500	3203f-j	1543qr	22.35f-k	20.9m-q	44.6a	41.03f-i	17490e-h	9370tuv	18.33f-n	16.19opq
Hyola 401	4178a	1177uv	24.94b	22g-l	43.26bcd	40.07i-l	19380b	7401w	21.57ab	16.1opq
Hyola 42	3248f-i	1493rs	25.01b	21.27k-o	42.95b-e	38.05pq	15720kl	8682v	20.68bcd	17.8g-o
Hyola 60	3306e-h	1175uv	18.84rs	17.48t	43.56abc	40.27ijk	18040c-f	8625v	18.37f-n	13.79sd
Hyola 420	3038ij	2027mno	22.85e-i	20.05pq	43.08b-e	40.93g-j	17000g-j	10860qr	17.88g-o	19.15c-i
Hyola 330	4150a	1304stu	25.1b	21.15g-l	43.69ab	40.53h-k	19380b	8745v	21.44b	15.02qrs
Hyola 308	2654k	1722pq	24.05bcd	19.8qr	42.83b-e	39.54j-o	15360l	9755stu	17.28i-b	17.72g-o
Kimberly	3404d-g	1388r-u	24.76bc	22.8e-i	41.97d-g	38.13opq	18040c-f	8448v	18.93d-j	16.65m-q
RGS 006	3611bcd	1952mno	23.04d-g	17.11t	42.77b-e	39.78i-m	18530bcd	11270pq	19.52c-g	17.47h-p
19-H	3474cde	1272tu	22.19e-h	21.77i-m	42.1c-g	38.8l-q	18280cde	10350rs	19.01d-j	12.71t
Syn-3	4141a	1824op	22.11g-l	21.55j-n	43.03b-e	39.2k-p	20780a	11770opq	19.94b-f	16.34opq
PR-401.16	3376efg	1264tuv	23.55de	22.15g-l	42.96b-e	39.67i-n	17550e-h	9234tuv	19.26c-h	14.26rst
PP-401.15E	3632bc	2010mno	23.75cde	18.56s	42.64b-e	38.68l-q	17410e-i	12640no	20.88bc	16.88l-p
PP 308.8	3257fgh	1373r-u	24.11bcd	20.3opq	42.44b-e	38.74l-q	17670d-g	10100rst	18.46e-m	13.86st
PP 308.3	3599bcd	2138m	24.09bcd	18.58s	43.58abc	39.6j-n	18890bc	12830n	19.03d-j	16.94k-p
ORS 3150-3006	3126hij	1350r-u	23.35def	19.9q	42.35b-f	37.42q	16640h-k	10170rst	18.8e-k	13.54st
ORS 3150-3008	3791b	2129m	20.55n-q	15.61u	42.64b-e	38.29n-q	16430ijk	12420no	23.08a	17.17j-p
RG 4403	3007j	1500rs	21.99g-l	20.1pq	42.92b-e	39.79i-m	15970kl	9161uv	18.85d-j	16.89l-p
RG 405.03	3187g-j	2385l	19.81qr	14.8u	41.74e-h	38.56m-q	17260f-i	13930m	18.59e-l	18.23f-n
RGAS 0324	3151hij	1411rst	23.75cde	22.65e-j	42.63b-e	40.05i-l	16940g-j	9141uv	18.64e-l	15.75pqr
RG 405.02	3411def	2060mn	21.11l-p	15.5u	42.27b-g	37.7q	17180f-i	11420pq	19.95b-f	20.3b-e

For a given means within each column of each section followed by the same letter are not significantly different ($p < 0.05$).

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