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Evaluation of Qualitive and Quantitive Traits of Canola (*Brassica Napus* L.) in Different Sowing Dates and Regions

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Abstract

In order to study Evaluation of qualitive and quantitive traits of canola, an experiment was conducted during 2011. The results from variance analysis indicated that regions of cultivation had significant effect on all of studied traits, except the content of proteins. Also Torbat-jam region had better seed yield rather than Taybad. However, there were identical trends about seed yield changes in two regions, but there were significant differences between genotypes regard to seed production. As Hyola-401 and Mudena genotypes had the most and the least seed yield in both regions, respectively. Although, it is revealed that delay in cultivation lead to reduce most of agronomical traits such as seed yield. Also, the results from correlation coefficients indicated positive and significant relations between seed yield vs traits: number of sub-branches, number of seed in pod, 1000 seed weight and oil contents, whereas negative and significant relation vs number of seed in pod, pod length, and protein contents. Altogether, according to the results, Hyola 401 genotype can be recommended to cultivate in two regions; in this way, the best sowing date is September in Torbat-jam region, whereas it can be delayed until October in Taybab region.

Keywords: Canola, Delay cultivation, Yield and Yield Components

INTRODUCTION

Canola is the best oil seed candidate to cultivate in all over the world due to excellent characteristics such as tolerance to cold, salt and water deprivation stresses and lack of sensivity to soil culture, high capability to competing with weeds; Canola after soybeen is the second oil plant in the world [4]. Sownig date in the autumn cultivation of canola is verey important. There is a direct correlation between select of perfect sowing date with geographic status and local metereological conditions. Frostbite is a one of the effective ecological factors on delay cultivatioin in autumn crops. The cold resistance plants nessesary to reach enough growth and storage before beginning cold seasons. According to proper adaption of canola cultivars to different ecological conditions, Sun and colleagues [9] concluded that it is important to choose the best genotype reaching to maximum of yields. Christmas [2] said that canola genotypes react to weather conditions widely; at least he concluded the response of canola cultivars to region is very different. According to ferry and colleague's studies [5] about effects of sowing dates on seed yield, they reported that delaying in cultivation will reducing seed yield significantly. Generally, our studies indicated that there are significant interactions between genotypes with environmental parameters. So, the presence study will evaluate three genotypes performance at different sowing dates in two regions simultaneously and it is determined the most effiecient sowing date in each climate.

MATERIALS AND METHODS

In order to study Evaluation of qualitive and quantitive traits of canola, an experiment was conducted in Taybad and Torbat-jam regions during 2010-2011. Taybad region locate in 34'.45" Latitude, 60'.46" longitude and 900.4 meters above sea level. Torbat-Jam region locate in 35'.15" Latitude, 60'.35" longitude and 950.4 meters above sea level. Chemical and physical characteristics of soil in experimental field and Meteorological statistics duration period of canola in Taybad and Torbat-Jam field stations are showed in table 1 and 2, respectively.

The experimental design was a split plot arranged in RCBD with three replications. Three sowing dates (6 September, 7 October and 6 November) were assigned to main plots and three canola genotypes (Hyola401, Zarfam and Mudena) were randomized to subplots (Hyola401 is a spring and hybrid genotype (single cross) and cultivate in warm and moist regions commonly. However, Mudena and Zarfam are winter genotypes and cultivate in cold and moderate regions commonly). The agronomical operations include prepration of farm, cultivation, sowing date and genotypes selection was performd in both regions, identically. In each region, the plot has eight rows (5 m lenght). Distance between each row was 25 cm and Seeds implanted on rows by 8 centimeters distances from each others. To evaluate traits, 10 plants were selected randomly. Then the averages of the traits were used to statistical calculations in SAS ver. 9.12.

RESULTS

The results of variance analysis showed that the cultivation regions had significant effects on all studied traits except protein content. Also, the results of means comparison indicated significantly difference in all traits (table 3). Generally, the Hyola401 genotype in both regions had the best performance especially about seed yield.

The results of means comparison for sowing dates indicated that delaying in cultivation led to reduction of most traits espetially seed yield in both regions; but there were no significant effects between different sowing dates (table 4).

The results of interaction between genotypes and sowing dates in region of Torbat-jam indicated that Hyola401 had the best performance in all traits except number of seed in pod, pod length and protein percent cultivar, when is cultivated at 6 September; whereas Mudena genotype had the worst performance in most traits
especially seed yield when is cultivated at 6 November (table5).

Interaction between genotypes and sowing dates in Taybad indicated that Hyola401 had the most performance in the majority of traits especially seed yield when is cultivated at 6 October and 7 November; whereas Mudena had the least performance in the majority of traits except seed number in pod, pod length and peotein content when is cultivated at each three sowing dates (table6). The results of correlation coefficients indicated that there are significant and positive correlations between seed yield with some traits such as: number of sub-branch, number of pod, 1000 seed weight, oil percent; whereas there are significant and negative correlation between seed yield with some traits such as: number of seeds in pod, length of pod and protein percent (table7).

DISCUSSION

Regard to the results of study, the genotypes of canola indicated variable reflections in regions; hence it is impotant to determine the most efficient genotypes of canola in each region and to select the appropriate times for planting. It has been showed genotypes are significant in all traits that it cleared genetic differences between genotypes. Also it is determined delay in sowing date lead to decrease in all traits especially in plant height, number of pod and number of seed in pod, due to environment conditions and growth period affect on these traits violently. There was positive correlation between seed yield and these traits, so increasing in each traits lead to increase the seed yield. Jenkins and Leitch [6] believed that delay in cultivation of canola caused to decrease vegetative period, perception of solar radiation and temperature, subsequent lead to decrease in plant height and sub-branch significantly. Ozer [7] after studing different sowing tes in canola stated that the number of sub-branches and seed yield decreased in later sowing dates. Also, Si and Walton [8] showed that delay in cultivation decrease seed yield and number of pod, while it increased number of seed in pod strongly; because there was negative correlation between number of seed in pod and number of pod in plant. Diepenbrock [3] stated that probably, since appropriate culture leads to decrease number of seed in pod, this event caused to increase number of pod to compensate more produced seed. Also, they know that delay in cultivation will decrease 1000 seed weight, probably due to short period of photosynthetic transition and unfavourable conditions at the end of growing season. Anyway, Champan and colleagues [1] emphasised that decreasing the seed yield and seed weight are due to lost of green leaves as magor photosynthetic tissues in the delay cultivations. Whitfield [10] stated that high temperature in seed production stages leads to increase in pod metabolism and cellular respiration, subsequent lead to waste the energy storage and phytosynthetic materials of plants. So seeds will receive less photosynthetic materials and the percent of light weight and hollow seeds will increase. In this study, it observed negative relations between oil and protein percent; also there was a positive and negative relation between seed yield with oil and protein percent, respectively. So can be said that increasing of oil content will increase seed yield whereas decreasing the protein content increase seed yield. Generally, the plants in which seed yield intensively is affected by yield components, like canola, improving these traits directly improve seed yield; So these traits are known as main components and effective traits to enhance seed yield. Ozer [7] proposed that some traits such as number of pod, number of seed in pod and 1000 seed weight are key factors and determining seed yield potential of the genotypes.

Table 1. Chemical and physical characteristics of soil in experimental field

Region	Components of soil Texture (%)			EC mmohs/cm^2	PH
	Silt (%)	Clay (%)	Sand (%)		
Torbat-Jam	10	30	60	3.8	7.2
Taybad	11	31	58	4.2	7.8

Table 2. Meteorological statistics duration period of canola in Taybad and Torbat-Jam field stations during 2010-2011

Meteorological Parameters	September		October		November		December		January		February		March		April		May	
	Taybad	Torbat-Jam	Taybad	Torbat-Jam	Taybad	Torbat-Jam	Taybad	Torbat-Jam	Taybad	Torbat-Jam	Taybad	Torbat-Jam	Taybad	Torbat-Jam	Taybad	Torbat-Jam	Taybad	Torbat-Jam
Average Min. temperature ºC	16	15	15	15	11	10	7	3	3	5	4	5	11	9	12	15	20	19
Average max. temperature ºC	33	30	32	32	28	27	22	18	14	17	14	20	20	26	29	31	34	34
Average temperature ºC	24	22	23	24	20	19	14	10	9	11	9	12	15	18	21	23	27	26
Precipitation (mm)	0	0	0.3	0.1	3.9	4.5	6.3	6.8	26.4	33.1	15.5	18.6	9.1	8.5	1.1	1.3	0	0

Table3. Means comparison of cultivars in Taybad and torbat-jam regions

genotypes	Plant height (cm)	Number of sub-branch	Number of pod	Number of seed in pod	1000 Seed weight (g)	Pod length (cm)	Pod diameter (mm)	Oil percent	Protein percent	Seed yield (kg/ha)
Torbat-jam										
Mudena	131.7 a	4.1 c	119.0 b	15.0 a	3.1 b	6.0 a	3.9 c	37.9 b	26.2 a	1636.7 c
Hyola401	119.8 a	5.9 a	157.7 a	10.2 c	4.0 a	5.1 b	6.0 a	40.4 a	23.5 b	2705.9 a
Zarfam	102.7 b	4.8 b	142.5 a	12.3 b	3.5 ab	5.4 ab	5.0 b	39.6 a	24.3 b	2345.3 b
Taybad										
Mudena	131.6 b	2.1 c	87.6 b	19.3 a	2.1 b	6.8 a	4.6 a	36.0 c	26.1 a	1438.8 b
Hyola401	164.4 a	3.9 a	122.1 a	15.0 b	3.0 a	6.4 a	3.0 b	38.5 a	25.0 b	2437.2 a
Zarfam	145.0 b	3.0 b	92.2 b	18.1 a	2.3 a	6.2 a	4.3 a	37.2 b	23.6 c	1588.4 b

Table 4. Means comparison of sowing dates in Taybad and torbat-jam regions

genotypes	Plant height (cm)	Number of sub-branch	Number of pod	Number of seed in pod	1000 Seed weight (g)	Pod length (cm)	Pod diameter (mm)	oil percent	Protein percent	Seed yield (kg/ha)
Torbat-jam										
6 September	124.3 a	5.2 a	143.7 a	12.8 a	3.6 a	5.2 b	5.3 a	39.3 a	24.7 a	2310.4 a
7 October	115.6 a	5.0 a	143.0 a	12.4 a	3.5 a	5.9 a	5.2 a	39.3 a	24.8 a	2305.7 a
6 November	114.2 a	4.6 a	132.4 a	12.4 a	3.4 a	5.4 ab	4.4 a	39.2 a	24.5 a	2071.8 a
Taybad										
6 September	152.7 a	3.1 a	96.8 a	18.6 a	2.2 a	6.5 a	3.9 a	37.3 a	24.3 a	2038.8 a
7 October	149.6 a	3.1 a	108.7 a	16.8 a	2.5 a	6.6 a	3.9 a	37.3 a	25.0 a	1876.1 a
6 November	138.8 a	2.9 a	96.4 a	16.9 a	2.7 a	6.2 a	4.2 a	37.1 a	25.4 a	1549.5 a

Table 5. Interactions between sowing date and cultivar in Torbat-jam region

genotypes	Sowing times	Plant height (cm)	Number of sub-branch	Number of pod	Number of seed in pod	1000 Seed weight (g)	Pod length (cm)	Pod diameter (mm)	oil percent	Protein percent	Seed yield (kg/ha)
	6 September	141.1 a	4.2 cd	128.3 ed	15.5 a	3.2 bc	5.8 b	4.4 ed	37.9 cd	25.8 ab	1847.2 cde
Mudena	7 October	130.3 ab	4.3 c	118.0 e	14.3 b	3.3 bc	6.5 a	4.1 ed	37.5 d	26.2 a	1630.4 ed
	6 November	123.7 abc	3.7 d	110.3 e	15.1 ab	2.6 c	5.7 b	3.3 e	38.3 cd	26.6 a	1432.4 e
	6 September	131.7 ab	6.2 a	170.3 a	9.9 e	4.2 a	4.7 c	6.0 ab	40.6 a	23.3 e	2786.7 a
Hyola401	7 October	122.3 abc	6.0 a	162.3 ab	10.4 e	4.0 ab	5.5 b	6.5 a	40.1 a	23.8 ed	2570.6 ab
	6 November	105.3 cd	5.4 b	140.3 cd	10.5 e	3.6 ab	5.2 bc	5.5 abc	40.6 a	23.4 ed	2760.5 ab
	6 September	100.3 d	5.2 b	130.3 cde	11.7 d	3.4 b	5.2 bc	5.5 abc	39.5 ab	25.0 bc	2297.1 bc
Zarfam	7 October	119.8 c	4.7 c	150.7 abc	12.5 cd	3.3 bc	5.7 b	5.1 bcd	40.4 a	24.4 cd	2716.2 ab
	6 November	113.7 bcd	4.6 c	146.7 bcd	12.7 c	3.8 ab	5.4 b	4.4 cd	38.9 bc	23.4 ed	2022.6 cd

Table 6. Interactions between sowing dates in three genotypes in Taybad region

genotypes	Sowing dates	Plant height (cm)	Number of sub-branch	Number of pod	Number of seed in pod	1000 Seed weight (g)	Pod length (cm)	Pod diameter (mm)	oil percent	Protein percent	Seed yield (kg/ha)
	6 September	138.7 abc	2.5 ed	90.0 cd	20.6 a	1.9 d	6.2 b	4.6 ab	36.5 c	25.9 ab	1431.7 c
Mudena	7 October	130.3 bc	1.7 f	98.7 bcd	18.1 c	2.2 d	6.5 ab	4.7 ab	35.4 d	26.4 a	1439.9 c
	6 November	125.7 c	2.1 ef	74.0 d	19.2 b	2.1 d	5.7 b	4.5 ab	36.2 cd	26.0 ab	1444.9 c
	6 September	170.3 a	4.2 a	108.3 abc	15.5 d	2.7 bc	7.3 a	3.5 c	38.8 a	24.0 ed	2647.1 a
Hyola401	7 October	161.7 ab	4.1 a	133.7 a	15.1ed	3.1 ab	6.6 ab	3.1 cd	38.5 a	25.3 bc	2559.9 a
	6 November	161.3 ab	3.5 b	124.3 ab	14.4 e	3.3 a	6.5 ab	2.5 d	38.0 ab	25.7 ab	2104.6 b
	6 September	149.0 abc	2.6 ed	92.0 cd	19.8 ab	2.0 d	5.9 b	3.7 bc	36.6 c	23.0 e	2037.8 b
Zarfam	7 October	156.7 abc	3.4 bc	93.7 cd	17.4 c	2.3 cd	6.8 ab	3.8 bc	37.8 ab	23.2 e	1628.4 c
	6 November	129.3 bc	3.0 cd	91.0 cd	17.0 c	2.8 b	6.5 ab	5.5 a	37.1 bc	24.5 cd	1098.9 d

Table 7. Correlation coefficients among traits in three canola genotypes

	Number of sub-branch	Number of pod	Number of seed in pod	1000 Seed weight	Pod length	Pod diameter	Oil percent	Protein percent	Seed yield
Plant height	0.35	0.36	-0.46	0.37	-0.71 **	0.67 **	0.39	-0.02	0.10
Number of sub-branch	1	0.90 **	-0.94 **	0.91 **	-0.54 *	0.48 **	0.94 **	-0.45	0.76 **
Number of pod		1	-0.92 **	0. 93 **	-0.56 *	0.42	0.87 **	-0.36	0.77 **
Number of seed in pod			1	-0.94 **	0.56 *	-0.47 *	-0.91 **	0.35	-0.72 **
1000 Seed weight				1	-0.54 *	0.44	0.83 **	-0.33	0.65 **
Pod length					1	-0.62 **	-0.52 *	0.25	-0.34
Pod diameter						1	0.41	-0.34	0.23
oil Percent							1	-0.51 *	0.83 **
protein Percent								1	-0.54 *

* : P < 0.05 and ** : P < 0.01

CONCLUSION

The results of expriment revealed that the trend of seed yield changes in canola genotypes was similar at both regions, whereas there were significant different between genotypes. Following, it is observed that decreased most agronomical traits, especially seed yield; due to delay in cultivation. Among studied traits, the protein content was a constant trait, because of being indifferent to changing in regions, sowing dates and genotypes. Moreover, the protein and oil contents had negative relation by each other. Finally regarding to acquire results, it can be concluded Hyola401 genotype is the best candidate for both studied regions (Taybad and Torbat-jam) and the best sowing date in Torbat-jam is September but it can be delayed to October in Taybad.

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