Available online www.ijpras.com

International Journal of Pharmaceutical Research & Allied Sciences, 2020, 9(3):41-45

Research Article

ISSN : 2277-3657
CODEN(USA) : IJPRPM

Evaluation of Traits Affecting Yield and Components of Yield in Different Cultivars of Canola under Cold Climate Conditions

Zabihollah Mohammad Alipour [1]*, Behrouz Mir Darikvand [2]

[1] *Department of Agriculture Biotechnology Payame Noor University (PNU), P.O. Box, 671-81395, Isfahan, Iran.*

[2]*Department of Agriculture, Faculty of Agriculture, Karaj Branch, Islamic Azad University, Karaj, Iran.*

Corresponding Author

ABSTRACT

To investigate the yield of different cultivars of canola and selection of cultivars with high production and appropriate to cold areas of Lorestan Province, an experiment was carried out in a complete randomized block design with 13 cultivars and 4 lines and three replications in Biranshahr area of Khorramabad city in the crop year of 2017-2018. The results of the analysis of variance showed that plant height, number of siliques, number of seeds per silique, number of secondary branches, pod length, 1000-seed weight, and seed yield were significant in different cultivars of canola. Comparing of the means revealed that the highest yield with 4745 kg/ha belonged to Atura cultivar and the lowest yield with 2042 kg/ha belonged to Ahmadi cultivar. Out of 17 cultivars and lines of study, the cultivars and lines of Atura, X-Power, line 144, Brutus, line 1008, Nepton and Extertum had superior yield compared with other cultivars and lines. To assess the stability of these cultivars and lines in other areas, similar studies are recommended.

Key words: *canola, yield, yield components, cold climate.*

INTRODUCTION

Planting of canola for oil production has been considered in Iran since the 1990s. The existence of spring and winter growth types of canola has caused this plant to show high adaptation to different environmental conditions. With approximately 40-50% oil, canola seed is considered as a valuable source for the provision of edible oil. Also, planting canola in alternation with grains through the management of weeds, pests, and diseases increase the production of these products. Autumn planting of canola and the use of seasonal precipitation have made this plant use lower surface and underground water resources in comparison with other oil seeds such as sunflower, soybeans, and sesame that are cultivated in spring. This issue is crucial in the current status of Iran, which suffers from a water shortage crisis [1]. In light of climate diversity, Lorestan Province is one of the most prone parts of Iran to develop the planting of this product. A wide area of the agricultural lands of this province is located in areas with cold winter, so evaluating and identifying the genotypes adaptable to these areas and investigating the yield traits have a particular priority.

Investigation on the components of yield due to the availability and ease of measurement has always been considered in the analysis of seed yield [2]. Many studies have been conducted on the correlation of important agronomic traits on canola plant and introduced the traits of 1000-seed weight, the number of seed in silique, and the number of silique in the plant as the most important traits with high correlation in yield [3, 4]. Christmas

(1996) observed that canola cultivars react highly to climate conditions [5]. Sun et al (1991) concluded that different cultivars are adaptable to certain climatic conditions, so the choice of cultivar for production is important [6]. Algan and Ilgan (2001) introduced the traits of several siliques per plant, number of seeds per silique, harvest index and 1000-seed weight as the most important factors affecting the seed yield of canola [7]. Majidi et al (1970) reported that seed yield with the traits of the number of silique per plant and number of seeds in silique and 1000-seed weight had the highest contribution in justifying seed yieldn. Kandil et al (1995) reported that the number of siliques in the plant had a significant effect on the 1000-seed weight of canola [8]. Taylor and Smith (1992) stated that the number of siliques in the surface unit and the number of seeds per silique were the most important factors of seed yield in different cultivars of canola, but the role of siliques in the surface unit or plant is higher in improving seed yield [9]. Therefore, the number of siliques in the plant has the highest effect on increasing yield. Ghush and Mukhupadha (1994) in a study on the seed yield components in canola reported that 1000-seed weight had a slight positive and direct effect on the yield [10]. Hakan and Unsal (1999) reported the number of pods per plant had a positive and direct effect and had the highest effect on the yield compared to other traits [11]. Dipenbrook (2000) observed that the number of seeds and silique has a positive and significant correlation with length of silique so that as the silique is longer, the seed yield will be higher [12]. However, Rahimi and Uzuni Doji (2014) stated that pod length has a negative and significant correlation with yield [13]. The number of seeds in silique showed a direct negative effect on seed yield. In a study on 30 canola genotypes with different origins, Khan et al. (2000) reported the correlation between seed yield and plant height, number of secondary branches and number of siliques in the plant 0.03, 0.39, 0.28, respectively [14]. Sharif and Koshta (2006) stated that there was a positive and significant correlation between the number of secondary branches and seed yield of canola [15]. This study aimed to assess the relationship between different traits and seed yield of different cultivars of canola under cold climate conditions and determine the best cultivars of planting and determination of cultivars with high yield potential.

METHODOLOGY

The number of 13 cultivars and 4 lines of canola (Table 2) were cultivated in the crop year of 2017-2018 (September 14) in Biranshahr region, 40 km distant from northeast of Khorram Abad city with a North latitude of 33° and 37′and eastern Longitude of 48° and 33′and 1663 meters above the sea level. The experiment was carried out as a complete randomized design with three replications. Before planting, the land preparation, including tillage was done with a decal plow and a disking operation was performed. Based on soil test results (Table 1), 150 kg/ha of triple superphosphate (TSP) chemical fertilizer before planting was added to the soil and was mixed with soil with a light disk. 300 kg/ha urea fertilizer was used in three stages, 25% at *cotyledon* stage along with conventional irrigation, 40% in the stem elongation and 35% in the complete budding stage [1]. Each of the experimental plots was considered four meters long, consisting of 8 planting lines with 25- cm spacing lines and the plant spacing on 8 cm lines (based on the density of 50 plants per square meter) was considered. To record the characteristics of the studied traits, including plant height, number of seeds per silique, number of secondary branches, number of siliques, and silique length, 10 plants were randomly selected from each plot in the stage of 50% of the change in the color of pods, and the mentioned traits were measured. To calculate the seed yield and 1000-seed weight of each plot, after removal of a marginal line from each side of plots in the stage of 70% of the pods' maturity (seed moisture of about 25%), a surface with 2 square meters was selected and harvested. To achieve about 10 moisture content of the seeds, the plants were placed against the sun for one week and then weighing operation was carried out. The needed statistical calculations were performed using MSTAT-C computer software. To compare the means, Duncan's multi-range test ($P \leq 0.05$) was used.

Table 1: Soil chemical traits

Absorbable potassium (mg/kg of soil)	Absorbable phosphorus (mg/kg of soil)	Organic carbon (%)	Soil electrical conductivity	Soil reaction
320	12.7	0.98	0.77	8

Table 2: Cultivars and lines used in the study

Cultivar number	Cultivar name	Cultivar type	Growth type
1	Nepton	hybrid	winter

2	hydromill	hybrid	winter
3	1009	Open pollination	winter
4	966	Open pollination	winter
5	Danob	hybrid	winter
6	Ahmadi	Open pollination	winter
7	Oktano	hybrid	winter
8	Rohan	hybrid	winter
9	Atura	hybrid	winter
10	Okapi	Open pollination	winter
11	144	Open pollination	winter
12	Nima	Open pollination	winter
13	Garu	hybrid	winter
14	Brutus	hybrid	winter
15	1009	Open pollination	winter
16	Extertum	hybrid	winter
71	X-power	hybrid	winter

RESULTS AND DISCUSSION

The results of the analysis of variance showed that there was a significant difference between cultivars and lines cultivated in terms of plant height, number of seeds per siliques, number of secondary branches, number of siliques, silique length, 1000-seed weight and seed yield at the probability level of 1% (Table 3). The results of comparing the means showed that the highest height of plant with 150.6 cm belonged to X-power cultivar, the maximum number of seeds per silique with 28.27 seeds belonged to Oktano cultivar, the highest number of secondary branches with 7.867 branches belonged to Nepton cultivar, the highest number of siliques with 96.53 siliques belonged to Atura cultivar, the longest silique with 6.157 cm belonged to Rohan cultivar, the highest 1000-seed weight with 4.5 g belonged to cultivar and line of Brutus and 1003 and the highest seed yield with 4745 kg belonged to Atura cultivar. Also, the lowest height of plant with 108.7 cm belonged to Ahmadi cultivar, the minimum number of seeds per silique with 14.77 seeds belonged to Danob cultivar, the lowest number of secondary branches with 4.133 branches belonged to line 966, the lowest number of siliques with 30.63 siliques belonged to line 1009, the shortest silique with 4.147 cm belonged to line 966, the minimum 1000-seed weight with 3.733 g belonged to line 966 and the lowest seed yield with 2042 kg belonged to Ahmadi cultivar (Table 4).

Results of the simple correlation between traits (Table 5) showed that there is a significant positive correlation between plant height and seed yield (0.404) at 1% probability level. In a study conducted on different cultivars of canola in cold and temperate regions, Akhundi et al (2006) reported a positive and significant correlation between plant height and seed yield, which is in line with the results of this study. There was a significant and negative correlation (-0.337) between the number of seeds per silique and seed yield at 5% probability level. It seems that with increasing the number of seeds per silique, the availability of photosynthetic materials for each seed to decrease, resulting in a reduction in 1000-seed weight and a reduction in seed yield. Ali et al. (2003) did not observe a significant correlation between the number of seeds per silique and yield of each plant in canola. Moreover, Safi Khani et al. (2016) reported a negative and significant correlation between the number of seeds per silique and 1000-seed weight in the canola plant [16]. A positive correlation (0.370) was observed between the number of secondary branches and seed yield. Increasing the number of secondary branches increases the number of formation of siliques in the plant on one hand and increases the yield by photosynthesis and increasing the photosynthetic materials on the other hand. Sharif and Koshta [15] reported a significant and positive correlation between the number of secondary branches and seed yield of canola. This result is in line with the result of the present study. There was a positive and significant correlation between 1000-seed weight and plant yield of canola (0.722) and a positive and significant correlation was observed between the number of seeds per silique and silique length (0.514). Dipenbrook (2000) observed that the number of seeds per silique

was significantly and positively correlated with silique length. Algan and Ilgan (2001) introduced a 1000-seed weight trait as one of the most important factors affecting seed yield of canola. Also, Rusta Baghi et al. (2012) and Sabaghnia et al. (2010) introduced 1000-seed weight as one of the most important traits with high a correlation in yield.

Table 3: Analysis of variance of studied traits of 17 cultivars and lines of canola

Mean squares								
Source of variations	df	Plant height	Number of seeds per silique	Number of secondary branches	Number of siliques	Silique length	1000-seed weight	Seed yield
replication	2	6.075	2.963	0.615	9.342	0.140	0.010	13006.020
Cultivar	16	**464.180	**46.207	**2.913	**1035.472	**0.812	**0.210	**2044638.061
error	32	9.110	3.931	0.265	30.557	0.053	0.020	26417.374
Coefficient of variations (%)	-	2.46	9.99	8.93	8.42	4.43	3.42	4.61

** Significant at 1% probability level

Table 4: Comparison of mean traits of 17 cultivars and lines of canola

Cultivars and lines	traits						
	Plant height	Number of seeds per silique	Number of secondary branches	Number of siliques	Silique length	1000-seed weight	Seed yield
Nepton	d119.8	def19.03	a7.867	ef64.10	cdef5.363	ab4.267	b4083
Hydromill	c132.3	cde21.00	e5.133	cd75.83	efgh5.030	ab4.300	c3568
1008	d120.4	efg17.60	5.067	bc78.77	defg5.307	a4.500	b4165
966	f109.3	efg17.80	f4.133	fg56.80	j4.147	e3.733	de2904
Danob	ef112.6	g14.77	de5.600	h46.43.	hi4.710	de3.833	c3416
Ahmadi	f108.7	cd21.77	ef5.000	de67.90	bcd5.563	cd4.000	g2042
Oktano	ef113.8	a28.27	de5.667	ab587.50	ab5.963	cde3.967	e2797
Rohan	b138.3.	bcd22.340	de6.000	bc81.67	a6.157	ab4.367	c3528
Atura	c133.1	bcd22.23	cd6.467	a96.53	cde5.457	ab4.273	a4845
Okapi	b142.5	efg17.90	de5.533	bc81.53	ij4.440	bc4.133	d3124
144	d120.2	efg18.13	ef5.000	bc80.83	gh4.917	a4.433	b4300
Nima	de117.5	ab25.73	e5.267	ef61.40	abc5.757	de3.800	fg2257
Garu	f110.5	fg15.36	bc6.933	de67.87	efgh5.123	ab4.300	c3628
Brutus	ef112.4	fg15.43.	ab7.733	i34.63	cdef5.377	a4.500	b4271
1009	d120.4	bcd22.20	e5.467	i30.63	hi4.840	de3.800	f2420
Extertum	d123.1	g14.80	de5.733	gh48.43	fgh4.957	ab4.400	b4030
E-power	a150.6	bc23.10	e5.333	ef62.33	cdef5.360	ab4.367	a4600

The means followed by a common letter in each column do not have a significant difference at the 5% probability level

Table 5: simple correlation coefficient between traits studied

Traits	1	2	3	4	5	6	7
1-plant height	1						
2-number of seeds per silique 3-number of secondary branches	0.208	1					
	—0.050	—0.120	1				
4- number of siliques	*0.342	*0.302	—-0.108	1			
5-silique length	0.101	**0.514	*0.301	*0.275	1		
6-1000-seed weight	*0.344	—0.247	**0.381	0.256	0.232	1	

7- seed yield	**0.404	—*0.337	**0.370	0.229	0.013	**0.722	1

*and**, respectively, have significant correlation at 5% and 1% probability level.

REFERENCES

1. Nagashzadeh, M., Canola Agriculture (planting, grazing, and harvesting), Lorestan Agricultural Jihad Organization, agricultural extension cooperation management, 2017; P. 22.
2. Peyman, Kh., Taghavi, D., Effect of winter cold on quantitative and qualitative traits of different canola cultivars in Zanjan. Research in Crop Ecosystems, 2015; 2 (1): 105-112
3. Rosta-baghi, B., H. Dehghani, B. Alizadeh and N. Sabaghnia. 2012. Variation and evaluation of the relationship between yield and yield components of rapeseed using multivariate methods. Journal of Crop Production and Processing, 2: 53-62.
4. Sabaghnia, N., H. Dehghani, B. Alizadeh and M. Moghaddam. 2010. Interrelationships between seed yield and 20 related traits of 49 canola (Brassica napus L.) genotypes in non-stressed and water-stressed environments. Spanish Journal of Agricultural Research, 8: 356-370.
5. Christmas E. P. 1996. Evaluation of planting date for winter canola production in Indiana. Pp. 139-147. In: J. Janic (ed), Progress in New Crop. ASHS Press, Alexandria, VA.
6. Sun W. C., Q. Y. Pan, X. An, and Y. P. Yang. 1991. Brassica and Brassica – related oilseed crop in Gansu, China. In: McGregor. D. I. (ed). Proceedings of the Eighth International Rapeseed Congress, Saskatoon, Canada. Pp. 1130-1135.
7. Algan, N. and H. Aygun. 2001. Correlation between yield and yield components in some winter rape genotypes. The Journal of Ege University, Agricultural Faculty, 38: 9-15.
8. Kandil, A. A., Malandes, S. I., Mahrous, N. M. 1995. Genotypic and phenotypic variability, heritability and interrelationship of some characters in oilseed rape (Brassica napus L.). Plant breed Abs. 65 (9): 50.
9. Taylor A. J. and Smith C. J. 1992. Comparative physiology of divergent type of winter rapeseed, In: Proceeding of International Canola Conference of Saskatoon, Canada.
10. Ghosh, D. C. and D. Mukhopadhyay. 1994. Growth and productivity of Indian rapeseed (B. compestris L.). Growth under short and mild winter condition of west Bengal. Indian Journal of Agricultural Research, 28: 239-244.
11. Hakan-ozer, E. O. and D. Unsal. 1999. Relationships between yield and yield components on currently improved spring rapeseed cultivars. Turkish Journal of Agriculture and Forestry, 23: 603-607.
12. Diepenbrock, W. 2000. Yield analysis of winter oilseed rape (Brassica napus L.). A review. Field Crops Research., 67: 35-49.
13. Rahimi, M., Uzuni Doji, A. Study of Relationship between Yield and Some Physiological Traits of Spring Canola Cultivars, Crop Physiology, Islamic Azad University of Ahvaz, 2014; 6 (23) 67-83
14. Khan, A., M. I. Khan and S. Riaz. 2000. Correlation and path coefficient analysis contributing parameters in Brassica napus. Pakistan Agricultural Research, 16: 127-130.
15. Sharief, A. E., Keshta, M. M. Influence of sowing date and plant density on growth and yield of canola (Brassica napus L.) under salt affected soils in Egypts. Scientific Journal of King Faisal University (Basic and Applied Sciences). 2006 ; 3 (1): 65-78.
16. Safifkhani, S., Biabani, A. Faraji, A., Rahemi Karizi, A., Gholizadeh, M., Azarnia, M. Evaluation of Yield and Yield Components of Canola Spring Cultivars Affected by Planting Dates and Different Nitrogen Fertilizer Levels, Applied Research in Plant Ecophysiology, 2016; 3 (2): 53-66.