American-Eurasian J. Agric. & Environ. Sci., 9 (4): 436-439, 2010
ISSN 1818-6769

Yield Differences of *Brassica* Oilseed Rape Cultivars Based on Physiological Parameters

[1]Abdollah Youssefi, [1]Artash Nshauian and [2]Mehdi Azizi

[1]Armenian State Agrarian University
[2]Center of Agricultural and Natural Resources Research of Khorasan-e Razavi, Mashhad, Iran

Abstract: This investigation was conducted to study yield differences of 9 cultivars of *B. napus*, *B. rapa* and *B. juncea* species at the Center of Agricultural and Natural Resources Research of Khorasan-e Razavi, Mashhad, Iran on 2008-2009. Data analysis showed that there were significant differences among cultivars of canola for all measured traits (Plant height, branches per plant, pod number per plant, seed number per pod, 1000 seeds weight, plant dry weight at pod formation stage and seed yield), except total dry matter at flowering stage. Means comparison showed that the highest number of seeds per pod was related to cultivars of *B. napus* and the lowest one was belonged to cultivars of *B. juncea.* Totally, the highest yield was obtained from cultivars of *B. napus, B. rapa* and *B. juncea* species, respectively. Correlation coefficients of measured traits showed that plant height and seed numbers per pod produced 54% of seed yield fluctuations among cultivars of different species of canola.

Key words: *B. napus* · *B. rapa* · *B. juncea* · Spring rape seed

INTRODUCTION

Oil seeds are the second source of world food after cereals. Canola is one of the most important oil plants at the world and according to FAO statistics it is the third source of vegetative oil after soybean and palm [1, 2] and 14.7% of total vegetative oil production is produced by canola [1, 3, 4, 5, 6].

Oil and fat consumption per capita is 17.4 kg in Iran. Iran's population is 70 million people, therefore 1218000 tones vegetative oil is required per year and 90% of this need is imported, mean while Iran has potential to increase oil seeds production [6, 7, 8]. There is 3 species containing *Brassica napus*, *B. rapa* and *B. juncea* from *Brassica* genus that have vegetative oil value, respectively. *Brassica napus* and *B. rapa* are adapted to temperate regimes with high humidity, but *B. Juncea* is adapted to hot and dry weather [8, 2, 9]. Canola has different names like; rapeseed, colza, turnip, rape and candle. Traditional rapeseed, single zero, double zero and triple zero are cultivars that have lower erucic acid and glucosinolate content, so, their oil quality increase, respectively [1, 3, 5].

This investigation has been done on yield variation of different cultivars of spring canola resistant to low temperatures that is part of PhD thesis (article writer) as "Effect of drought stress on agronomic and physiological characteristics and some nutrient element concentrations in spring canola", in order to extent cultivation of oil seeds by introducing high yield cultivars that are adapted to dry land conditions.

MATERIALS AND METHODS

Nine spring Canola cultivars (Table 1) were studied in a randomized complete block design with 6 replications in the Center of Agricultural and Natural Resources Research of Mashhad, Iran on 2008-2009. Elevation of the location for this research was 985 m and its average rainfall was 286 mm. Its latitude was 36° and 12′ and its longitude was 59°and 38′.

Each plot had 8 lines with 30 cm distance between rows and length of each line was 6 m. plant density was 93 plants/m^2 that planted by seed drilling machine.

Plant height, branches per plant, pod number per plant, seed numbers per pod, 1000 seeds weight, plant dry weight at flowering and pod formation and seed yield were measured and analyzed by SAS (V. 9.0) and Minitab (v. 13) software.

Some unusual heavy rainfall occurred during the growing season of this plant on March, April and May that changed climate circumstances of the region.

Corresponding Author: Abdollah Youssefi, Armenian State Agrarian University
E mail: abdollah.youssefi@yahoo.com & dr.youseffi@gmail.com.

Table 1: spring canola cultivars

Brassica napus	*Brassica rapa*	*Brassica juncea*
C_1=Hyola 401	C_6= Goldrush	C_8=Landrace
C_2 =Hyola 330	C_7 = Parkland	C_9= B.P. 18
C_3 =RGS 003		
C_4 = Sarigol		
C_5 = Zarfam		

RESULTS AND DISCUSSION

Analysis of variances showed that there were significant differences among nine cultivars for all traits except for plant dry matter at flowering stage (Table 2).

Means comparison showed that the highest plant height and pod numbers per plant was related to varieties of *B. juncea* species that shows positive relationship between these two traits (Table 3). The highest seed yield was obtained for *B. napus* cultivars and after that was related to *B. rapa* and *B. juncea*, respectively. Seed numbers per pod and 1000-seed weight in cultivars of *B. napus* were higher than the others, so that can be the main cause of yield increase of *B. napus* cultivars (Table 3).

Although, cultivars of *B. juncea* species had high number of pods per plant, but their seed yield were low because of their lower seed numbers per pod and 1000-seed weight (Fig 1, 2, 3 and 4).

Correlation coefficients for measured traits (Table 4) showed that there was negative correlation between plant height and 1000-seed weight that is significant at 1%

Table 2: Summery of analysis of variances for measured traits

			Mean of squares						
Source of variation	Degree of freedom	Seed yield	plant dry weight/ pod formation	plant dry weight in flowering	1000-seed weight	Seed numbers per pod	Pod numbers per/planttt plant	Branches per plant	Plant height
Block	5	179202.08^{ns}	0.021^{ns}	0.244^{ns}	1.232*	0.419*	0.133^{ns}	10.354**	184.166^{ns}
Varieties	8	3957787.61**	0.268*	0.133^{ns}	1.514**	0.536**	0.434**	2.217*	2105.208**
Error	40	88581.95	0.112	0.131	0.419	0.120	0.126	0.768	254.208
Total	53	866211.06	0.127	0.139	0.604	0.211	0.173	1.890	520.204
Coefficient of variation(%)		10.08	9.00	14.14	22.97	11.43	6.71	17.93	10.12

^{ns}: Non-significant, * and **: significant statistically at 5% and 1% level, respectively.

Table 3: Means comparison for measured traits

Row	varieties	Seed yield	Plant dry weight at pod formation	Plant dry weight at flowering	1000-seed weight	Seed numbers per pod	Pod numbers per plant	Branches per plant	Plant height (cm)
1	Hyola 401	4238.1^{a}	37.5^{bc}	13.64^{a}	2.87^{ab}	30.44^{a}	228.7^{abc}	4.7^{bc}	^{de} 133.3
2	Hyola 330	4030.5^{a}	46.39^{bc}	13.26^{a}	3.37^{a}	23.44^{abc}	215.06^{abc}	4.8^{bc}	127.5^{e}
3	R.G.S003	3310.4^{b}	40.50^{bc}	14.86^{a}	3.18^{a}	29.17^{a}	212.89^{abc}	4.7^{bc}	147.5^{cd}
4	Sarigol	3233.5^{b}	41.94^{bc}	16.97^{a}	2.70^{abc}	22.94^{ab}	160.50^{c}	4.2^{c}	147.5^{cd}
5	Zarfam	2587.6^{c}	67.78^{a}	15.22^{a}	2.95^{a}	28.94^{a}	160.72^{c}	4.3^{c}	^{ab} 169.2
6	Goldrush	2715.7^{c}	37.78^{bc}	14.85^{a}	3.40^{a}	23.56^{ab}	140.78^{c}	4.7^{bc}	149.2^{cd}
7	Park land	2417.7^{cd}	33.83^{c}	12.15^{a}	2.82^{abc}	17.38^{bc}	197.06^{bc}	6.1^{a}	159.2^{bc}
8	Landrace	1885.1^{e}	55^{ab}	11.69^{a}	2.00^{c}	15.00^{bc}	304.28^{ab}	5.6^{ab}	177.5^{ab}
9	B. p. 18	2152.1^{de}	41.39^{bc}	12.38^{a}	2.08^{bc}	13.22^{c}	328.83^{a}	5.1^{abc}	181.66^{a}

^{ns}: Non-significant, * and **: significant statistically at 5% and 1% level, respectively.

Table 4: Correlation coefficients of measured traits

measured traits	Plant height	Branches per plant	Pod numbers per plant	Seed numbers per pod	1000-seed weight	Plant dry weight at flowering	Plant dry weight at pod formation
Branches per plant	0.162^{ns}						
Pod numbers per plant	0.109^{ns}	0.317^{*}					
Seed numbers per pod	-0.139^{ns}	0.037^{ns}	-0.288^{*}				
1000-seed weight	**-0.418	-0.032^{ns}	-0.116^{ns}	0.153^{ns}			
Plant dryweight at flowering	-0.157^{ns}	-0.243^{ns}	-0.121^{ns}	0.053^{ns}	0.146^{ns}		
Plant dry weight at pod formation	0.090^{ns}	-0.156^{ns}	-0.080^{ns}	-0.010^{ns}	-0.190^{ns}	0.010^{ns}	
Seed yield	**-0.693	*-0.278	-0.133^{ns}	0.354^{**}	* 0.287	0.010^{ns}	-0.111^{ns}

^{ns}: Non-significant, * and **: significant statistically at 5% and 1% level, respectively.

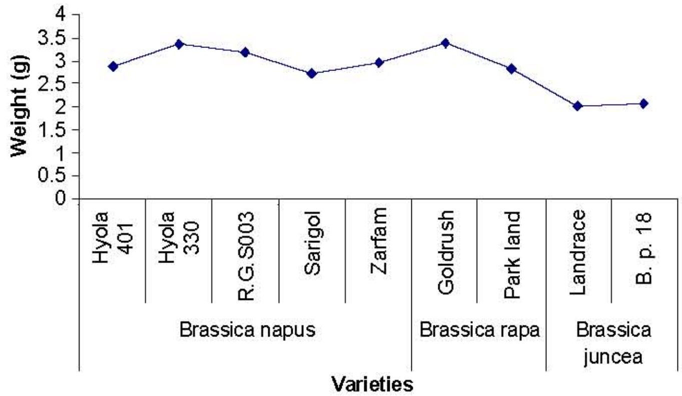

Fig. 1: Trend of 1000 seeds weight in different species of *Brassica*

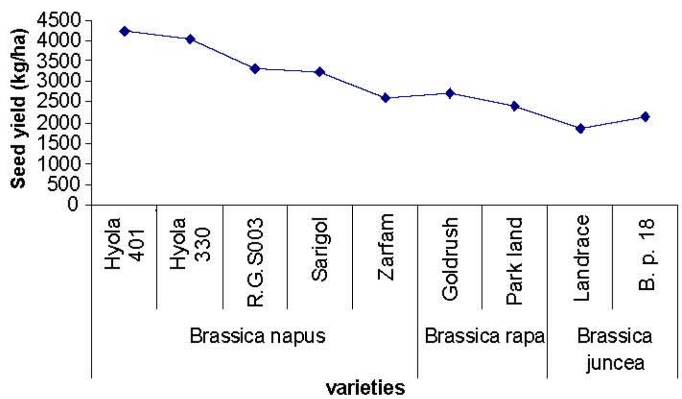

Fig. 2: Trend of seed yield in different species of *Brassica*

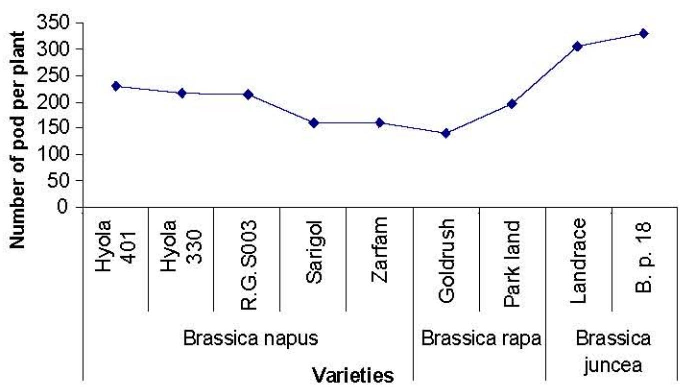

Fig. 3: Trend of pod number per plant in different species of *Brassica*

level. The reason for this correlation was that by increasing plant height more assimilate is allocated to vegetative growth than pods and seeds [3, 7, 9]. There was positive correlation between pod number per plant and branches that was significant at 5% level, but correlation between yield and branches was negative. Correlation coefficient of pod numbers per plant and seed numbers per pod was negative and significant at 5% level. On the other hand, seed numbers per pod was decreased by increasing pod numbers per plant. Also, correlation coefficient between seed numbers per pod and yield was positive and significant at 1% level. So, screening of cultivars with higher seed number per pod can led to increase of yield per unit area.

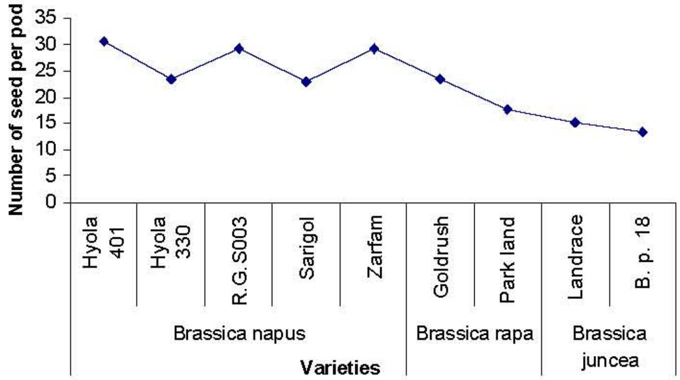

Fig. 4: Trend of seed number per pod in different species of *Brassica*

Step wise regression showed that 54% of fluctuation of seed yield as dependent variable among different varieties is happened by variation of two traits, plant height and seed numbers per pod that is corresponded with Ahmadi *et al* [1], Habe Kotte [7] and Kimber and Mebreyor [8]. Totally, results of this research were:

- Varieties of *Brassica napus* had the highest yield and varieties of *B. rapa* and *B. Juncea* had lower seed yield, respectively.
- Varieties of *Brassica napus* had the highest seed numbers per pod and 1000-seed weight, but varieties of *B. Juncea* had the lowest seed numbers per pod and 1000-seed weight that can be the main reason for seed yield differences among varieties of different species.
- Seed yield per unit area was decreased by increasing plant height that show more assimilate allocation for vegetative growth in varieties by increase of plant height.
- Unusual rainfalls in spring in 2009 led to vegetative growth of varieties and their lodging. So, remobilization of assimilates to pods and seed disturbed that led to decrease of 1000-seed weight and yield.
- Extension of cultivation of spring canola resistant to low temperature in arid and semi-arid regions on the basis of regional research according to the limitations of water resources, date of planting and etc, is necessary for sustainable production and increase of resources use efficiency.

REFERENCES

1. Ahmadi, M., A. Khajeh attari, F. Javidfar, B. Alizadeh, H. Amirioghan, M. Aalam-e khomaram and S. Azizinia, 2006. Results of canola breeding research in 2004-2005. Institute of Plant and Seed Breeding and Supplying of Karaj, Iran.
2. Niknam S.R., Q. Ma and D.W. Turner, 2003. Osmotic adjustment and seed yield of *Brassica napus* and *B.juncea* Genotypes in a Water–Limited Environment in South–Western Australia. Australian J. Experimental Agriculture. No 43: 1127-1135.
3. Bhow mik, T.P., 2003. Oilseed *Brassica:* constraints and their management. CBS Publishers and Distributors.
4. Food and Agriculture Organization. 2007. Crop production statistics. http//www.fao.org.
5. Solimanzadeh, H., N. Latifi and A. Soltani, 2007. Relationship among phonology, physiological traits and seed yield in different canola varieties under dry farming conditions. Agri. Sci. and Natural Resources J., pp: 14.
6. Azizi, M. and A. Falah-e Toosi, 2001. Results of canola breeding and improvement designs in Khorassan province, Iran. Center of Agricultural and Natural Resources Research of Khorasan-e Razavi, Mashhad, Iran.
7. Habe Kotte, B., 1997. Option for increasing seed yield of winter oilseed rape (*Brassica napus* L.): A simulation study. Field Crops Res., 54: 109-126.
8. Kimber, D.S. and D.L. Mebreyor. 1995. *Brassica* Oilseeds, Production and Utilization. CAB Publisher.
9. Rasteghar, M.A., 2004. Agronomy of Industrial Plants. Brahmand Publication.