I J T A
© Serials Publications
National Academy of Agricultural Science (NAAS) Rating : 3.03

Study of Yield and Yield Components of Different Canola (*Brassica napus* L.) Varieties during Different Planting Dates in Urmiyeh

Mehdiyeh Fallah[1], Esmail Nabizadeh[1*], Abdollah Hassanzadeh Qurt Tappeh[2]

ABSTRACT: *In order to study the effects of planting date on yield and yield components of canola (Brassica napus L.) a factorial experiment arranged in RCB design with three replications was carried out in 2012-13. The first factor, planting dates, were 6th of September, 7th of October and 6th of November. The second factor, cultivars, were Hyola308, Hyola330, Hyola60, Talayeh, Okapi and spring RGS). The studied traits were plant height, number of secondary branches, number of siliques per plant, number of siliques per silique, 1000 kernel weight, grain yield, oil content and oil yield. The results of the analysis of variance showed that the effect of planting date on all traits except the number of secondary branches was significantly different (pd"0.01). the highest grain yield (4785 kg/ha) resulted from the planting date of September 6th. The effects of cultivar were significantly different (pd"0.01) on all traits. The highest number of seeds per silique and siliques per plant resulted from the planting date of September 6th and the Talayeh cultivar (26 seeds and 95 siliques, respectively). The interaction of (planting date×cultivar) was significantly different (pd"0.01) on all traits except plant height and 1000 kernel weight.*

Key Words: *Planting Date, Canola, Yield and Yield Components, Urmiyeh*

INTRODUCTION

Canola is a plant susceptible to planting date. Therefore, the determination of an accurate planting date in any region is important to the plant's production. Generally speaking, canola must be planted six weeks before the start of freeze (-4 °C) (Rudy *et al*, 2010). Too late or too early planting dates are not suitable. In delayed planting date the seed germination is retarded and the number of emerged seedlings is small. According to research findings the delayed planting date causes yield loss in many plants (Uzan, 2009). Studies show that the interaction between different canola cultivars and the environment is significant. Therefore, to obtain suitable grain and oil yield we need cultivars which are compatible with the intended region's climate. Thus, by selecting suitable cultivar and planting date in different areas the loss caused by adverse environmental conditions can be reduced (Bhuiyan *et al.*, 2008). Number of secondary branches per each plant is affected by planting date and is reduced by delayed planting date (Rudy *et al.*, 2010). Reportedly the effect of planting date on the number of secondary branches and the interaction between genotype and planting date with secondary branches were negative and significantly different (Hokmalipour *et al.*, 2011).

In canola the number of siliques is of great importance on which the grain yield depends to a great extent because after flowering with decreasing plant leaf area the siliques play an important role in photosynthesis. The number of siliques has a strong correlation with grain yield so that delayed planting by shortening flowering period decreases number of bearing branches resulting in decrease in number of siliques per plant (Rabiee *et al.*, 2010).

Pods per plant and seeds per pod influence the oil yield and delayed planting reduces oil yield by reducing the number of pods (Shargi *et al.*, 2011). In a certain variety delayed planting date causes increase in number of seeds per silique. Greater number of siliques in early planting dates causes competition at the time of seed primordia formation and according to relative effect of yield components on each other

1 Department of Agroecology, Mahabad Branch, Islamic Azad University, Mahabad, Iran
2 Center of Natural Resources and Agricultural Research , West Azerbaijan
Corresponding Author: Email: esmaeil_nabizadeh@yahoo.com

the number of seeds per silique decreases (Razmi, 2009).

The effect of planting date on the number of siliques per plant and the number of seeds per silique have been studied by Hokmalipour *et al* (2011) and their findings showed that delayed planting date reduced the number of seeds per silique. But the effect of cultivar and the interaction between cultivar and planting date with the number of siliques was not significant.

The least 1000 kernel weight occurs in plants which are planted later resulting in yield loss (Bhuiyan *et al.*, 2008). The studies on qualitative traits show that the interaction between cultivar and environment is significant in traits less affected by heredity (Khan *et al*, 2008).

Sidlauskas *et al* (2003) showed that planting date influences the oil content and delayed planting reduces the oil content and if grain filling encounters warm weather the oil content and quality will reduce.

The purpose of this study was to define the best planting date for canola variety and their interaction between Canola variety and planting date to achieve high yield under field condition in West Azerbaijan province (Urmiyeh) in Iran.

MATERIALS AND METHODS

Study Side

The study was carried out in Sadatlou Station of Urmiyeh Agricultural Research Center in Iran(during 2013, growing season). The station lies between latitudes 37°44'18" and 44° N, and longitudes 45°10'95" E and its elevation is 1338 m above the free waters level.

Experimental Design and Treatments

The experimental design was split plot arranged in RCB with three replications.

The main factor (a) contained three planting dates of September6th, October7th and November6th. The second factor (b) contained six canola cultivars of Hyola 330, Hyola 60, Hyola 308, Talayeh, Okapi and spring RGS. The experiment had 54 plots. After the field preparation operation the seeds were sowed in four 2m-long lines. The lines were 50cm apart. Before planting as much as 50kg/ha of nitrogen (as urea), 100kg/ha P2O5 (as Ammonium Phosphate) and 200 kg/ha of N (as urea) at two stages of stemming and flowering were, according to the soil test, applied to the field as a top dress.

The weeds were controlled by hand several times.

Sampling and Measurement Traits

During the growing season, the traits of plant height, number of lateral branches, number of siliques per plant, number of seeds per silique (based on an average of 10 random plants), 1000 kernel weight, grain yield, oil yield and oil content were measured.

Statistical Analysis

Statistical analysis and drawing graphs were performed using MSTAT-C and Excel programs.

RESULTS AND DISCUSSION

Number of Lateral Branches

According the results of analysis of variance the effect of planting date on the number of lateral branches was not significant but the effect of cultivar on the number of lateral branches was significantly different ($p \leq 0.01$). The interaction between planting dates and cultivars with the number of lateral branches was significant (Table 1).

Means comparison showed that the greatest number of lateral branches (20 branches) belonged to the first planting date (September 6 th) and Talayeh and the lowest (six branches) belonged to the last planting date (Nevember 6 th) and Hyola 308 (Fig. 1).

According to Farias *et al* (2007) the plants planted at earlier dates will have more vegetative growth than those planted at later dates. The rosette formation at earlier dates and in cold weather results in more lateral branches while at later planting dates the plant enters the reproductive phase more rapidly and the it will not have the possibility of more vegetative growth including increase in the number of lateral branches.

Plant Height

The results of analysis of variance (Table 1) show that the effects of planting date and cultivar on plant height are significantly different ($p \leq 0.01$). The interaction of planting date and cultivar with plant height was not significant.

The results of means comparison (Table 2) show that the greatest ant the lowest plant heights were seen at planting date of September 6th (76.6 cm) and November 6th (45.23 cm), respectively. The planting date of November 6 th was not significantly different from the second planting date (October 7 th).

According to Kassab *et al.* (2012) the effect of planting date on the height of chickpea was significant. They explained that this significant effect was due to optimum use of precipitation during growth stages leading to increase in plant height.

Number of Siliques per Plant

The results of analysis of variance (Table 1) showed that the planting date, cultivar and their interaction with the number of siliques per plant were significantly different at p≤0.01. The results of means comparison made by Dunkan's method (Fig. 2) showed that the greatest number of siliques was obtained from the planting date of September 7th and Talayeh cultivar with 95 siliques which was not significantly different from spring RGS. The lowest number of siliques was obtained from the planting date of November6th and Hyola330 cultivar with 10 siliques which was not significantly different from Hyola60, Okapi and spring RGS.

Delay in planting date, by decreasing flowering period, reduces number of fertile branches per plant leading to decrease in siliques per plant. The results conform with those of Hokmalipour *et al* (2011). They concluded that delay in planting leads to decrease in number of siliques per plant.

Number of Seeds per silique

The results of analysis of variance (Table 1) showed that the planting date, cultivar and their interaction with the number of seeds per silique were significantly different at p≤0.01. According to Fig. 3 the greatest number of seeds per silique was obtained from the planting date of September 6th and Talayeh cultivar with 26 seeds and the lowest number of seeds per silique was obtained from the planting date of November 6th and Hyola60 with nine seeds per silique which was ot significantly different from the cultivars Hyola330 and Hyola 308.

In canola the number of siliques per plant is an important trait on which the grain yield is highly dependent because after flowering with decrease in leaf area, the siliques play an important role in photosynthesis. Number of siliques has a high correlation with grain yield (Ilikaii and Imam, 2003). Rabiei *et al* (2010) reported that delay in planting, by decreasing flowering period, reduces the number of fertile branches per plant leading to decrease in the number of siliques per plant.

1000 Kernel Weight

The analysis of variance (Table 1) showed that the effects of different planting dates and cultivars were significant at p≤0.01. But the interaction between planting date and cultivar with 1000 kernel weight was not significant. According to means comparison (Table 2) the greatest 1000 kernel weight (4.03 g) belonged to the first planting date (September 6 th) and the lowest (3.5 g) belonged to the third planting date (November6 th).

Low temperature during growth stages, lower absorption and shorter reproductive period along

Table 1
Combined analysis of variance of studied traits in different sowing times and canola genotypes

		MS							
S.O.V.	*df*	*Plant height*	*Number of branch*	*Number of pod per plant*	*Number of seed per pod*	*1000 seed weight*	*Seed yield*	*Oil percent*	*0il yield*
Block	2	437.77^{ns}	0.14^{ns}	0.2^{ns}	0.42^{ns}	1.64**	102181.27**	0.397**	25081.75^{ns}
Sowing Date	2	549.77**	0.49^{ns}	11**	314.62**	2.37**	36138456.85**	259.32**	5725883.32**
Error	4	220.93	0.12	0.01	2.37	0.33	26760.31	2.84	8980.53
Genotype	5	1467.14**	0.57**	0.32**	80.35**	0.41**	5659136.04**	44.07**	674620**
SD *G	10	184.58^{ns}	0.29**	0.18**	**14.71	0.35^{ns}	1204122.95**	4.21**	1656686.1**
Error	30	93.74	0.02	0.09	1.67	0.52	16356.1	0.53	2799.83
Total	50								
CV		17.14	6.66	2.64	7.13	6.34	6.72	1.98	7.32

* and **: significant at p≤0.05 and p≤0.01, respectively.
ns: no significant difference

Table 2
Mean comparison of different sowing dates on some of studied traits

Treatment	*Plant height*	*1000-seed weight*	*Oil percent*	*Oil yield*
6 September	76.6[a]	4.03a	39.43a	1289.64a
7 October	51.8[b]	3.83b	38.91b	718.24b
6 November	45.23[c]	3.5c	32.61c	161.65c

Means of each column have similar letters and aren't significantly different from each other. [Duncan's test range, 5%].

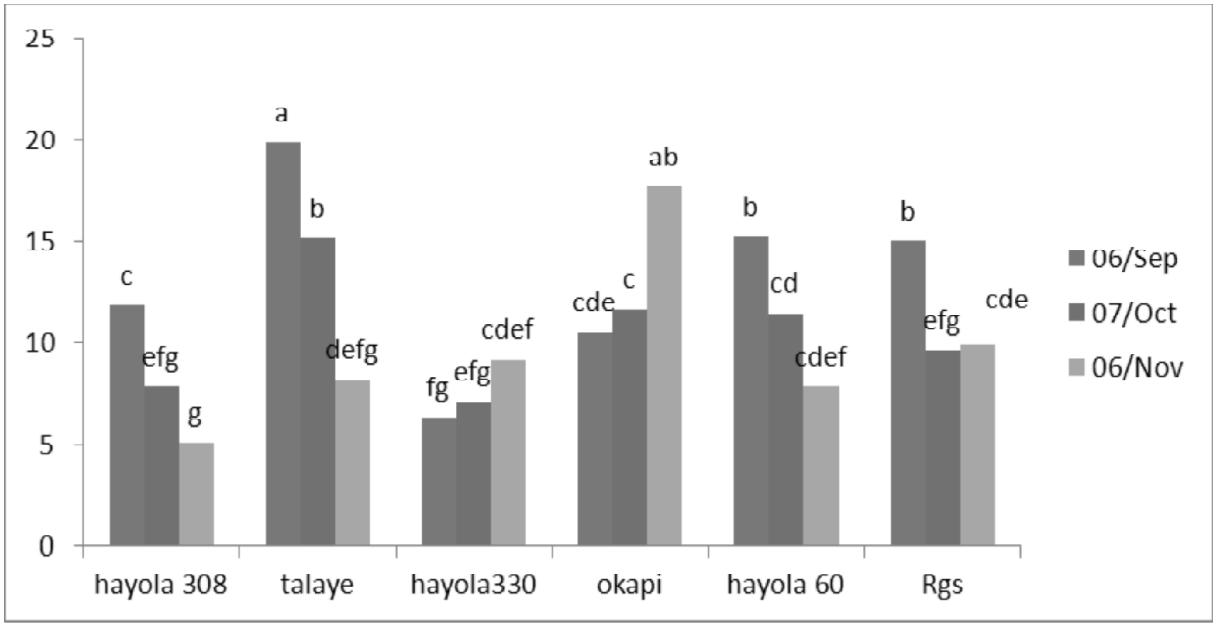

Figure 1: Effects of sowing date and genotype on number of branches

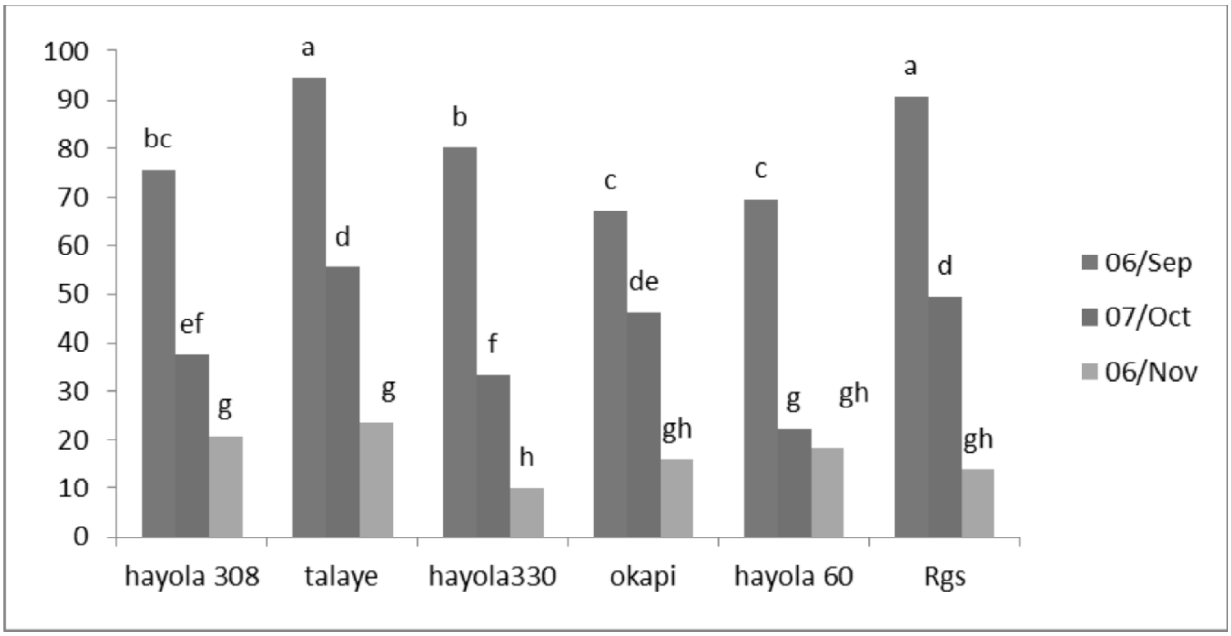

Figure 2: Effects of sowing date and genotype on number pods per plant

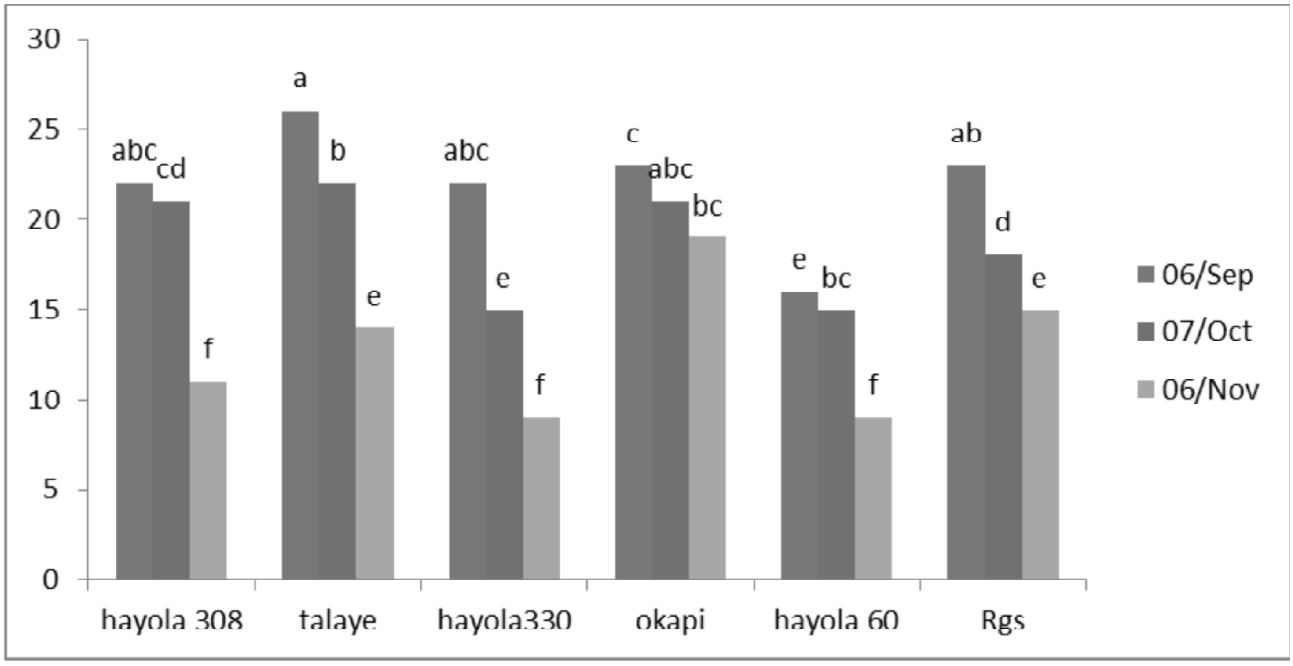

Figure 3: Effects of sowing date and genotype on number seeds per silique

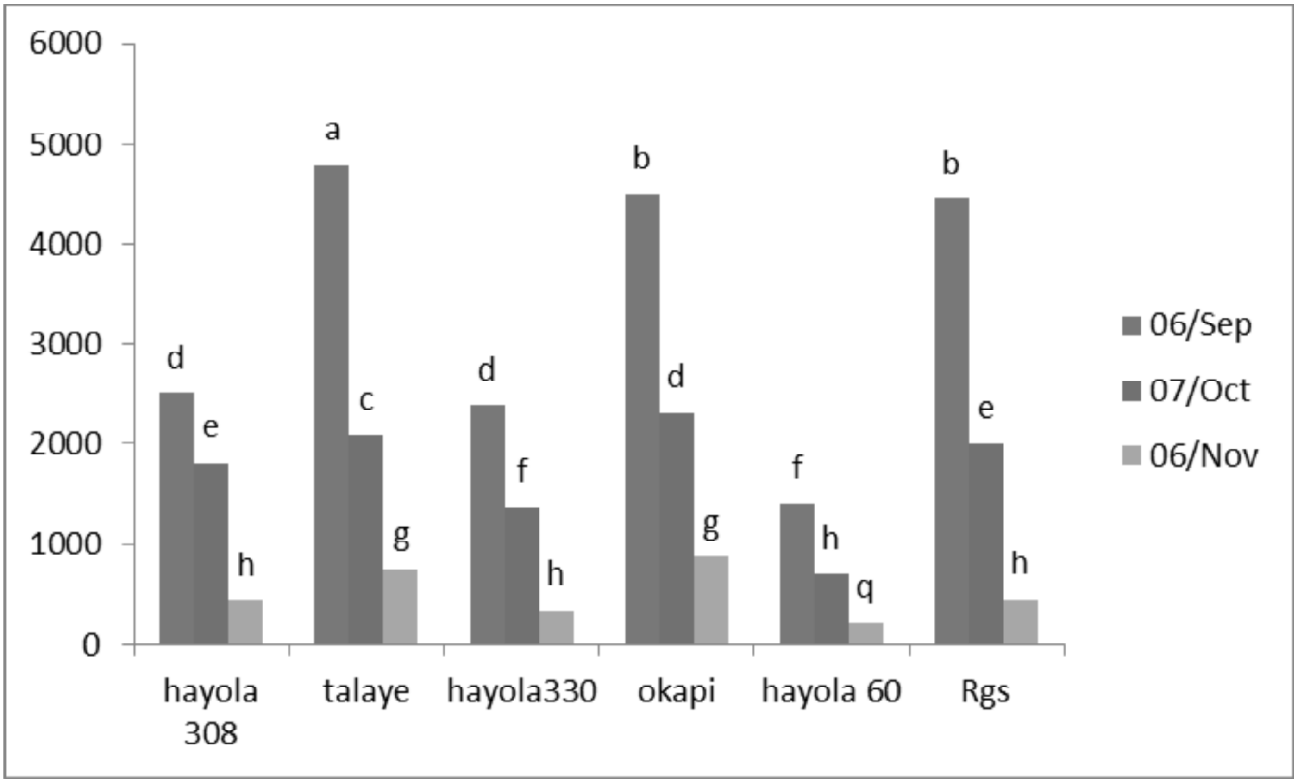

Figure 4: Effects of sowing date and genotype on grain yield

with high temperature during flowering cause decrease in fertile siliques and disruption to the translocation of assimilates into seeds leading to the production of hollow grains and decrease in 1000kernel weight and yield. Similar results have been reported by Bhuiyan *et al* (2008). The stated that the lowest 1000kernel weight occurs in plants being planted at delayed dates leading to decrease in yield.

Grain Yield

According to the results of analysis of variance the effects of planting date, cultivar and the interaction between planting date and cultivar with grain yield were significantly different at p≤0.01 (Table 1). According to means comparison (Table 2) the greatest grain yield (4785kg) belonged to the first planting date and Talayeh (September 6 th) and the lowest (212kg) belonged to the third planting date (November 6 th) and Hyola60 (Fig 4).

Kiniry *et al* (2005) in a study on canola confirmed the positive and significant correlation between grain yield and 1000kernel weight and by the use of path analysis they showed that the 1000kernel weight had the greatest effect on grain yield and the next effect was of the number of siliques per plant. Delayed planting caused the susceptible flowering and grain filling periods to encounter drought and late season warmth leading to decrease in grain yield.

Turhan *et al* (2011) stated that the lowest grain yield results from the most delayed planting date. Uzan *et al.* (2009) reported that the major reason for yield loss is insufficient growth and consequently the lack of plant's preparedness for overwintering.

%Oil Content

The analysis of variance (Table 1) showed that the effects of planting date, cultivar and interaction between planting date and cultivar with %oil content were significantly different at pd"0.01. According to means comparison (Table 2) the greatest %oil content (42.84) belonged to planting date of October 7 th and Hyola308, not being significantly different from Hyola308 and Okapi at September 6 th they all were in the same statistical group. The lowest %oil content (30.35) belonged to the planting date of November 6th and Talayeh which was statistically in the same group as Okapi. Lateral branches of canola play an important role in grain yield and compensating yield under unfavorable conditions such as different stresses and low plant density.

Marjanovic *et al* (2008) showed that earlier planting dates lead to increase in lateral branches and consequently increase the number of lateral siliques and %oil content at the above-mentioned dates.

Oil Yield

The analysis of variance (Table 1) showed that the effects of planting date, cultivar and interaction between planting date and cultivar with oil yield were significantly different at p≤0.01. According to means comparison (Table 2) the greatest oil yield (1289.64 kg/ha) belonged to the first planting date (September 6 th) and the lowest (161.65 kg/ha) belonged to the third planting date (November 6th).

Si and Valton (2004) reported that for each two-week delay in planting canola in west Australia the oil content and grain yield decreased by 1.1% and 309 kg/ha, respectively.

Pasban Eslam (2014) reported that by postponing planting date from September 11 th to October 11 th the oil and grain yields decreased significantly. Delay in planting winter canola reduces the number of fertile siliques per m^2 leading to grain yield loss and consequently oil yield loss.

CONCLUSION

- Delay in planting canola caused decrease in all yield components except the number of lateral branches.
- The most suitable canola planting date in Orumiyeh is September.

REFERENCES

Bhuiyan, M S., Mondol. M. R. I.,. Rahman. M. A, , Alam. M. S and Faisal . A. H. M. A. 2008. Yield and yield attributes as influenced by date of planting. *International Journal Sustainable Crop Production*. 3(3): 25-29.

http://cidsbd.org/int-j-sust-crp-prodn-volume3-issue3-may-2008.

Farias, J. R. B., Saans, M.A, and Zullo. J. R. (2007), Agro meteorology and sorghum production, Chapter 13G.1-17. 1-17. *http://www.agrometeorology.org.*

Hokmalipour, S., Tobe., A. Jafarzadeh. B, and Darbandi. M. H. (2011), Study of sowing date on some morphological traits of spring Canola (Brassica napus L.) cultivars. World applied sciences Journal. 14(4): 531-538 . *www.idosi.org/wasj/wasj14(4)11/5.pdf*

Ilikaie, M. N., and Imam, Y. (2003), Effect of plant density on yield and yield components of two cultivars of winter oilseed rape (Brassica napus. L.). *Iranian Journal of Agricultural Sciences* 34 (3): 38-35. (In Persian).

http://jijas.ut.ac.ir/jufile

Kassab, O. M., Abo Ellil, A.A. Abdallah.E.F and Ibrahim. M.M (2012), Performance of Some Chickpea Cultivars Under Sprinkler Irrigation Treatments In Sandy Soil. *Australian Journal Basic and Applied Science.* 6(8): 618-625.

http://ajbasweb.com/old/ajbas/2012/August/618-625.pdf

Khan, S., Farhatullah R., Khalil., I. H. Khan. M.Y, N. Ali. N. (2008), Genetic variability, heritability and correlation for some quality traits in F3:4Brassica population. Sarhad . journal of agriculture. Vol.24, No.2, 223-231. *http://www.aup.edu.pk/sj_pdf/*

Kiniry, J. R., Simpson, C. E., Schubert, A. M., and Reed, J. D. (2005), Peanut leaf area index, light interception, radiation use efficiency, and harvest index at three sites in Texas. Field Crops Research 91: 297-306.

http://dx.doi.org/10.1016/j.fcr.2004.07.021

Marjanovic-Jeromela, A., Marinkovic, R., Mijic, A., Zdunic, Z., Ivanovska, S., and Jankulovska, M. (2008), Correlation and path analysis of quantitative traits in winter rapeseed (Brassica napus L.). Agriculturae Conspectus Scientificus. Vol. 73.No. 1 (13-18). *www.agr.unizg.hr/smotra/pdf_73/acs73_03.*

Rabiee, M., and TousiKehal, P. (2010), Comparison of yield and some of important agronomic traits of spring lines and varieties of rapeseed as second crop in paddy field in Guilan region. Pp. 303. In: The proceedings of the 11th Iranian Crop Science Congress. Shahid Beheshti University, Tehran, Iran. *http://sppj.spii.ir/files/site1/user_files_bd6efb/admin-A-10-1-84-87e7a86.pdf*

Razmi. N. (2009), Effect of sowing date on seed yield, yield components and some agronomic characteristics in Rapeseed Genotypes in Moghan Region. *Seed and Plant Improvement Journal*. Vol. 2-225.No 3.PP.301-314.(in pesian).

http://en.journals.sid.ir/ViewPaper.aspx?ID=168110

Rudi Davood., Amiri Oghan. H, B. Alizadeh. B. (2010), Study of grain yield and yield components of winter Canola cultivars at different planting dates in Karaj. Sustainable Danesh Journal. Vol. 202. No 1. (in Persian).

Shargi, Younes., A., Shirini Bad., H., Ayeneh Band., A. Noormohammadi. G,and zahedi. H. (2011), Yield and yield components of six canola(Brassica napus) cultivars affected by planting date and water deficit stress. African journal of biotechnology, 10(46):9309-9313. *http://www.ajol.info/index.php/ajb/article/view/95671*

Si, P., and Walton. G. H. (2004), Determinants of oil concentration and seed yield in canola and indian mustard in the lower rainfall areas of Western Australia *Australian Journal of Agriculture Research*. 55: 367–377. *http://dx.doi.org/10.1071/AR03151*

Sidlauskas, V., and Bernotas. S. (2003), Some factor affecting seed yield of spring oilseed rape (Brassica nupus L.). Agronomy Research 1(2):229-243.

http://agronomy.emu.ee/vol012/Sidlauskas.pdf

Turhan, Hakan., M., Gul., K. M. Egesel. C, Kahriman. F. (2011), Effect of sowing time on grain yield, oil content, and fatty acids in rapeseed. *Turk Journal Agriculture.* 35: 225-234.

http://journals.tubitak.gov.tr/agriculture/issues/tar-11-35-3/tar-35-3-2-1002-717.pdf

Uzan, B., Zengin.,U, furut.S, and Akdesir. O. (2009), Sowing date affection growth, flowering, seed yield and oil content of canola cultivars. Asian journal of chemistry. 21:1957-1965. *http:/www.asianjournalofchemistry.com*