Alinteri J. of Agr. Sci. (2019) 34(1): 75-83
e-ISSN: 2587-2249
info@alinteridergisi.com

http://dergipark.gov.tr/alinterizbd
http://www.alinteridergisi.com/
DOI: 10.28955/alinterizbd.543434

Alinteri Journal of Agriculture Sciences

RESEARCH ARTICLE

Determination of Yield, Yield Components and Oil Ratio of Some Winter Canola (*Brassica napus* L.) Cultivars under Semi-Arid Conditions

Hasan Haliloğlu[1*], Vedat Beyyavaş[2]

[1]*Harran University, Faculty of Agriculture, Department of Field Crops, Osmanbey Campus, Şanlıurfa/Turkey*
[2]*Harran University, Suruç Vocational School, Department of Industrial Plants Cultivation, Suruç, Şanlıurfa/Turkey*

ARTICLE INFO

Article History:

Received: 16.02.2019
Accepted: 20.03.2019
Available Online: 23.03.2019

Keywords:

Canola
Cultivar
Yield
Pod
Oil ratio

ABSTRACT

This study was carried out to determine the yield, yield components and oil ratio of some canola cultivars under semi-arid conditions. Trials were established in the trial field of Department of Field Crops, Faculty of Agriculture, Harran University in randomized complete blocks trial design as 3 replications. In the experiment, Licord, Es-Astrid, Embleme, Eldo, Elvis, EGC-102, Licrown, Bristol, Es-Nectas and Es-Hydromel winter cultivars were used. In the results of study; the highest seed yield was obtained from Elvis cultivar (2270.3 and 2081.7 kg ha^{-1}) in two years of the experiment. According to the results of two years between the cultivars; the plant height was from 125.13 to 146.57 cm, number of branches 3.83-5.76 (per $plant^{-1}$), number of pods 115.20-194.73 (per $plant^{-1}$), number of seeds 21.00-27.30 (per pod^{-1}), 1000 seed weight 3.07-3.78 g, oil ratio 27.16-44.96%, number of flowering days 157-169, and the number of maturation days was from 198 to 214. Because of seed yield and especially oil ratio were observed very high, Elvis variety can be recommended in conditions of less rainfall areas with limited irrigation facilities.

Please cite this paper as follows:

Haliloğlu, H. and Beyyavaş, V. (2019). Determination of Yield, Yield Components and Oil Ratio of Some Winter Canola (*Brassica napus* L.) Cultivars under Semi-Arid Conditions. *Alinteri Journal of Agriculture Sciences*, *34*(1): 76-83. doi: 10.28955/alinterizbd.543434

Introduction

Due to the its importance in human and animal nutrition, raw material in the industry and usage area, the production and consumption of oilseed plants have increased in recent years. Canola production has shown a large increase in the last 40-50 years in the world, took the second place after soybean in oilseed production, and took the 3rd place after palm and soybean in the vegetable oil production (Anonymous, 2016). Contrary to the developments in the world, the cultivation areas and production of oilseed plants in our country has fluctuated in the last 25-30 years. While the area of oilseed plants decreased by 25% in this period, an increase of 10 % of oilseed production was observed (Uyanık and Kara, 2011). The production of oilseed plants was able to meet 30 % of the vegetable oil needed for our country and the remaining 70 % was tried to be met by oilseed or crude oil imports (Uğur, 2012).

Canola seeds contain approximately 40-45% of oil (Jawad et al., 2017) and 20-25% of protein ratio according to their growing conditions and cultivar (Tan et al., 2017). The remaining cake after removing the oil is an important animal feed since it has a protein content of 33-44% (Doğan and Zincirlioğlu, 1982). Canola is a very valuable plant for beekeepers because of attracting honey bees, opening yellow flowers in early spring, pollen and nectar source (Süzer 2014).

* Corresponding author
E-mail address: haliloglu@harran.edu.tr

Crop rotation systems, climate and soil conditions are suitable for canola which is demanded by oil and feed industry. Canola is an important oil plant in terms of oil acids composition (linoleic acid: 19.4%; oleic acid: 59.8%; linolenic acid: 10.2%; eicosenoic acid: 0.2%; palmitic acid: 9.2% and erucic acid: 0.3%) (Tan et al., 2017).

Canola; with regard to its features the presence of winter and summer forms, the wider adaptation than most oil plants (Aminpanah, 2013), not too much soil demand and the suitability for mechanization, is an important plant should be involved in agriculture (Süzer, 2012). In addition to these properties, on account of high oil ratio and oil acids in human nutrition and suitability in biofuel use (Durrett et al., 2008).

Canola can be grown as winter and summer in terrestrial and subtropical climatic zones, as well as growing in sea and temperate climates (İncekara et al., 1983). It is important that winter varieties to put in the fallow fields in the Thrace, Central Anatolia and Passage Regions of Turkey and include in the crop rotation (Kolsarıcı, 1987). In addition, the Aegean coastal region, Mediterranean and Southeastern Anatolia Region which have a moderate winter season, are important for the second crop agriculture, and have an important potential in terms of canola agriculture (Tan et al., 2016).

Rapeseed, as winter or summer cultivars, or depending on the environmental factors, from sowing to harvest on average 100-210 days, in general 40-60 days after flowering, and as for summer sowing reach the harvest maturity in 80-90 days (Tan, 2009; Öz, 2013).

Many studies were conducted on canola both in Turkey and world. Başalma (2004), reported that in 25 winter canola cultivars used study, the highest seed yield was obtained from the Contact cultivar with 2650 kg ha^{-1} in 2000 year and from the Licord cultivar with 3013 kg ha^{-1} in 2001, the highest oil yield was obtained from the Contact cultivar with 1141 kg ha^{-1} in 2000 year and from Licord cultivar with 1367 kg ha^{-1} in 2001.

Öz (2013), in a research where the canola varieties sown in winter, seed yield was 1610-3850 kg ha^{-1}, plant height 160.7-195.6 cm, number of branches 7.5-10 per $plant^{-1}$, number of pods 462-803 per $plant^{-1}$, number seeds 19.9-25.4 per pod^{-1}, 1000 seed weight 3.2-3.8 g, number of flowering days 114.7-126.7, number of physiological maturity days 164.3-171, oil yield 640-1610 kg ha^{-1} and the oil ratio ranged from 43.46 to 47.6%.

Bilal et al. (2015), was showed in his study; seed yield per plant was 9.67-21.12 g, plant height 164.14-194.0 cm, 1000 seed weight 6.97-7.64 g, number of maturation days 186.64-212.90; Ahmed et al. (2016), seed yield was 595.6-889.3 kg ha^{-1}, number of pods 72.3-97.7 per $plant^{-1}$, number of seeds 17.1-36.5 per pod^{-1}, plant height 82.7-99.4 cm; Noreen et al. (2016), number of pods was 108-199 per $plant^{-1}$, number of seeds 19-22 per pod^{-1}, plant height 68.40-93.25 cm; Khan et al. (2018) reported that the number of pods per plant varied from 364 to 388 per $plant^{-1}$ and oil ratio between 45% and 47%.

It is great important to increase the production areas and to produce high yielding cultivars per unit area and to take a canola which is an oil plant in crop rotation systems (wheat etc.). In order to contribute to the closure of the oil deficit and to increase the production of canola, it is very important to determine the varieties with high yield potential and to put these into production systems. In a plant species which is partly new for a region, it is great important to determine the appropriate varieties and production techniques (Coşgun and Öztürk, 2015).

Sanliurfa is the hottest city in Turkey. Average annual rainfall is about 400-450 mm. Growing drought-resistant plants in a place that is so arid is extremely important. Canola plant has the potential to be considered as a plant which can be used in areas where irrigation possibility is not available, especially due to its drought resistance. However, few studies have been performed in the region.

This study was carried out to determine the yield, yield components and oil ratio of some canola cultivars under the Harran Plain conditions and to help the studies to be carried out thereafter.

Materials and Methods

10 winter canola cultivars (Licord, Es-Astrid, Embleme, Eldo, Elvis, EGC-102, Licrown, Bristol, Es-Nectas and Es-Hydromel) were used as plant material. Trials were established in the trial field of Department of Field Crops, Faculty of Agriculture, Harran University according to the randomized block trial design as 3 replications in 2011-2012 and 2012-2013 growing seasons. In the experiment, each plot was 6 m in length with 5 rows, inter-rows and intra-rows spaces were 30 and 5 cm, respectively.

The soil of the trial area is clay and the lime content is very high. In addition, the pH is slightly alkaline. Some physical and chemical properties of trial site are given in Table 1.

Table 1. Some physical and chemical properties of trial site

Depth (cm)		0-20
Organic Matter (%)		1.13
Total Salt (%)		0.089
pH		7.6
Lime (%)		5.4
P_2O_5 (kg ha^{-1})		3.8
K_2O (kg ha^{-1})		9.1
Fe (ppm)		2.07
Zn (ppm)		0.42
Texture (%)	Sand	23.96
	Clay	53.64
	Silt	1.8

Sowings were done by hand in the form of 2 seeds per one bed on November 8, 2011 and November 12, 2012. After the emergence, plants were thinned in stage of 3-4 leaves (Jenkins and Leitch, 1986). Superphosphate (pure phosphorus 80 kg ha^{-1}) was applied as the basal fertilizer for the phosphorus requirement of the plant. Half of Ammonium sulphate (21%) was added as a source of nitrogen by sowing and the remaining nitrogen was appilied as Ammonium Nitrate (33%) fertilizer (60 kg ha^{-1} of pure N) during the branching period of the plants. Fertilizers were applied manually to the sides of the plant

rows. No irrigation was applied during the growing seasons. Weed control was done by hand when it was seem necessary. In both years, no diseases and pests have emerged.

The area in which the experiment was established is Harran Plain and the summers are hot and dry, and the winters are cold and rainy. The average annual rainfall was 365 mm and the average temperature was 17.2 °C. Distribution of the precipitation by seasons; 56 % was in winter, 30 % in spring, 13 % in autumn and 1 % in summer. The average number of rainy days was 70 days. When the average meteorological data for the experimental years (November-June) are examined from table 2, the average monthly temperature was 5.5 °C and the highest temperature was 30.6 °C in 2011-2012 growing season (November-June); the average monthly minimum temperature was 8.3 °C and the highest temperature was 29.0 °C during 2012-2013 growing season (November-June). While total rainfall was 483.1 mm in 2011-12 growing season (November-June), total rainfall was 491.25 mm in 2012-13 growing season (November-June). In both trials, more precipitation occurred when compared to the average of longs terms (Anonymous, 2013).

Since the varieties reached harvest maturity on different dates, the plants were harvested manually in the 1st year of the experiment on 7-13 June 2012 and in the 2nd year on June 10-16 June 2013 with the mowing from the soil level. 3 rows out of 5 rows in the middle part of each plot were harvested, 0.5 m part of the head and ends of the each plot and 2 edge rows put away to eliminate side effects.

Table 2. Average meteorological data for the experimental years (Anonymous, 2013)

	2011-2012			2012-2013			1929-2013
Months	**Monthly Avg. Temp. (°C)**	**Rainfall (kg/m²)**	**Avg. Relative Humidity (%)**	**Monthly Avg. Temp. (°C)**	**Rainfall (kg/m²)**	**Avg. Relative Humidity (%)**	**Average of Long Terms (°C)**
November	9.4	62.1	53.7	14.9	68.4	65.6	12.9
December	7.4	47.1	57.4	8.3	142.8	73.0	7.5
January	5.5	170.9	81.0	6.8	86.8	69.5	5.4
February	5.8	95.8	57.0	9.3	107.2	73.6	6.8
March	9.7	35.8	47.3	12.9	12.1	-	10.7
April	19.3	23.3	42.4	18.4	18.0	44.9	16.0
May	22.4	42.3	40.8	22.9	56.2	43.4	22.1
June	30.6	5.8	21.2	29.0	-	24.0	28.0
Average	13.76	-	43.39	15.31	-	49.25	13.67
Total	-	483.10	-	-	491.25		-

Yields were obtained from the harvested plots and the agronomic characters such as plant height, number of branches per plant, number of pods per plant, number of seeds per pod and 1000 seed weight were calculated from the randomly selected 10 plants (Öğütçü, 1979). The number of flowering days were calculated from the sowing time to the first flowers appear in each plot (Chay and Thurling, 1989), and the maturation days was decided as 80% of the pods were large, spherical and blackish colored on the plants (Schuler et al., 1992).

The oil ratios (%) were determined for all cultivars from the sufficient amount of seed grinded and dried in the oven at 70 ^{0}C for 48 hours, then 5 g of each sample was taken and boiled in hexane for 6 hours in Soxholet device (Bilsborrow et al., 1993).

The variance analysis of the obtained data in randomized complete blocks design were made in JMP 13.2.0 statistics program and the means were grouped with regard to the Tukey HSD test ($p \leq 0.05$).

Results and Discussion

In the analysis of the combined years, variance analysis of each year was done separately since there were differences between the years. There were statistically significant differences among the cultivars in terms of all traits studied.

Seed Yield

Statistically significant differences of yield between cultivars varied from 421.7 to 2270.3 kg ha^{-1}. Becker (1993), stated that there were high differences between the cultivars explain the quantitative characteristics such as yield and yield components are less or more affected by the environmental conditions is consistent with project results. In particular, it is thought that the yield varies depending on the genotype x environment interaction. While the highest seed yield was obtained from the Elvis variety (2270.3 and 2081.7 kg ha^{-1}), the lowest yield was obtained from the Es-Nectas variety (421.7 and 658.7 kg ha^{-1}) in two years of the trials.

The results of the study were found similar with the results of some researchers; Gizlenci et al., 2011 (2193-4439 kg ha^{-1})

and was found lower than the result of Gizlenci et al., 2013 (2861-5746 kg ha^{-1}) and was found higher than the result of Ahmed et al., 2016 (595.6-889.3 kg ha^{-1}) (Table 3). This difference is due to the dissimilarity of experimental sites, the time of planting, the variation of soil and climatic conditions as well as the plant material used.

Table 3. Averages regarding to seed yield (kg ha^{-1}), plant height (cm) and number of branches (per plant^{-1}) and CV (%) values in winter canola cultivars

Cultivars	Seed Yield (kg ha^{-1})		Plant Height (cm)		Number of Branches (per plant^{-1})	
	2011-12	2012-13	2011-12	2012-13	2011-12	2012-13
Licord	1466.3^{d}	1328.7^{d}	142.83^{ab}	136.73^{ab}	5.16^{bcd}	4.56^{bcd}
Licrown	1269.7^{e}	1302.7^{d}	146.23^{a}	135.73^{ab}	5.00^{cde}	4.73^{bc}
Es-Astrid	1758.7^{c}	1614.7^{c}	139.57^{abcd}	135.17^{ab}	5.16^{bcd}	4.93^{b}
EGC-102	1403.0^{d}	1338.3^{d}	132.73^{cde}	127.13^{bc}	4.73^{def}	4.36^{cde}
Elvis	2270.3^{a}	2081.7^{a}	130.93^{de}	134.23^{abc}	5.46^{abc}	5.33^{a}
Es-Hydromel	1958.3^{b}	1867.7^{b}	127.53^{e}	125.13^{c}	4.33^{fg}	4.16^{ef}
Eldo	1804.7^{c}	1586.3^{c}	134.63^{bcde}	127.53^{bc}	3.93^{g}	3.83^{f}
Es-Nectas	421.7^{g}	658.7^{f}	134.80^{bcde}	130.17^{bc}	4.53^{ef}	4.30^{de}
Embleme	967.0^{f}	857.7^{e}	146.57^{a}	141.23^{a}	5.76^{a}	5.56^{a}
Bristol	1472.3^{d}	1212.7^{d}	140.57^{abc}	135.93^{ab}	5.56^{ab}	5.50^{a}
% CV	2.86	3.43	2.22	2.57	3.62	2.89
			F value			
Cultivars	459.07**	244.79**	13.52**	6.78**	30.87**	57.28**

*The differences between the averages indicated in the same letter in each column are not significant ($p \leq 0.05$)

Plant Height

The highest plant height was obtained from the Licrown and Embleme (146.23 and 146.57 cm) cultivars in the first year, and from Embleme (141.23 cm) variety in the second year. Plant height values between cultivars ranged from 125.13 to 146.57 cm according to the results of two years (Table 3).

The research results were compatible with the results of Gizlenci et al., 2007 (120.4-141.5 cm), and lower than the results of Öz, 2013 (160.7 195.6 cm); Bilal et al., 2015 (164.14-194.0 cm), and higher than the results of Ahmed et al., 2016 (82.7-99.4 cm); Noreen et al., 2016, (68.40-93.25 cm). Türkeç et al. (1993) stated that the plant height is a genotypic factor, the overgrowth causes plant fall down and is not suitable for combine harvesting. Although plant height is a genetic feature that can be directly affected by planting time, irrigation and fertilization. Therefore, the differences found between the experiments are a natural result.

Number of Branches

In the two years of the experiment, significant differences were found between the cultivars. The Embleme cultivar was in the first group by forming the highest number of branches (5.76-5.56 per plant^{-1}) in both years. The number of branches varied from 3.83 to 5.76 per plant^{-1}.

The study results were consistent with the results of Gizlenci et al., 2007 (2.88-5.12 per plant^{-1}), and lower than the results of Öz, 2013 (7.5-10 per plant^{-1}); Gizlenci et al., 2011 (5-8.5 per plant^{-1}), and higher than the result of Noreen et al., 2016 (2.75-4.00 per plant^{-1}). Since the number of branches have positive effect on the yield of canola, as the number of branches increases, both the seed yield increases and the losses that may occur in the plant rows can be compensated (Başalma, 1997). The fact that the Elvis variety, which gave the highest seed yield per decare, is also placed in the first rank in terms of the number of branches confirms this result.

Number of Pods

The highest number of pods was obtained from the Licord and Elvis cultivars (194.73 and 193.27 per plant^{-1}) in the first year, from the Elvis variety (191.23) in the second year. Among the cultivars, the number of pods varied from 115.20 to 194.73 per plant^{-1} in the results of two years (Table 2).

The results obtained from this study were consistent with the results of Noreen et al., 2016 (108-199 per plant^{-1}), and lower than the results of Öz, 2013 (462-803 per plant^{-1}); Khan et al., 2018 (364-388 per plant^{-1}), and higher than the result of Ahmed et al., 2016 (72.3-97.7 per plant^{-1}). Different results in previous studies were due to the genetic differences of the cultivars, sowing time, climate and soil factors.

Number of Seeds

The number of seeds ranged from 21.00 to 27.30 (per pod^{-1}). In the first year of the experiment the Elvis (27.30 per pod^{-1}) cultivar, in the second year the Embleme (24.37 per pod^{-1}) and EGC-102 (24.50 per pod^{-1}) cultivars gave the most number of seeds.

The research results were consistent with the reults of Gizlenci et al., 2011 (16.5-29.6 per pod^{-1}) and higher than results of Öz, 2013 (19.9-25.4 per pod^{-1}); Noreen et al., 2016 (19-22 per pod^{-1}). Among the cultivars used in the trial, the number of groups formed not too much statistically, and therefore the number of seeds among the cultivars can not be said to be very different. However, it is stated by a couple of researchers that the number of seeds per pod^{-1}, which is one of the important characters affecting the yield, varies according to the cultivars, cultivation conditions and climatic conditions (Hodgsen, 1979).

Table 4. Averages regarding to number of pods (per plant^{-1}), number of seeds (per pod^{-1}), 1000 seed weight (g) and CV (%) values in winter canola cultivars

Cultivars	Number of Pods (per plant^{-1})		Number of Seeds (per pod^{-1})		1000 Seed Weight (g)	
	2011-12	2012-13	2011-12	2012-13	2011-12	2012-13
Licord	194.73^{a}	181.40^{ab}	23.76^{ab}	21.77^{ab}	3.39^{cd}	3.19^{cd}
Licrown	145.70^{d}	138.83^{d}	23.86^{ab}	22.17^{ab}	3.15^{de}	3.25^{abcd}
Es-Astrid	168.76^{c}	164.00^{c}	24.66^{ab}	22.47^{ab}	3.31^{cde}	3.26^{abcd}
EGC-102	142.80^{d}	134.10^{d}	25.40^{ab}	24.50^{a}	3.93^{cd}	3.32^{abcd}
Elvis	193.27^{a}	191.23^{a}	27.30^{a}	23.20^{ab}	3.43^{bc}	3.28^{abcd}
Es-Hydromel	172.87^{bc}	165.20^{c}	21.50^{b}	21.00^{ab}	3.07^{e}	3.08^{d}
Eldo	122.83^{e}	118.17^{e}	25.46^{ab}	22.13^{ab}	3.67^{ab}	3.52^{a}
Es-Nectas	115.20^{e}	121.40^{e}	22.70^{ab}	20.90^{ab}	3.51^{bc}	3.43^{abc}
Embleme	185.10^{ab}	173.10^{bc}	25.43^{ab}	24.37^{a}	3.30^{cde}	3.24^{bcd}
Bristol	174.90^{bc}	183.60^{ab}	22.50^{ab}	20.43^{b}	3.78^{a}	3.48^{ab}
% CV	2.74	2.48	6.96	6.71	3.4	2.87
			F Values			
Cultivars	123.49**	141.70**	3.15*	2.60*	17.48**	6.31**

*The differences between the averages indicated in the same letter in each column are not significant ($p \leq 0.05$)

1000 Seed Weight

The highest 1000 seed weight was obtained from the Bristol cultivar (3.78 g) in the first year of the experiment, from the Eldo cultivar (3.52 g) in the second year. According to the results of two years, 1000 seed weight values varied from 3.07 to 3.78 g (Table 4).

The results obtained from the study were consistent with the results of Öz, 2013 (3.2-3.8 g); Gizlenci et al., 2011 (2.9-4.9 g) and lower than the results of Gizlenci et al., 2013 (3.91-4.57 g); Bilal et al., 2015 (6.97-7.64 g). It is known that 1000 seed weight is related to the hereditary structure of the cultivar (Degenhardt and Kondra, 1981). Differences in the results of the research might be caused by experimental areas, planting time, climate and soil conditions.

Oil Ratio

The highest oil ratio (44.96 %-43.90%) was obtained form the Elvis cultivar in both trial years. The oil ratio varied from 27.16 % to 44.96 % among the cultivars used in the experiment.

The results obtained from the study were consistent with the results of Tan, 2009 (12.31 %-46.47%) and lower than the results of Öz, 2013 (43.46 %-47.6%). The differences between the results of the research were caused by the genetic structure of the cultivars and the environmental interaction (Öğütçü and Kolsarıcı, 1978). Zukalova et al. (1985) stated that the oil ratio is affected by the presence of potassium and magnesium, soil structure and pH. Schuster (1970) indicated that the oil ratio values of canola varying in accordance with year, cultivar, location and environmental factors but the genetic structure of the cultivars is more effective than environmental conditions.

Number of Flowering Days

In both trial years, Es-Nectas cultivar (161-157 days) came to the earliest flowering. The latest number of flowering days was obtained from the Es-Nectas cultivar (169 and 164 days).

According to the results of two years between flowering days (157-169 days) a difference of 12 days appeared (Table 5). Between the 1st and 2nd years of the experiment, difference between the number of flowering days was approximately 4 to 5 days. The reason for this that can be attributed to a more

rainy in March-April months of the first year than the second year (Table 1). The results of the study were consistent with the result of Süzer (2016) in terms of the number of flowering days (9-17 April). Although there are no significant differences between the number of flowering days of the cultivars used in our study, it can be said that flowering of the some cultivars are earlier than others due to their genetic structure and reaction to environmental conditions.

Table 5. Averages regarding to oil ratio (%), number of flowering days (days) and number of maturation days (days) and CV (%) values in winter canola cultivars

Cultivars	Oil Ratio (%)		Number of Flowering Days (days)		Number of Maturation Days (days)	
	2011-12	2012-13	2011-12	2012-13	2011-12	2012-13
Licord	40.06^{b}	39.90^{b}	167^{ab}	162^{ab}	212^{ab}	207^{a}
Licrown	20.73^{g}	27.56^{f}	164^{bc}	160^{abc}	209^{bc}	204^{abc}
Es-Astrid	30.00^{e}	29.90^{e}	163^{bc}	159^{bc}	208^{bc}	201^{cd}
EGC-102	27.20^{f}	27.83^{f}	167^{ab}	162^{ab}	212^{ab}	208^{a}
Elvis	44.96^{a}	43.90^{a}	161^{c}	159^{bc}	206^{c}	201^{cd}
Es-Hydromel	32.23^{d}	33.03^{d}	161^{c}	157^{c}	206^{c}	198^{d}
Eldo	29.10^{e}	29.86^{e}	163^{bc}	158^{bc}	209^{bc}	200^{cd}
Es-Nectas	27.16^{f}	27.23^{f}	169^{a}	164^{a}	214^{a}	206^{ab}
Embleme	35.26^{c}	35.33^{c}	165^{abc}	160^{abc}	210^{abc}	202^{bcd}
Bristol	35.00^{c}	35.36^{c}	165^{abc}	161^{abc}	210^{abc}	204^{abc}
% CV	1.77	1.69	1.00	0.93	0.81	0.79
			F Values			
Cultivars	445.26**	304.53**	7.62**	5.82**	6.94**	12.32**

*The differences between the averages indicated in the same letter in each column are not significant ($p \leq 0.05$)

Number of Maturation Days

Elvis and Es Hydromel cultivars (206 days) came to the maturity earliest in the first year of the experiment, and Eldo cultivar (198 days) in the second year. The latest number of maturation days was obtained from the Es-Nectas cultivar (214 days) in the first year of the experiment and from the EGC-102 cultivar (208 days) in the second year. The values of the number of maturation days have shown a difference of 8-10 days in both years (Table 5).

The results of the study were consistent with the result of Bilal et al., (2015) in terms of the number of maturation days (186.64-212.90 days), and contradict with the results of Tan (2017) (149-163 days) and Öz (2013) (164.3-171 days). In research, it can be explained the reason of early maturity resulted from the differences between the number of maturation days, genetic structure of the cultivars and especially less rainfall of March and April months in the second year and the averages monthly temperature were higher in the second year than in the first year. Vegetation period is influenced substantially by the genetic structure of the cultivars (Özer and Oral 1997).

The highest seed yield per hectare was obtained from the Elvis cultivar (2270.3 and 2081.7 kg ha^{-1}) in the 10 winter canola cultivars sown under Harran Plain conditions in two years, and the lowest seed yield was obtained from the Es-Nectas cultivar (421.7 and 658.7 kg ha^{-1}). According to the results of the two years; the plant height values were observed between 125.13 and 146.57 cm, number of branches 3.83-5.76 per plant^{-1}, number of pods 115.20-194.73 per plant^{-1}, number of seeds 21.00-27.30 per pod^{-1}, 1000 seed weight 3.07- 3.78 g, oil ratio 27.16 %-44.96, number of flowering days 157-169 and number of maturation days 198 and 214.

Conclusion

As a result of this study; seed yield per hectare, number of branches, number of pods and number of seeds per pod, early maturation and especially because of the high oil ratio, Elvis cultivar got featured. It was concluded that like Sanliurfa where there is less rainfall and especially where irrigation possibilites are scarce, Elvis cultivar can be cultivated. It can contribute to decrease oil deficit partially and can be used as parent in breeding activities.

References

Ahmed, J., Leghari, S.K., Baloch, A., Sarangzai, M., Saeed, M., Igbal, M., Yagoob, M., Ahmed, S., Ur-Rahman, S. and Danish, M.Z., 2016. Impacts of climatic condition on different Brassica genotypes growth and productivities. Pure Appl. Biol., 5 (3): 594-600.

Aminpanah, H., 2013. Effect of nitrogen rate on seed yield protein and oil content of two conola (Brassica napus L.) cultivars. Acta Agricultura Slovenica, 101:183-190.

Anonymous, 2012. GAP Tarımsal Araştırma Enstitüsü Müdürlüğü Toprak Analiz Laboratuvarı kayıtları.

Anonymous, 2013. Şanlıurfa Meteoroloji İl Müdürlüğü kayıtları.

Anonymous, 2016. Oilseeds: World Markets and Trade. United States Department of Agriculture, Foreign Agricultural Services. USA.

Başalma, D., 1997, Adaptation of Germany originated winter rapeseed (*Brassica napus ssp. oleifera* L.) cultivars under Ankara conditions. Tarım Bilimleri Dergisi, 3 (3): 57-62.

Başalma, D., 2004. Kışlık kolza (*Brassica napus ssp. oleifera* L.) çeşitlerinin Ankara koşullarında verim ve verim öğeleri yönünden karşılaştırılması. Tarım Bilimleri Dergisi, 10 (2): 211-217.

Becker, H., 1993. Pflanzen-züchtung. Ulmer Verlag. Stuttgard, 42-43.

Bilal, M., Khan, S. A., Raza, H., Ali, F., Khan, S. H., Ali, N., Hussain, I. and Khan, J., 2015. Evaluation of some indigenous rapeseed genontypes for adaptability and yield traits in the agre-climatic conditions of Mansehra. International Journal of Biosciences, 7 (5): 127-135.

Bilsborrow, P.E., Evans, E.J. and Zhao, F.J., 1993. The influence of spring nitrogen on yield, yield components and glucosinolate content of autumn-sown oilseed rape (*Brassica napus* L.). J. Agric. Sci., 120: 219–224.

Chay, P. and Thurling, N., 1989. Variation in pod lenght in spring rape *(Brassica napus* L.) and its effect on seed yield and yield components. The Journal of Agricultural Science. 113(2): 139-147.

Coşgun, B. and Öztürk, Ö., 2015. Konya koşullarında bazı kışlık kolza çeşitlerinde tohum verimi ve verim unsurlarının belirlenmesi. Türkiye 11. Tarla Bitkileri Kongresi (7-10 Eylül 2015, Çanakkale). Poster Bildiriler, 510-513.

Degenhardt, D.F. and Kondra, Z.P., 1981. The influence of seeding date and seeding rate on seed yield and yield components of five genotypes of Brassica napus. Canadian Journal of Plant Sciense, 61:175-183

Doğan, K. and Zincirlioğlu, M., 1982. Kolza tohumu küspesinin protein kalitesi ve kasaplık piliç rasyonlarında kullanılma olanakları üzerinde araştırmalar. Doğa Bilim Dergisi, 9 (1): 1985.

Durrett, T.P., Benning, C. and Ohlrogge, J., 2008. Plant triacylglycerols as feedsocks fort he production of biofuels. Plant J., 54: 593-607.

Gizlenci, Ş. and Acar, M., 2007. Orta Karadeniz Bölgesi sahil ve geçit kuşağında bazı kolza çeşitlerinin verim ve verim unsurlarının belirlenmesi. Türkiye VII: Tarla Bitkileri Kongresi. 25-27 Haziran 2007, Erzurum.

Gizlenci, Ş., Acar, M., Özçelik, H. and Öner, E.K., 2011. Karadeniz Bölgesi sahil kuşağında bazı kolza çeşit ve hatlarının verim ve verim unsurlarının saptanması. Türkiye 9. Tarla Bitkileri Kongresi. 12-15 Eylül 2011, Bursa.

Gizlenci, Ş., Acar, M. and Öner, E.K., 2013. Bazı kolza (*Brassica napus ssp. oleifer*a L.) hat ve çeşitlerinin Amasya koşullarında performanslarının belirlenmesi. Türkiye 10. Tarla Bitkileri Kongresi. 10-13 Eylül 2013, Konya.

Hodgsen, A.S., 1979. Rapeseed adaptation in northern new South wales, III. Yield componentsand grain quality of B. campestris and B. napus in relation to planting date, Australian Journal of Agricultural Research, 30: 19-27.

İncekara, F., Schuster, W. and Tuğay, M.E., 1983. Çeşitli yağ bitkilerinde kimi nicelik özelliklerinin kalıtsal yapıya ve çevreye bağlı değişimi. Ege Üniv. Ziraat Fak. Yay. No: 437.

Jawad, M., Islam, M., Khan, B., Anjum., Hussain, Z., Shah, W.A., Amin, R., Ali, J., Ishaq, M. and Ur Rehman, A., 2017. Growth and yield attributes of canola varietes under different seed rates. Pure Appl. Biol., 6(3):864-870.

Jenkins, P.D. and Leitch, M.H., 1986. Effect of sowing date on the growth and yield of winter oilseed rape *(Brassica napus* L.). Journal of Sgricultural Science. 105 (2): 405-420.

Khan, B., Jawad, M., Ahmad, M., Islam, M., Anjum., Yar, M., Ilyas, M., Kakar, H.A., Khan, S.N. and Fahad, S., 2018. Effect of seed rates on yield and oil components of canola genotypes. Pure Appl. Biol., 7 (2):500-508.

Kolsarıcı, Ö., 1987. Bitkisel yağ açığımızda kolzanın yeri. TÜBİTAK, Bilim ve Teknik 20 (237): 7-9.

Noreen, S., Noor, S., Ahmed, S., Bibi F. and Hasanuzzaman, M., 2016. Quantifying same physiological and productivity indices of canola (*Brassica napus* L.) crop under an arid envoriment, Notulae Botanicae Horti Agrobotanici. 44 (1): 272-279.

Öğütçü, Z. and Kolsarıcı, Ö., 1978. Ankara iklim koşullarında yetiştirilen yabancı kökenli yazlık kolza çeşitlerinin verim komponentleri üzerine araştırmalar. Ankara Üniversitesi Ziraat Fakültesi Yıllığı, 28 (2): 521-536.

Öğütçü, Z.,1979. Orta Anadolu koşullarında yetiştirilen kolza (*Brassica napus ssp. oleifer*a L.) çeşitlerinin verim ve kaliteye ilişkin karekterleri. Ankara Üniv. Ziraat Fak. Yayınları. 717. Bilimsel Araştırma ve İncelemeler: 417s. Ankara.

Öz, E.S., 2013. Bazı yazlık kolza (kanola) çeşit ve hatlarının Bornova koşullarında kışlık ve yazlık olarak performanslarının belirlenmesi. Yüksek Lisans Tezi. E.Ü. Fen Bilimleri Enstitüsü.

Özer, H. and Oral, E., 1997. Erzurum ekolojik koşullarında bazı kolza (*Brassica napus ssp. oleifera* L.) çeşitlerinin fenolojik özellikleri ile verim ve verim unsurları üzerine bir araştırma. Journal of Agriculture and Foresty, 21: 319-325.

Schuler T.J., Hutcheson, D.S. and Downey, R.K., 1992. Heterosis in inter-varietal hybrids of summer turnip rape in Western Canada. Can J. Plant Sci., 72: 127-136.

Schuster, W., 1970. Deviation in fat content of different oil plants. I. Winter rape and sunflower. Field Crops Abst., 23 (1):85.

Süzer, S., 2012. Kanola yetiştiriciliği. Tarım Gündem Dergisi, 2 (10): 70-72.

Süzer S., 2014. Effects of plant nutrition on canola (*Brassica napus* L.) growth. Balkan Agriculture Congress 08-11 September 2014, Edirne, Turkey.

Süzer, S., 2016. Determination of Yield and Yield Components of Some Advanced Rapeseed (*Brassica napus* L.) Varieties in Edirne Conditions. Journal of Central Research Institute for Field Crops, 2: 142-148.

Uğur, A.E., 2012. Türkiye'de yağlı tohum bitkileri üretimi ve bitkisel yağ sanayi, YABİTED I. Bitkisel Yağ Kongresi, 12-14 Nisan 2012, İstanbul.

Uyanık, M. and Kara, Ş.M., 2011. Tarımsal üretim planlamasında ihmal edilen stratejik bitkiler: yağlı tohumlar. Uluslararası Katılımlı 1. Ali Numan Kıraç Tarım Kongresi ve Fuarı (27-30 Nisan 2011, Eskişehir).

Tan, A.Ş., 2009. Yield Potential of Some Rapeseed (Canola) Cultivars in Menemen Conditions. Anadolu, ANADOLU, J. of AARI, 19 (2): 1-32.

Tan, A.Ş., Aldemir, M. and Altunok, A., 2016. Aegean Region canola research project. 2015/16 development report. Aegean Agricultural Research Institute. Menemen, İzmir Turkey

Tan, A.Ş., Aldemir, M. and Memiş, A.A., 2017. Determination of Yield, Yield Components and Quality Characteristics of some Rapeseed (*Brassica napus* L.) Candidate Varieties in Menemen, Izmir Ecological Conditions. Anadolu Journal of AARI, 27 (1): 29 – 50.

Türkeç, A., Göksoy, A. and Turan, M., 1993. Kanolada en uygun ekim normunun saptanması üzerinde araştırma, Uludağ Üniversitesi Ziraat Fakültesi Dergisi, 10: 163-172.

Zukalova, H., Vasak, J. and Fabry, A., 1985. Changes in the quality characteristics of winter rape cultivars free from erusic acid glucosinolates. Czechoslovakia 31 (79): 685-692.