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Adaptation of Winter Type Germany Originated Rapeseed (*Brassica napus* ssp. *oleifera* L.) Cultivars Under Ankara Conditions

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Abstract: The aim of this research was to determine the adaptation ability of winter type German originated rapeseed cultivars under Ankara conditions. This study was carried out to determine the yield and yield components of eight rapeseed cultivars (Ceres, Cobra, Diadem, NPZ 71, NPZ 74, NPZ 82, NPZ 66, NPZ 62) under Ankara conditions in 1993-1994.

In both years, the sowing was done as early as possible to enable plants to enter winter conditions in rosette stage. Plant height, numbers of axillary branches, numbers of pods on the main stem; pod length, number of seeds per pod was observed in the field as yield components. Seed yields, thousand seed weights and oil ratio were also determined after harvesting. According to the results of the average of two years, the highest seed yield (322.01 kg/da) was obtained from cv. NPZ 62 and the highest oil ratio (37.12 %) was determined in cv. NPZ 66. Yields and oil ratio of these rapeseed cultivars were found to be high even though agricultural applications such as irrigation, hoeing and fertilization were not applied. The results indicated that these cultivars could be grown easily under Ankara conditions.

Key Words: Winter rapeseed , yield and yield components.

Almanya Orijinli Kışlık Kolza (*Brassica napus* ssp. *oleifera* L.) Çeşitlerinin Ankara Koşullarına Adaptasyonu

Özet: Bu araştırmanın amacı; Almanya kökenli kışlık kolza çeşitlerinin Ankara koşullarında adaptasyon yeteneklerini saptamaktır. Araştırma 1993-1994 yıllarında kışlık 8 kolza çeşidinin (Ceres, Cobra, Diadem, NPZ 71, NPZ 74, NPZ 82, NPZ 66, NPZ 62) verim ve verim komponentlerini belirlemek amacıyla yürütülmüştür.

Denemenin yapıldığı her iki yılda da bitkilerin kışa rozet devresinde girmesini sağlamak amacıyla ekimler mümkün olduğunca erken yapılmıştır. Verim komponentleri olarak bitki boyu, anasapa bağlı yandal sayısı, anasaptaki kapsül sayısı, kapsül boyu ve kapsüldeki tohum sayıları tarlada gözlenmiştir. Tohum verimleri, bin tohum ağırlıkları ve yağ oranları hasattan sonra belirlenmiştir. İki yılın ortalamalarına göre; en yüksek tohum verimi 322.01 kg/da ile NPZ 62 çeşidinden, en yüksek yağ oranı da % 37,12 ile NPZ 66 çeşidinden alınmıştır. Denenen bu çeşitlerin verim ve yağ oranları sulama, çapalama, gübreleme gibi kültürel uygulamalar yapılmadan bile oldukça yüksek bulunmuştur. Sonuçlar; bu çeşitlerin Ankara koşullarında rahatlıkla yetiştirilebileceğini göstermektedir.

Anahtar Kelimeler : Kışlık kolza, verim ve verim komponentleri.

Introduction

Fats are divided into two groups as animal and plant originated. Oils are obtained from plants. Turkey has been supposed to be one of the self-sufficient countries for needs in terms of food production. However, as there is not a satisfactory production increase parallel to the population the food needs growing increasingly each year have been met via importation. Oils are more important than fats in the oil production because of health and financial aspect. Because of the special growing requirements, oil crops have spread some partial areas in the world.

Today, in the world, totally 274 million tonnes oil seed productions have been obtained. Among these productions, soybeans can be seen as the first one with 136.73 million ton, cottonseed as the second one with 53.27 million ton and rapeseed as the third one with 29.96 million ton. Groundnuts with 28.49 million tonnes and sunflower with 22.21 million tonnes are following these productions (Anonymous, 1995). In Turkey, the sources of plants originated oils are some oilseed plants such as sunflower (780 thousand tonnes), cottonseed (1259 thousand tonnes), olive (1800 thousand tonnes, edible and for oil), soybeans (50 thousand tonnes) and groundnuts (80 thousand tonnes) (Anonymous, 1996).

The product and consumption of oil seed plants such as sesame and groundnuts have been changing each year. Meanwhile, as the mechanisation for the cultivation of these plants haven't been improved, and the production is based on human power. In addition, these crops are used for different purposes rather than in oil industry.

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It can safely be claimed that instead of enlarging cultivation areas to increase the production of oil seeds on behalf of some particular cultural plants, these crops can be grown in the areas that have received irrigation facilities. Besides, the use of good quality and high fertile seeds should be encouraged, fallow areas should be reduced and alternative oil seed crops production should be improved in these areas.

In the world, rapeseed, which is cultivated in several westerns and middle European countries (Germany, Poland, Sweden, Denmark and France) and in Canada, is one of the important oil crops. In Sweden, rapeseed oil is the main domestic source of polyunsaturated oilty acids (Adolphe, 1987). In those countries winter and summer types are grown. In Turkey, sunflower is the most important crop among oil crops. But some oil seed crops such as rapeseed and safflower should be included in the production plan to satisfy our oils needs. Rapeseed has got summer and winter varieties, its vegetation period is short and its high oil and seed yield and all of its growing techniques are suitable for mechanization.

Winter rapeseed enables factories to process the earlier than the other oil crops as it can be harvested in June and July. These are advantages of the rapeseed in competition to other oil crops.

In this research, yield and yield components of German originated winter rapeseed cultivars in Ankara conditions in two years were tried to be determined.

Material and Methods

The research was established in the trial field of Ankara University, Agricultural Faculty, Department of Field Crops in 1993-1994.

The main of monthly rain amount, moisture ratio and average temperature (°C) values in the growing period for both years are illustrated in Table 1. (Anonymous 1996). In two years, meteorological data are found to be similar. The place where the trial was established reflected the typical characteristics of the climate conditions of Ankara.

The soil of the trial area was clay and loam, pH value was 7.92, organic ingredients were 1.145%, lime ratio was 4.4%, humidity was 4.1%, clay was 32.5%, sand was 22.0% and silt was 45.5%.

In this research, some of the German originated rapeseed cultivars, Ceres, Cobra, Diadem, NPZ 71, NPZ 74, NPZ 82, NPZ 66, NPZ 62 were used as material. Diadem cv. obtained from German is orginated from Netherland.

The trial was established randomized complete block with 3 replications. In the experiment, the plot sizes were 16 m^2 (5x3.20 m) and in the harvest and measurements side lines were not considered.

The experimental plots were plagued before sowing, lines were drawn and the seeds were sown as 20 g per plot. Before the sowing, diamonium phosphate fertilizer was given to the soil, over pure material, as 3.6 kg/da nitrogen and 9.2 kg/da phosphorus. In order to supply a regular seedling irrigation was provided only once.

Seeds were sown with 40 cm row space and when they grew 10 cm tall, they were reduced in number as 15 cm space would be left between each plant on a line. Againts insecticide was implemented by means of Basudin.

After the plants bloomed, in 15 plants were randomly selected from each plot and plant height, numbers of axilliary branches, numbers of pods on the main stems, pod length and number of seeds per pod were measured in the experimental field. When the plants were mature enough to harvest, each plot were harvested and their plot yields were weighed and recorded.

For the oil analysis, 3 replicated samples were separated and their crude oil analysis was done in soxhelet (Machine/ device). Approximately three months after the harvesting, as ISTA (International Seed Testing-Association) suggests, their 1000 seed weight was calculated by counting eight replicated 100 seeds from each plot and weighing them by one on Sartorius scale and multiplying their mean with 10. All of the data were evaluated via Mstat-C software for analysis.

Table 1. Climatic data of experimental area for 1993-1994 growing period and long term means

Months	Precipitation (mm)			Temperature (°C)			Relative humidity (%)		
	1926-90	1993	1994	1926-90	1993	1994	1926-90	1993	1994
January	40.5	28.8	30.2	-0.1	-4.0	3.8	78.0	79.5	75.5
February	34.9	33.4	33.8	1.3	-0.7	1.8	74.0	72.8	74.0
March	35.6	22.4	18.4	5.4	5.7	6.8	65.0	61.3	60.1
April	40.3	28.1	30.7	11.2	10.4	14.0	59.0	56.5	55.0
May	51.6	88.6	39.0	15.9	15.3	17.0	57.0	65.1	56.6
June	32.6	13.1	6.6	19.8	19.7	20.6	51.0	52.4	47.3
July	13.5	3.5	5.0	23.1	22.9	24.2	44.0	45.3	44.4
August	10.3	11.1	1.1	23.0	23.1	23.5	42.0	49.8	46.7
September	17.4	0.9	6.3	18.4	19.3	22.8	47.0	46.8	44.0
October	24.4	1.8	30.6	12.8	15.0	16.0	58.0	45.8	60.8
November	30.9	35.6	67.5	7.3	4.1	5.6	70.0	65.4	75.1
December	45.6	33.0	20.6	2.3	4.0	0.5	78.0	76.6	78.9

Results and Discussion

First flowering and full flowering dates of cultivars used were determined from sowing to observation time and shown in Table 2. Cobra and NPZ 62 were found to be early cultivars the other.

The variance analysis related to yield components were given in Table 3. The average values related to the investigation held in 1993-1994 related to the yield components of this winter rapeseed varieties that were measured in the field are given in Table 4. The significance tests, in the determination of different groups both 5 % and 1% possibility level were applied.

In the study, yield and yield components criteria values are given and discussed in an order.

Plant height

The values of the plant height, which is closely related to the yield were 132.2 - 44.7 cm in the first year and 133.4 - 166.2 cm in the second year. The effect of genotype on plant height was quite big. These values was determined higher than Turan et al (1990) in the German originated winter rapeseed cultivar Chr 1617/82 as 119.8 - 133.5 cm.

The results correspond to the results of the research conducted with French cultivars at the same time and area. Başalma and Kolsarıcı (1997) reported that plant heights in 5 French originated rapeseed cultivars are 131.9 - 164.2 cm (average of the two years). In this research although the plant height was taller, in the both years there was no lying and loss of seed yield in the plants. As can be seen as a result of the variance analysis (Table 3) concerning plant heights; in the two years there were 1 % difference among the cultivars. According to the Duncan test (Table 4) at 5 % possibility level; in the first year, Ceres, Cobra, Diadem and NPZ 74 cultivars were at the same group however the other cultivars were in different groups. In the second year, there were coincidences to find differences between NPZ 71,NPZ 74 and Ceres, Cobra, Diadem, NPZ 82 cultivars.

The number of the axilliary branches on the main stem

The variance analysis (Table 3) concerning number of axilliary branches shows that there were 1% difference in both to be years. In the first year, Diadem and NPZ 74 cultivars were found different groups other cultivars. In the second year, Ceres, Cobra, Diadem,NPZ 82 and NPZ 66 cultivars were given similar results and take of at the same group.

In rapeseed, the number of axilliary branches is an important character to contribute to the yield positively. In this research the number of the axilliary branches varied from 4.83 to 6.53 in the first year and 5.27 - 7.17 in the second year. The reason of having a high number of axilliary branches is due to the genotype of the variety and especially to its being a winter type. Kolsarıcı and Er (1988) reported that according to the average of their two year study there are 6.95 axilliary branches in Quinta cultivars and 6.80 in Jet-Neuf cultivars as winter typies. Sağlam and Atakişi (1995) found that the winter type cultivars were used which number of the axilliary branches ranged between 5.60-6.50. The values that we obtained in our study are quite similar to the ones obtained by the other researches.

The number of pods on the main stem

The variance analysis related to the pod number on the main stem are given in Table 3. In this character, there were 1% significant difference among cultivars in the first year and second year. In 1993,Cobra cultivars gave the highest number of pods among the other cultivars. In 1994, Ceres,Cobra, Diadem and NPZ 74 cultivars were in terms of this character at the same groups.

The number of pod is a peculiarity with positive relationship with yield. In this research this character varied between 44.30-54.60 in the first year and 44.57-53.90 in the second year. Baydar and Yüce (1996) reported that the number of pods on the main stem were higher in winter type than in summer type. These researchers found that a few pods on the main stem but the highest pods on the plant from NPZ 62 cultivars. In our research this cultivar were given 49.07- 51.33 pods on the main stem in two years average.In Thrace Region Sağlam and Atakişi (1995) used Ceres cultivars in their research. They found that the number of pods on the main stem was 44.80 as two years avarege in this cultivars. The results obtained in this study (45.37- 53.13) are within these values (Table 4).

Table 2. In 1993-1994 the first and 100% flowering times of winter rapeseed cultivars (number of days from sowing to observation)

Cultivars	First flowering time	100% flowering time
Ceres	190.5	202.0
Cobra	180.5	194.0
Diadem	183.5	197.5
NPZ 71	185.0	197.0
NPZ 74	188.0	196.5
NPZ 82	182.5	195.5
NPZ 66	184.0	197.0
NPZ 62	185.5	194.5

Table 3. Variance analysis of yield components of German originated rapeseed cultivars

Source of variance	D.F.	Plant height (cm)		Number of axilliary branches		Number of pod on the main stem		Pod length (cm)		The number of seeds per pod	
		1993	1994	1993	1994	1993	1994	1993	1994	1993	1994
Total	23										
Replication	2	58.18	7.24	0.02	0.06	2.35	13.06	0.38	0.02	1.40	0.52
Cultivars	7	24.50**	385.04**	1.13**	1.17**	43.06**	28.60**	0.25**	0.72**	3.94**	2.33
Error	14	4.50	11.74	1.10	0.05	4.82	1.04	0.04	0.06	0.44	1.09

*, ** Significant at 0.05 and 0.01 level respectively

Table 4. According to Duncan Tests means of yield components German originated rapeseed cultivars in 1993-1994

Cultivars	Plant height (cm)			Numbers of axillary branches			Numbers of pod on the main stem			Pod length (cm)			The number of seeds per pod		
	1993														
	Mean	5%	1%	Mean	5%	1%	Mean	5%	1%	Mean	5%	1%	Mean	5%	1%
Ceres	142.1	ab	ab	4.83	c	c	45.37	cd	c	5.67	c	bc	27.77	bcd	abc
Cobra	141.4	abc	ab	4.90	c	c	54.60	a	a	6.05	ab	ab	28.90	ab	ab
Daidem	143.4	a	a	6.53	a	a	44.30	d	c	5.50	c	c	26.66	de	cd
NPZ 71	139.3	bc	abc	5.17	bc	c	52.30	ab	a	5.78	bc	abc	27.17	cd	bcd
NPZ 74	144.7	a	a	6.27	a	ab	52.00	ab	a	6.03	ab	ab	25.92	e	d
NPZ 82	132.2	e	d	5.63	b	bc	45.93	cd	bc	5.47	c	c	28.25	abc	abc
NPZ 66	137.6	cd	bc	5.37	bc	c	48.90	bc	abc	6.21	a	a	29.23	a	a
NPZ 62	134.4	de	cd	5.33	bc	c	51.33	ab	ab	6.12	ab	ab	28.78	ab	ab
LSD		3,71	5,16		0.54	0.75		3.84	5.33		0.33	0.46		1.16	1.61
	1994														
	Mean	5%	1%	Mean	5%	1%	Mean	5%	1%	Mean	5%	1%	Mean	5%	1%
Ceres	158.5	b	ab	6.07	b	b	53.13	a	ab	5.24	b	b	27.39	a	a
Cobra	153.2	b	b	6.10	b	b	53.90	a	a	5.36	b	b	26.53	a	a
Daidem	157.7	b	ab	6.00	b	b	53.10	a	ab	5.39	b	b	26.94	a	a
NPZ 71	166.2	a	a	6.97	a	a	49.63	cd	c	5.51	b	b	26.53	a	a
NPZ 74	166.1	a	a	7.17	a	a	52.57	ab	ab	5.70	b	b	25.96	a	a
NPZ 82	157.3	b	ab	7.70	b	bc	51.13	bc	bc	6.33	a	a	26.48	a	a
NPZ 66	133.4	d	d	6.07	b	b	44.57	e	e	4.57	c	c	26.51	a	a
NPZ 62	142.4	c	c	5.27	c	c	49.07	d	c	4.50	b	b	27.41	a	a
LSD		6.00	8.33		0.39	0.54		1.78	2.47		0.44	0.61		1.83	2.54

Pod length

In both years statistical difference were determined among cultivars at the level of 1% (Table 3). In the first year, there was no difference between Ceres; Diadem,NPZ 82 and NPZ 71 cultivars. However, in the second year there were NPZ 82 and NPZ 66 cultivars take part of different groups the others in Table 4.

Pod length varied between 5.47-6.21 cm and 4.50-6.33 cm. Başalma (1991), recorded that pod length varied between 5.51-6.03 cm in her research. Pod length is not releated to seed yield directly.

The number of seed per pod

The variance analysis related to the number of seed in pod given in Table 3. It was found to be important difference between the cultivars at the level 1% only first year. There was important difference between NPZ 74 and NPZ 66, the values of other cultivars were found to be close. In the second year, there was no significant difference among the cultivars.

The average number of seed per pod varied between 25.92- 29.23 in the first year and between 24.39-27.40 in the second year (Table 4). These values showed a few degree from the researches conducted to Mendham et al (1984), who says average 30 seeds per pod in the rapeseed plants. Başalma (1991), found that, there are 28.67 - 31.42 seeds per pod in Tower cultivar as a summer rapeseed. Başalma and Kolsarıcı (1997), say that according to the two year average; they observed 25.60 - 32.70 seeds per pod in five French originated rapeseed cultivars. These values were similarities in our research results.

Seed yield

The variance analysis related to the seed yield are given in (Table 5) In the first year, there was no significant difference among the cultivars. But it was found to be important difference among cultivars at the level of 1% in the second year. As Diadem, NPZ 74 and NPZ 66 cultivars were found to be harmonius each other, NPZ 62 and NPZ 82 cultivars different with them.

The seed yield related to the two annual trials given in (Table 6). As can be seen from examining in Table 6 seed yield varied between 277.33 - 319.35 kg/da in the first year and 249.33 - 324.67 kg/da in the second year. In both years, the highest yield and the lowest yield were obtained from cultivars NPZ 62, Diadem respectively. Sağlam and Atakişi (1995), who also used the same cultivar (Ceres) in the ecology of The Thrace Region. While the same cultivar gave 227.50 kg/da yield in Thrace region, it was given 280.67 kg/da yield under Ankara conditions.

Oil ratio

The variance analysis related to oil ratio are given in Table 5. Statistical difference was determined among cultivars at level of 1% in the first year, 5% in the second year.NPZ 74 and Diadem cultivars showed different values, however, other cultivars had been given close results for oil ratio.

The oil ratio of the cultivars were given as replication mean in Table 6. The oil ratio varied between 27.71-38.00 % in the first year, 33.31-40.77 % in the second year. The reason of high oil ratio in the second year may be explained with the high weather temperature (as shown Table 1.) during the growing period in this year. Baydar and Yüce (1996) reported that the study conducted in Antalya, oil ratio in winter rapeseed cultivar NPZ 62 was found to be 47.5 %. In our research, the reason of low oil ratio in NPZ 62 cultivar may be explained with the harder winter conditions and more sudden increase in temperature in Ankara compared to Antalya resulting in late ripening without completing.

Table 5. Variance analysis of seed yield, oil ratio and 1000 seed weight of German originated rapeseed cultivars

Source of variance	D.F.	Seed yield (kg/da)		1000 Seed weight (g)		Oil ratio (%)	
		1993	1994	1993	1994	1993	1994
Total	23						
Replication	2	27.17	485.04	0.01	0.04	1.04	1.85
Cultivars	7	840.33	3565.05**	0.29**	0.06*	29.58**	16.09*
Error	14	555.60	632.99	0.02	0.02	3.99	5.28

*, ** Significant at 0.05 and 0.01 level respectively.

Table 6. According to Duncan tests means of seed yield,oil ratio and 1000 seed weight of German originated rapeseed cultivars in 1993-1994

Cultivars	Seed yield (kg/da)			1000 Seed weight (g)			Oil ratio (%)		
	1993								
	Mean	5%	1%	Mean	5%	1%	Mean	5%	1%
Ceres	281.33	a	a	3.38	e	de	32.39	bc	bc
Cobra	277.00	a	a	4.13	a	a	31.36	bcd	bc
Daidem	277.33	a	a	3.66	cd	bcd	27.71	d	c
NPZ 71	284.00	a	a	3.28	e	e	32.53	bc	bc
NPZ 74	288.00	a	a	3.39	e	de	38.00	a	a
NPZ 82	314.00	a	a	3.47	de	cde	34.47	b	ab
NPZ 66	298.34	a	a	3.80	bc	abc	33.47	b	ab
NPZ 62	319.35	a	a	3.98	ab	ab	29.37	cd	bc
LSD		41.28	57.29		0.25	0.34		3.50	4.85
	1994								
	Mean	5%	1%	Mean	5%	1%	Mean	5%	1%
Ceres	280.00	abcd	abc	3.50	ab	ab	36.55	ab	ab
Cobra	307.00	abc	ab	3.34	abc	ab	33.31	b	b
Daidem	249.33	de	bc	3.57	a	a	37.53	ab	ab
NPZ 71	229.00	e	c	3.13	bc	ab	35.08	b	ab
NPZ 74	272.67	bcde	abc	3.27	bc	ab	34.32	b	b
NPZ 82	320.00	ab	a	3.24	c	ab	37.57	ab	ab
NPZ 66	260.00	cde	abc	3.16	c	b	40.77	a	a
NPZ 62	324.67	a	a	3.22	c	ab	36.01	b	ab
LSD		44.06	61.15		0.23	0.32		4.02	5.58

Seed testing

As seen the variance analysis results; it was found to be important difference among cultivars in the first year at the level of 1 % and in the second year at level of 5 % in terms of 1000 seed weight (Table 5). In the first year, because the values of Ceres, NPZ 71 and NPZ 74 cultivars showed close results, they were in the same groups. In the second year, Ceres, Cobra and Diadem cultivars gave closely results each other but the other cultivars were in different groups.

Findings for 1000 seed weight were given in Table 6 as the replication means. The 1000 seed weight of these cultivars varied between 3.28 - 4.13 g in the first year and 3.13 - 3.57 g in the second year. In the study conducted in Antalya conditions, Baydar and Yüce (1996) recorded that 1000 seed weight of NPZ 62 cultivar was 2.83 g in our study, the values of NPZ 62 cultivar (3.22-3.98 g) paralleled to the literatures gave.

Consequently; eight winter German originated rapeseed cultivars used in this study gave satisfactory results in Ankara conditions. The most suitable winter and summer rapeseed cultivars with high yield and superior quality according to different growing region must be selected. This important oil crop should be absolutely introduced and accepted to the farmers so that our vegetable oil deficiency can be met.

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