

INVESTIGATING THE ADAPTATION OF PEA (*Pisum sativum* L.) LINES AND VARIETIES UNDER MEDITERRANEAN CLIMATIC CONDITIONS

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Summary. This research was conducted in Adana ecological conditions of the Eastern Mediterranean region in order to determine the yield and yield components of pea genotypes that were advanced in the breeding studies carried out in Adana province during the 2022-2023 growing period. The experimental material consisted of 20 genotypes and 3 commercial varieties considered as control. The experiment was carried out according to the randomized block design with three replications, 45 cm between rows, 10 cm above rows, 5 m in length and 4 rows (5mX4 rowsX0,45m) for each genotype. The sowing of the experiment was carried out on December 20, 2022 for winter and the harvest was completed on June 5, 2023. According to the results of the research findings, the flowering period of the varieties varied between 67.50-58 days, pod setting period 79.50-70 days, plant height 182.50-57cm, first pod height 68-23.50cm, hundred grain weight 28.85-11.24gr and grain yield 245-105.33kgda. According to the data obtained at the end of the research, Adana1, Adana3, Adana8, Adana13, Adana14, Adana15 and Adana16 genotypes, which have high values in terms of grain yield and hundred grain weight, were found suitable for evaluation for the region and recorded in breeding studies. However, in order to make a better decision, it should be supported by more long-term and detailed agronomic studies.

Keywords: pea, yield, quality and yield parameters.

Introduction

In Turkey, pea (*Pisum sativum* L.) has a cultivation area of 887 ha, a production of 2,392 tons and a grain yield of 26,967 kg/ha (FAO, 2024). In terms of pea cultivated area and production amount, our country ranks last in dry pea production. However, its consumption in fresh, canned or frozen food industry is quite common (Ceyhan et al., 2005). Edible grain legumes are among the plants used in human nutrition in our country and are important vegetable protein sources. Pea is a very important food type with its protein, carbohydrate, phosphorus, potassium and vitamin A content. Due to its protein richness, it is one of the irreplaceable food sources in human and animal nutrition in eliminating the nutritional deficit. Pea, which is an important legume among edible grain legumes, is consumed as green vegetables and also as dry grains due to its high protein and vitamin richness. The protein ratio of pea grain at dry maturity varies between 18-28.4% and it is a very rich plant in terms of vitamins A and B as well as mineral substances (Şehirali, 1988). The nitrogen fixer is an important component of the low-input crops group due to its symbiotic life with bacteria. Dry peas are a good source of nutritionally low digestible carbohydrates, protein and micronutrients (Thavarajah et al., 2022). According to Pawar et al. (2017), it is the second most valuable legume crop in the world. The dry, green leaves are fed to animals and the highly nutritious dense green pods are preferred for eating. Depending on soil structure and moisture conditions, in some cases, taproots can go as deep as 150 cm; however, under normal conditions, the majority of pea roots develop close to the soil surface. For these reasons, peas are a good preplant for other crops. In pea cultivation, a significant yield decrease is observed in successive plantings in the same place. In pea roots, nodosites formed by *Rhizobium* bacteria, which help to retain the free nitrogen of the air, develop (Şehirali, 1988). Our country has rich genetic resources in terms of many cultivated plants and pea is one of them. It is important to examine pea gene resources originating from Turkey in terms of agronomic and quality traits through different

researches and to evaluate them in breeding programs. Therefore, conservation of genetic diversity in local varieties is of utmost importance (Tan, 2010). It has been stated by many researchers that local pea genotypes are very important genetic resources in terms of adaptation to different ecologies (Nechit et al. 1988; Ceccarelli 1994; Bunder et al. 1996; Chahal and Gosal 2002). In our country, which is very rich in pea gene resources, it is very important to examine these gene resources in terms of their ability to adapt to different ecologies and their agronomic and quality characteristics and to use these materials rapidly in pea breeding programs in order to develop new varieties originating from Turkey suitable for different ecological regions. Pea is an important self-fertilized legume plant with diploid chromosome number $2n=2x=14$ (Dolezel and Greilhuber 2010).

Material and methods

This research was conducted in the experimental field of Eastern Mediterranean Agricultural Research Institute in the growing year 2022-2023. The research experiment was established according to the randomized block design with three replications. The plots were planned as 4 rows (5mX4 rowsX0,45m) of 9 m² with 45 cm between rows and 8 cm above rows, and fertilizer was applied as 3 kg /da N and 6 kg /da P₂O₅ with sowing. Wheat was planted as a pre-plant in the trial area and pea trial was planted after harvest. Doğankent locality, where the trials were planted in this study, is located at (37°00' N, 35°20' E) latitude and longitude coordinates. The trial material consisted of 20 genotypes and 3 commercial cultivars as control. The genotypes are part of the trials carried out for the purpose of variety registration in the regional conditions of the lines that have been developed from crossbreeding studies of national materials. Breeding studies were shared from trial evaluations. The list of dry pea genotypes and dry pea varieties used in the trial is given in Table 1.

Table 1

List of materials used in the experiment

Adana1 (KIRKLARELİ X JOF-6)	,Adana2 (UTRILLO X RONDO)	Adana3 (BURDURX EKİRDAĞ-2),	Adana4 (CARİNA X BOLERO-1),
Adana5 (CARİNA X BOLERO-2)	Adana6 (CARİNA X BOLERO-3),	Adana7 (BURDUR X TEKİRDAĞ-6),	Adana8 (KIRKLARELİ X JOF-2),
Adana9 (KIRKLARELİ X JOF-3)	Adana10 (BURDURX TEKİRDAĞ-1)	Adana11(KIRKLARELİ X JOF-4),	Adana12 (BURDUR X TEKİRDAĞ-5),
Adana13 (KIRKLARELİ X JOF-1)	Adana14 (KIRKLARELİ X JOF-5),	Adana15 (BURDUR X TEKİRDAĞ-4),	Adana16 (BURDUR X TEKİRDAĞ-7),
Adana17 (BURDUR X TEKİRDAĞ-3)	Adana18 (Irmak01),	Adana19 (Deren),	Adana20 (Elena),

The experimental area is under the influence of Mediterranean climate and meteorological data are given in Table 2. When the temperature averages of the year in which the experiments were carried out are examined, it is observed that the temperature values are close to the long-term average in terms of temperature, but the temperature values in July showed values above the long-term average.

When the precipitation values are analyzed according to years, irregularities in the distribution of precipitation and periodic intensities in precipitation amounts have been experienced in recent years due to global warming. In the 2023 growing years, it is observed that precipitation amounts are lower and their distribution is irregular compared to long years. Relative humidity rates, on the other hand, showed values parallel to long years Table 2. As it is known, climatic factors (temperature and precipitation) play a major role on the fruit setting period of pea (Bilgili, 2009).

Table 2

2022-2023 Growing Season and Long Term Climate Data

Months	Rainfall (mm)	Long Years (37 years)	Temperature (°C)	Long Years (37years)	Moisture (%)	Long Years (37 years)
	2022-2023	1982-2021	2022-2023	1982-2021	2022-2023	1982-2021
December	24,7	121,48	11,2	10,43	68,53	68,67
January	16,0	109,01	9,9	9,05	63,65	67,69
February	61,1	81,87	8,62	10,15	58,89	65,68
Mart	81,4	63,08	14,86	13,14	67,09	66,74
April	47,5	49,67	17,14	17,27	66,08	68,02
May	42,2	42,15	21,55	21,40	61,27	68,03
June	0,0	13,97	23,72	25,17	67,50	69,01
July	2,00	7,46	36,32	27,08	62,15	69,94
Total	274,9	488,69	143,31	133,69	515,16	543,78

Results and discussion

This research was carried out in the Mediterranean region in the Mediterranean region in the 2023 growing year in Adana-Doğankent experimental area by winter sowing in December. In this study, the dry pea genotypes were obtained,

The statistical difference between the varieties in terms of days to flowering and days to pod tying was significant; however, the highest number of days to flowering was obtained from genotypes Adana1 with 67.50 days and the lowest number of days to flowering was obtained from genotypes Adana15, Adana16, Adana17, Adana19 with 58-59 cm. The highest number of days to pod setting was obtained from genotypes Adana1 and Adana6 with 79.50-79 days and the lowest number was obtained from Adana17 and Adana19 varieties with 70 days.

The statistical difference between the varieties in terms of plant height and first pod height was significant; however, the highest plant height was obtained from Adana4 and Adana5 genotypes with 182.50-160.50 cm, the lowest plant height was obtained from Adana 16 and Adana15 genotypes with 57-59 cm. The highest first pod height was obtained from Adana1, Adana4, Adana5 and Adana6 genotypes with 70 cm, the lowest first pod height was obtained from Adana 15 and Adana16 genotypes with 24 cm.

The statistical difference between the varieties in terms of hundred grain weight and grain yield was found to be significant. The highest hundred grain weight was determined from genotype Adana14 with 28.85 g and the lowest hundred grain weight was determined from genotype Adana20 with 11.24 g. The highest dry pea grain yield values were obtained from genotype Adana13 with 245 kg/ha and the lowest from genotype Adana2 with 105.33 kg/ha (Table 3). Ceyhan et al. (2005), in a study conducted with six local and twenty exotic pea genotypes under Konya ecological conditions in 2001-3, reported that the year-genotype interaction was significant, the number of branches on the plant ranged between 3.8-7.8, the number of pods between 18-38, thousand grain weights between 101-236 g, and grain yields between 112-243 kg/ha. Geisler (1983), Mart (2022) reported that atmospheric temperature is more important than soil moisture on pea yield and it is effective on fertilization biology. In a study conducted by Kaya et al. (2003) in 1998-9 under Ankara conditions, the effects of four different sowing times (20 days apart starting from the beginning of March) on grain yield and some traits were investigated. In the study where significant differences were found between sowing times, thousand grain weight varied between 140 and 178 g, grain yield varied between 63 and 224 kg/ha and it was determined that early spring sowing was effective to obtain high grain yield.

Table 3

Number of days to flowering, number of days to pod tying, plant height values, first pod height, 100 grain weight (g) and grain yield (kg/ha) values of pea genotypes

Genotypes	Flowering (days)	Number of Days for Pod Tying (days)	Plant Height (cm)	First pod height (cm)	100 Grain Weight (g)	Yield (kg/da)
Adana-1	67,50 a	79,50 a	128,00 b	66,50 a	<u>21,34 cd</u>	<u>191,67 a-c</u>
Adana-2	65,00 ab	76,50 a-c	75,00 cd	34,50 bc	19,08 de	105,33 f
Adana-3	64,00 a-c	75,50 a-d	72,00 cd	30,50 bc	<u>24,79 bc</u>	<u>206,33 a-c</u>
Adana-4	64,00 a-c	77,50 ab	182,50 a	70,50 a	18,22 d-f	125,11 d-f
Adana-5	64,00 a-c	77,00 ab	160,50 a	68,00 a	18,07 d-f	111,22 ef
Adana-6	64,00 a-c	79,00 a	126,50 b	66,00 a	17,04 e-g	113,33 d-f
Adana-7	62,50 b-d	75,00 a-e	92,00 c	43,50 b	17,28 e-g	167,22 b-e
Adana-8	62,00 b-d	75,00 a-e	123,00 b	43,00 b	<u>20,92 d</u>	<u>190,44 a-c</u>
Adana-9	62,00 b-d	75,50 a-d	73,00 cd	35,50 bc	18,92 de	218,78 ab
Adana-10	60,50 b-d	71,50 c-e	87,00 c	37,00 bc	19,86 de	208,11 ab
Adana-11	60,50 b-d	71,50 c-e	93,50 c	39,50 b	25,55 ab	149,89 c-f
Adana-12	60,00 cd	72,50 b-e	93,50 c	30,50 bc	17,90 d-g	202,78 a-c
Adana-13	59,50 cd	70,50 de	74,50 cd	34,50 bc	<u>24,72 bc</u>	<u>245,00 a</u>
Adana-14	59,50 cd	71,00 de	71,50 cd	32,50 bc	<u>28,85 a</u>	<u>191,33 a-c</u>
Adana-15	59,00 d	71,00 de	59,50 d	23,50 c	<u>25,30 ab</u>	<u>186,22 bc</u>
Adana-16	58,50 d	71,00 de	57,00 d	24,50 c	<u>25,04 b</u>	<u>207,56 a-c</u>
Adana-17	58,00 d	70,00 e	75,50 cd	32,50 bc	18,52 d-f	219,78 ab
Adana-18	61,50 b-d	75,50 a-d	117,00 b	60,50 a	14,49 gh	118,89 d-f
Adana-19	58,50 d	70,00 e	84,50 c	33,00 bc	15,14 fg	169,00 b-d
Adana-20	61,00 b-d	73,50 b-e	93,00 c	40,00 b	11,24 h	117,33 d-f
CV	3,75	3,89	10,97	15,78	8,51	15,99
LSD	4,83	5,25	22,27	13,97	3,58	57,67
F	**	**	**	**	**	**

* 5% significant level, ** 1% significant level

Conclusions

As a result of the study conducted with the genotypes and varieties used in the experiment, it was observed that some varieties stood out in the ecology of the region. According to the results of the research findings, the flowering period of the varieties varied between 67.50-58 days, pod setting period 79.50-70 days, plant height 182.50-57 cm, first pod height 68-23.50 cm, hundred grain weight 28.85-11.24 g and grain yield 245-105.33 kgda. The flowering and pod setting times of the varieties provided important data on the earliness of the genotypes, while plant height and first pod height provided important data on the suitability of pea genotypes for mechanized farming. According to the data obtained at the end of the research, the genotypes Adana1, Adana3, Adana8,

Adana13, Adana14, Adana15 and Adana16, which have high values in terms of grain yield and hundred grain weight, were found suitable for evaluation for the region and recorded in breeding studies. However, in order to make a better decision, it should be supported by more long-term and detailed agronomic studies.

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