

# Determining the Yield and the Quality Parameters for Some Local Pea (*Pisum sativum* L.) Varieties in Eastern Mediterranean Region

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## Abstract

This research was carried out to determine the seed yield and quality components of some pea genotypes under eastern mediterranean ecological conditions during 2015 and 2016 at East Mediterranean Agricultural Research Institute, Adana location. Research was conducted with different local pea populations, pea varieties from ICARDA and from Menemen gene bank under Eastern Mediterranean conditions for pea variety breeding. Trials were investigated under winter conditions. The area of the research was located between the geographic latitudes of 36° 51' 17.21 North and 35° 20' 41.61 East with an altitude of 23 m. According to the results of the analyses from this study, the highest and the lowest values are following, 273.6-142.2 kg/da for the yield, 57-38 days for the flowering time, 121.0-62.7 cm for the plant height, 28.4-15.1 gr for the 100-grain weight in the winter sowing conditions. In addition to these, the highest and the lowest protein content were 31.84-26.26. Pea has an important place in human and animal nutrition with its rich nutritional content. These results provide an initial step for the development of promising *Pisum sativum* L. varieties in sustainable breeding programs.

## Keywords

Pea, Yield, Quality, Genotype

## 1. Introduction

Peas (*Pisum sativum* L.) are important leguminous plant used as a food source of human as well as being an animal feed worldwide owing to its high protein content of 20-30%. As a leguminous plant, pea transforms the free nitrogen in the air into a form that plants can take, it contains sufficient level of carbohydrates; rich in calcium, iron and especially phosphorus and it is also a good source of vegetable protein in terms of having various vitamins [1-2]. Turkey is a motherland of many leguminous plants including peas (*Pisum sativum* L.). Peas were originated mainly in Eastern-Mediterranean, Iran and between Caucasus and Tibet [3-6]. For the origination of peas, Watts and Watts (1954) was mentioned that Ethiopia, Mediterranean sides, South-West Asia on the other hand, [7] stated that Mediterranean countries and Ethiopia are the centers that pea spreaded into the world. Peas, which can be grown in almost every region of Turkey, are the most commonly used ingredient in the canned food industry and in the community. It is one of the most important raw materials of the canned and frozen food industry, the straw of pea is also used for animal feeding.

Having an important place in human and animal nutrition with its rich nutritional content, pea is the fourth place after chickpeas, lentils and beans in terms of sowing area and production in [8]. According to the statistics of the year 2021 in our country, total pea cultivation area is about 781 ha, production is 2.193 tons and the yield is 28.079 hg/ha [8]. Peas farming in our country is carried out mostly in the production of fresh peas especially in the coastal areas (Marmara,

Aegean and Mediterranean regions in particular).

The development of varieties with high yields, desired characteristics for domestic consumption and exporting and the application of the cultivation techniques which will reveal these characteristics are very important for the presentation of pure and high quality product for the market, for feeding our people and for exporting [9].

Pea is a very important plant as an intermediary product in the cultivation of field crops. Peas are very important crops as an intermediary product in terms of giving the opportunity to the following crop to be treated as a main crop due to the cultivation of peas during winter in the Mediterranean Region and leaving the field in the early period.

In many countries around the world, peas are produced in large quantities for consumption as fresh and processed food. It is one of the products that produced for canned and frozen food industry. Pea is one of the leading plants in canned and stuffed vegetable production. Due to the short consumption period of peas, the canned process is very common in both factories and homes. As the pea flour is used in the food industry, especially the plant margin stem and straw are used as animal feed. The varieties of peas that are grown in Turkey can be grouped under three main groups: round seeds, husked/wrinkled seeds and sultani-sweet peas. Round seeded peas from these groups are not preferred in canned food industry due to the formation of sediments in the bottom of the center by converting the sugar into starch during starch processing. Canned peas are being cultivated in the countries where the climate is temperate and both the spring and autumn sowing are possible that aims to extend the product processing season of the canning factories [10].

Quality values for pea are very important; especially starch values, which is an important criteria for maintaining the protein values and suitability to canned in the canned food industry. Due to the high quality and quantity of the product, the development of suitable varieties in pea cultivation is an important factor in increasing production and quality. Turkey has rich genetic resources for many cultivated plants, as well as peas. It is important to investigate the pea gene sources in Turkey with different researches in terms of agronomic and quality characteristics and to use them in breeding programs. The new pea lines that generated using the local gene resources were lead to an increase in quality and quantity of peas [11-12]. The study of agronomic and quality characteristics of these local gene resources which have high ability to adapt to different ecologies and the rapid integration of this material into the pea breeding programs will be very important for the development of new varieties originating in Turkey that suitable for different ecological regions. This research was carried out to develop new varieties of peas which can be grown under winter conditions in Eastern Mediterranean region, having high yield and quality, suitable for machine harvest and tolerant to diseases and insects.

## 2. Materials and Methods

This study contains some pea varieties from the pea breeding program conducted by the Eastern Mediterranean Agricultural Research Institute. The materials are local pea populations collected from various regions of Turkey, from ICARDA Genebank and from Izmir Menemen Genebank. From these populations, single plant selection is made and the lines are purified. In this study, the responses of the varieties in the field conditions and quality values of the advanced lines are investigated. The high quality and quantity lines were determined for breeding studies.

This research was conducted in the field trial locations from The Eastern Mediterranean Agricultural Research Institute (Adana) during the 2015-2016 raising season. The plots were made in 4 rows (parcels of 9 m<sup>2</sup>) with a length of 5 m, with 45 cm between rows and 10 cm above the rows. 3.0 kg N, 6 kg P<sub>2</sub>O<sub>5</sub> was fertilized before the sowing. Some important morphological observations were made in each plot.

**Table 1. Some Physical and Chemical Properties of Trial Area Soils**

Soil Structure Distribution							
Sand (%)	Silt (%)	Clay (%)	pH (1:1)	Lime (%)	Org. Mad (%)	Total salt (%)	P <sub>2</sub> O <sub>5</sub> (kg/da)
32.0	37.7	30.3	7.43	12.0	1.3	0.2	4.1

The Eastern Mediterranean Agricultural Research Institute located in Adana/Turkey contains of a class of clayey-brown alluvial soils that are run in the sense that the texture is moderate throughout the profile when the physical and chemical analysis results of the land area are examined (Table 1). Although the organic matter content was low, the soil was suitable for agricultural use without salinity problem. In areas where the research was originally established, as shown in Table 1, the soil pH was 7.43; the salt level was found to be 0.23% and the content of lime was found to be 12.0.

The climatic characteristics during the production period such as monthly rainfall, temperature and relative humidity rates of Adana where the research was conducted can be seen in Table 2. In particular, it is observed that rainfall has not been distributed evenly during the growing seasons especially there has been low rainfall according to the average for many years during the plant development periods in November, December, February and April. This uneven distribution of rainfall has had a negative effect on the development of plants.

**Table 2. Climate Data in Adana Province of 2015-16 Growing Year**

Month	Rain (mm)		Average Temperature C°		Moisture (%)	
	Long Years	2015-2016	Long Years	2015-2016	Long Years	2015-2016
November	67.2	0	15.3	13.1	63	71.6
December	118.1	0	11.1	9.1	66	65.5
January	111.7	105	9.7	7.3	66	72.4
February	92.8	64	10.4	12.3	66	79.2
March	67.9	97.5	13.3	14.0	66	70.0
April	51.4	5	17.5	18.5	69	73.4
May	46.7	71	21.7	19.8	67	70.3
June	22.4	0	25.6	23.0	66	83.1
July	5.4	5	27.7		68	
<b>Total</b>	600	383.5				

### 3. Results and Discussion

The yield values of the winter peas cultivated in the trial area of Eastern Mediterranean Agricultural Research Institute, Adana during the 2015-2016 growing season are given in Table 3. Adverse effects were detected on yield due to irregular distribution of rainfall amount.

In Table 3, the highest values for grain yield were shown as 273.6 kg/da from the Bolero variety; 244.1 kg/da from the Antalya 13 variety; and 238.9 kg/da from the Rondo variety while the lowest value was obtained from the Denizli 8 variety which was 130.4 kg/da. The amount of rainfall was low compared to long years and the distribution was irregular which resulted in low yield. [13-14] were conducted a two year study on some pea lines to identify their suitability and their yield performance under Eastern Mediterranean conditions and found the yield ranged between 238.7-422.3 kg/da for the first year and between 100.7-273.7 kg/da for the second year and between 181.9-309.8 kg/da as an average of two year [15-16].

The number of flowering days were ranged between 57-38 days and the number of days for pod binding varied between 71.3-51.3 days. Plant height values were ranged between 93.8-47.2 cm, the first pod height was between 121.0-62.7 cm and also it has been determined that the 100-grain weight varied between 28.4-15.1 gr [17]. As quality parameters, the highest and the lowest protein values were found to vary between 30.62-26.33 and starch values between 47.20-28.02%. A wide variation was observed on varieties due to the availability of short and tall plant types due to the fact that the base of our material is the population.

The variation of new resources which is the crucial parameter in sustainable breeding programs is highly limited in peas [17-18]. It is important to develop new varieties of peas with the local pea populations which will contain early maturity, high quality, high yield, resistance to low temperature and drought, which can be adapted to different regions [19]. The negative conditions for the production and export of pea should be solved and new promising projections should be planned. The pea has the least number of local variety number among the edible legumes in Turkey [20]. There are three registered pea varieties in Turkey for the dry consumption and two of those varieties (Irmak, Deren) were developed by our team in the Eastern Mediterranean Research Institute. The expansion of pea agriculture as a winter intermediate crop in the coastal regions will contribute significantly to the production and consumption of peas in our country. Therefore, the study of these gene sources in our country, rich in pea gene resources, with their agronomic and quality characteristics [21].

Their ability to comply with different ecologies, and their integration into pea breeding programs will be very important and beneficial for the development of local varieties suitable for different ecological zones.

### 4. Conclusion

Pea is also a very important crop in multiple crop/year production types as an intermediate crop. Especially the winter growing of pea in Mediterranean region will allow the following crop to act as a main crop with leaving the field in early period [22]. The studies on the promising lines that are identified as Antalya 13, Konya 155, Antalya 50, Gaziantep 94 will continue further. Turkey is one of the most important gene center for many crop species including field peas. Although, several investigations has been conducted on the Turkish field pea genetic resources, however, there is further need to conduct more research on these genetic resources to evaluate agronomic performance and

quality traits as well. This will be very crucial to use in effective breeding programs, germplasm collection and as well as in conservation strategies [23]. We continue our efforts to develop high-yielding and high-quality pea varieties that are adaptable to the region, tolerant to diseases, in line with our breeding objectives.

The quality parameters for pea are very important. Especially the starch values has an important role on protein content and suitability for canned food industry.

**Table 3. Obtained from 2015-2016 Year Number of Days Pea Genotypes Flowering, Plant Height, 100-Grain Weight, Yield Values**

Sıra No	Pea Genotypes	Flowering Days (day)	Pod Days (day)	First Pod Height (cm)	Plant Height (cm)	100 Grain Weight (gr)	Seed Yield (kg/da)	Protein %	Starch %
1	MUĞLA 46	57.0a	71.3a	75.5a	113.8a-c	17.7f-1	160.3f-j	30.37	39.62
2	Konya 155	53.3ab	69.0ab	72.1ab	117.2ab	21.7bc	218.1b-d	30.20	42.47
3	ANTALYA 80	52.0a-c	56.0f-1	60.5a-d	120.5a	28.4a	189.8d-f	28.23	43.81
4	DENİZLİ 8	51.6a-c	64.6b-d	62.7a-d	121.0a	22.2b	130.4j	30.29	43.84
5	KIRKLARELİ 124	50.6a-d	53.6g-1	44.9c-h	91.6b-h	16.2ij	142.2ij	28.86	44.51
6	Konya 134	49.6a-d	65.3bc	43.8d-h	89.4c-h	21.3b-d	208.1b-e	28.67	43.81
7	ANTALYA 50	49.0a-d	60.0d-f	47.7c-g	94.4b-g	17.4g-1	215.6b-d	27.87	44.75
8	ANTALYA 13	48.3a-d	62.3c-e	64.9a-c	113.3a-c	15.1j	244.1ab	28.80	28.90
9	ANTALYA 104	47.3b-e	59.3ef	47.7c-g	100.5a-f	16.5h-j	148.2g-j	30.00	43.75
10	BURSA 18	47.3b-e	58.6e-g	51.0c-f	103.8a-e	18.4f-1	205.9b-e	30.62	46.44
11	GAZİANTEP 94	47.0b-f	59.3ef	31.1f-h	73.8g-1	16.4h-j	211.8b-e	27.86	45.38
12	BURSA 20	46.0b-f	57.6e-h	38.2e-h	79.9e-1	20.9b-e	156.0f-j	30.03	43.20
13	KARS 49	45.3b-f	58.6e-g	52.2b-e	108.8a-d	17.6f-1	181.2d-h	26.33	47.20
14	CARİNA	45.0b-f	57.0f-h	28.8gh	<b>62.7i</b>	18.7e-g	147.7h-j	27.45	45.31
15	Kars 22	44.6b-f	57.0f-h	28.8gh	74.9f-1	19.1d-g	175.0e-1	28.88	46.59
16	JOF	44.0c-f	57.0f-h	27.2h	78.3e-1	18.5f-h	202.4c-e	27.66	45.54
17	ANTALYA 23	42.6d-f	56.3f-1	38.8e-h	83.3d-1	19.7c-f	186.9d-g	29.14	28.73
18	TÜRKİYE 1	42.6d-f	56.3f-1	39.9e-h	92.2b-h	19.7c-f	206.5b-e	28.28	30.08
19	BOLERO	39.3ef	53.0h1	<b>26.6h</b>	66.6h1	18.2f-1	<b>273.6a</b>	28.65	28.02
20	RONDO	<b>38.3f</b>	<b>51.3i</b>	29.4gh	72.2g-1	28.2a	238.9a-c	27.66	28.86
	F	*	**	**	**	**	**		
	CV (%)	2.54	1,87	5,56	14,67	0.27	12.22		

CV: Variation of Coefficient. \*: Significant.

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