

ORIGINAL ARTICLE

YIELD AND ITS COMPONENTS IN FIELD PEA (*Pisum arvense* L.) LINES**A.S. TEKELI, ATES, E.****ABSTRACT**

Morphological characters such as main stem length (cm), number of branches per plant, leaf length (cm), number of leaves per main stem, number of leaflets per leaf, diameter of main stem (mm), pods / main stem and seeds / pod as well as agricultural herbage yield (t ha^{-1}), dry matter yield (t ha^{-1}), seed yield (t ha^{-1}), crude protein (%) were investigated in Trakya, during the 1999-2002. The maximum main stem length (124.375 cm), leaf length (24.808 cm), number of pods per main stem (16.526), herbage yield (27.881 t ha^{-1}), dry matter yield (7.319 t ha^{-1}) and seed yield (2.590 t ha^{-1}) were determined from the 16-K and 16-DY field pea lines. K line has given higher values than four lines for the number of branches per plant (5.567). Main stem diameter ranged from 3.077 to 4.300 mm. It's found that the 23.025 leaves/main stem, 6.833 leaflets/leaf, 7.692 seeds/pod and 17.550% crude protein from the field pea lines.

KEYWORDS: field pea, *Pisum arvense* L., yield, morphological characters, agricultural traits**DETAILED ABSTRACT**

The study was conducted during the 1999-2000, 2000-2001 and 2001-2002 growing season on clay soil with pH 6.9-7.4 at Tekirdag Agriculture Faculty experimental area in Trakya University (41° N, 27.5° E) located at about 5m altitude above sea level and with a typical subtropical climate. Five field pea (*Pisum arvense* L.) lines (16, 16-K, 16-DY, 16-Z and K) were used in the experiments. The highest main stem length (123.975-124.375 cm), leaf length (24.567-24.808 cm), number of pods per main stem (16.432-16-526), herbage yield (27.400-27.881 t ha^{-1}), dry matter yield (7.271-7.319 t ha^{-1}) and seed yield (2.518-2.590 t ha^{-1}) were determined from the 16-K and 16-DY field pea lines. K line has given higher values ($P < 0.01$) than four lines for the number of branches per plant (5.567). Main stem diameter ranged from 3.077 to 4.300 mm, and highest main stem diameter measured in 16-K (4.300 mm), 16-Z (4.217 mm) and 16-DY (4.192 mm) lines. The highest number of leaves per main stem values (23.025) was found from 16-K line. The number of leaflets per leaf ranged from 4.083 to 6.833. Crude protein ratio changed 17.135 to 17.550%. K line (7.692) and 16-Z (7.283) produced more seeds/pod than the other lines.

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INTRODUCTION

Field pea (*Pisum arvense* L.) is one of the oldest cultivated crops and was grown in farming villages of the China at least as early as 8000 B.C. [11]; but origin of field pea is near the Mediterranean [3]. This plant is a common forage legume in the semiarid regions of the Anatolia and Mediterranean area (rain fall 350-550mm). It's performs best on fertile, well-drained soils with high moisture holding capacity. Optimum growth is obtained on loams, silt loam, or well texture soils with a pH 6.0-7.5 [8].

Field pea is used for seed, hay, pasture, silage, and green manure [9]. Plant is rich in high quality protein. It is rich in phosphorus and calcium; and also a good source of vitamins, especially vitamins A and D. These qualities make field pea one of the best feeds for animals and almost indispensable for efficient, economical livestock feeding [4].

The plant height varies between 50 and 200 cm in field pea genotypes [13]. Usta [15] states that the 3.50 to 6.37 branches in the common vetch (*Vicia sativa* L.). Tekeli and Ates [14] investigated that the variation and heritability of some yield components in common vetch lines. They determined maximum number of branches per plant (9.83) and they also determined that number of leaves per main stem, leaf length was changed between 7.60-17.00 and 6.54-14.10 cm respectively. The number of leaflets per leaf was emphasized averages about 2-6 by Acikgoz [1]; Soya *et al.* [12]. Uzun [16] reported a 18.30 t ha⁻¹ green fodder yield, 2.99-6.49 t ha⁻¹ dry matter yield and 15.23-23.04% crude protein ratio from the field pea. Bilgili *et al.* [7] determined that the number of seeds per pod averages 3.34. Seed yield in pea varied from 1.5-8.0 t ha⁻¹ [6, 9].

The aim of this study was to compare of field pea lines for yield and yield components.

MATERIALS AND METHODS

Field experiments were carried out between November-June in 1999-2002 at the Experimental Area of Field Crops Department of Trakya University, Tekirdag (41.0°N, 27.5°E). The soil where the research was conducted was a clay-loam, low in organic matter (1.02%), moderate in phosphorus contents (65.1 kg ha⁻¹), but rich in potassium content (576.3 kg ha⁻¹) and the pH= 6.9-7.4. The average rainfall was 482 mm, 314 mm and

513 mm during the growing season (November-June) in each year. Rainfall approximately same with the long term (1989-1998) mean (444.4 mm). The monthly average temperature (1st year 10.89°C; 2nd year 12.35°C, and 3rd year 10.44°C) and relative humidity (1st year 80.4%; 2nd year 76.5%, and 3rd year 75.6%) means were similar to the long term average (10.35°C; 77.80%).

Five field pea lines (16, 16-K, 16-DY, 16-Z, and K) were used in the experiments. Lines were evaluated with pure-line selection in the Plant Breeding Application and Research Center, Trakya University, Turkey. Plots 2.0x5.0m, arranged in a randomized block design with four replicates [10]. Row distance of 20cm [5], sowing rate 120 kg ha⁻¹ [12]. Plots consisted of 10 rows. Seeds were sown November 1st in 1999, November 4th in 2000 and November 9th in 2001 with hand-seeder.

Main stem length (cm), number of branches per plant, main stem diameter (mm), number of leaves per main stem, leaf length (cm), number leaflets per leaf were determined on ten randomly selected plants at the full-bloom stage. Main stem diameter was measured between the second and third node. Leaf length and number of leaflets per leaf were determined on the leaf at third node of ten plants. The three inner rows (2.4 m²) were cut at ground level at full-bloom for herbage yield (t ha⁻¹). Approximately 500g samples were dried at 78°C for 24 h, to determine dry matter and calculated the yield (t ha⁻¹) [5]. The number of pods per main stem and number of seeds per pod were measured on ten randomly selected plants, when the plants were matured. One cut was taken in each year. Plots were not irrigated and fertilized after sown and harvest. Crude protein (%) was determined using Kjeldahl methods. When the pods were matured, three other rows were harvested for seed yield (t ha⁻¹). The results were analysed using the TARIST statistical program [2].

RESULTS AND DISCUSSION

Results of analyses for the characters investigated are given in Table 1. There were no significant differences between lines for crude protein. The other characters were significantly differences between lines (P<0.01).

Table 1: Yield and Yield Components of Field Pea Lines

| | 1999-2000 | 2000-2001 | 2001-2002 | | 1999-2000 | 2000-2001 | 2001-2002 | |
|--------------|---|-----------|-----------------|----------------|--|-----------|-----------------|----------------|
| Lines | Main Stem Length (cm) | | | Average | Braches/Plant | | | Average |
| 16 | 117.980 | 117.725 | 117.375 | 117.693b | 3.525 | 3.473 | 3.975 | 3.658bc |
| 16-K | 124.200 | 125.275 | 123.650 | 124.375a | 4.325 | 4.325 | 4.375 | 4.342b |
| 16-DY | 123.930 | 124.000 | 124.000 | 123.976a | 4.175 | 4.150 | 4.200 | 4.175bc |
| 16-Z | 116.930 | 116.425 | 117.250 | 116.868b | 3.500 | 3.525 | 3.450 | 3.492c |
| K | 108.680 | 106.478 | 107.223 | 107.460c | 5.575 | 5.475 | 5.650 | 5.567a |
| LSD | Line: 5.814** | Year: ns | Line x Year: ns | | Line: 0.749** | Year: ns | Line x Year: ns | |
| Lines | Main Stem Diameter (mm) | | | | Leaves/Main Stem | | | |
| 16 | 3.425 | 3.350 | 3.445 | 3.407b | 20.575 | 20.850 | 20.600 | 20.675bc |
| 16-K | 4.250 | 4.300 | 4.350 | 4.300a | 23.025 | 22.875 | 23.175 | 23.025a |
| 16-DY | 4.175 | 4.250 | 4.150 | 4.192a | 22.000 | 22.000 | 22.650 | 22.217ab |
| 16-Z | 4.200 | 4.225 | 4.225 | 4.217a | 21.200 | 21.700 | 21.350 | 21.417abc |
| K | 3.093 | 3.025 | 3.113 | 3.077c | 19.500 | 19.675 | 19.325 | 19.500b |
| LSD | Line: 0.328** | Year: ns | Line x Year: ns | | Line: 2.076** | Year: ns | Line x Year: ns | |
| Lines | Leaf Length (cm) | | | | Leaflets/Leaf | | | |
| 16 | 23.350 | 23.375 | 23.975 | 23.567b | 5.250 | 5.250 | 5.000 | 5.167b |
| 16-K | 24.875 | 24.725 | 24.875 | 24.825a | 6.500 | 6.500 | 6.000 | 6.333a |
| 16-DY | 24.425 | 24.750 | 24.525 | 24.567a | 6.750 | 7.000 | 6.750 | 6.833a |
| 16-Z | 24.225 | 24.275 | 24.200 | 24.233ab | 6.250 | 6.500 | 6.250 | 6.333a |
| K | 20.375 | 19.800 | 20.125 | 20.100c | 4.250 | 4.000 | 4.000 | 4.083b |
| LSD | Line: 0.972** | Year: ns | Line x Year: ns | | Line: 1.143** | Year: ns | Line x Year: ns | |
| Lines | Pods/Main Stem | | | | Seeds/Pod | | | |
| 16 | 12.825 | 12.878 | 12.835 | 12.846c | 6.050 | 6.100 | 6.075 | 6.075c |
| 16-K | 16.525 | 16.528 | 16.525 | 16.526a | 6.825 | 6.875 | 6.900 | 6.867b |
| 16-DY | 16.500 | 16.665 | 16.130 | 16.432a | 6.575 | 6.625 | 5.219 | 6.608bc |
| 16-Z | 14.950 | 15.053 | 14.995 | 14.999b | 7.250 | 7.325 | 7.275 | 7.283ab |
| K | 9.350 | 9.350 | 9.325 | 9.342d | 7.900 | 7.625 | 7.550 | 7.692a |
| LSD | Line: 0.857** | Year: ns | Line x Year: ns | | Line: 0.686** | Year: ns | Line x Year: ns | |
| Lines | Crude Protein (%) | | | | Herbage Yield (t ha⁻¹) | | | |
| 16 | 17.385 | 17.350 | 17.405 | 17.380 | 20.678 | 20.483 | 20.555 | 20.572b |
| 16-K | 17.447 | 17.550 | 17.135 | 17.378 | 27.978 | 28.155 | 28.568 | 28.234a |
| 16-DY | 17.197 | 17.437 | 17.432 | 17.356 | 27.835 | 28.480 | 27.328 | 27.881a |
| 16-Z | 17.395 | 17.432 | 17.210 | 17.346 | 22.150 | 21.943 | 20.853 | 21.648b |
| K | 17.275 | 17.295 | 17.535 | 17.368 | 15.575 | 14.733 | 14.483 | 14.930c |
| LSD | Line: ns | Year: ns | Line x Year: ns | | Line: 2.314** | Year: ns | Line x Year: ns | |
| Lines | Dry Matter Yield (t ha⁻¹) | | | | Seed Yield (t ha⁻¹) | | | |
| 16 | 5.242 | 5.360 | 5.265 | 5.289b | 2.030 | 2.033 | 2.037 | 2.033b |
| 16-K | 7.383 | 7.322 | 7.252 | 7.319a | 2.490 | 2.602 | 2.462 | 2.518a |
| 16-DY | 7.215 | 7.327 | 7.270 | 7.271a | 2.647 | 2.657 | 2.465 | 2.590a |
| 16-Z | 5.220 | 5.193 | 5.380 | 5.264b | 2.050 | 2.023 | 2.063 | 2.045b |
| K | 3.535 | 3.440 | 3.480 | 3.485c | 1.620 | 1.623 | 1.563 | 1.602c |
| LSD | Line: 0.310** | Year: ns | Line x Year: ns | | Line: 0.185** | Year: ns | Line x Year: ns | |

** : P<0.01, ns : P>0.01

Plant height, number of branches per plant, main stem diameter, number of leaves per main stem, leaf length and number of leaflets per leaf are important traits that are used to determine herbage and hay yield. The highest main stem length (123.975-124.375 cm), leaf length (24.567-24.808 cm), number of pods per main stem (16.432-16.526), herbage yield (27.400-27.881 t ha⁻¹), dry matter yield (7.271-7.319 t ha⁻¹) and seed yield (2.518-2.590 t ha⁻¹) were determined from the 16-K and 16-DY field pea lines. Stem length and seed yield values were similar to those reported by Erac and Ekiz [9], Tekeli [13], Biarness-Dumoulin *et al.* [6]. The lowest leaf length was found 6.540-14.100 cm by Tekeli and Ates [14]. The results of herbage and dry matter yield were higher than those reported by Uzun [16].

K line has given higher values (P<0.01) than four lines for the number of branches per plant (5.567). Usta [15] found similar results; but, highest number of branches per plant was determined 9.83 by Tekeli and Ates [14].

Main stem diameter ranged from 3.077 to 4.300 mm, and highest main stem diameter measured in 16-K (4.300 mm), 16-Z (4.217 mm) and 16-DY (4.192 mm) lines (P<0.01).

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The highest number of leaves per main stem values (23.025) was found from 16-K line. The number of leaflets per leaf ranged from 4.083 to 6.833. Acikgoz [1] and Soya *et al.* [12] emphasized that the average 2 to 6 leaflets from the field pea.

According to crude protein ratio there were no significant differences between lines. Crude protein ratio changed 17.135 to 17.550%. Uzun [16] reported similar results.

Number of seeds per pod is also one of the efficiency factors for the seed yield. Differences in number of seeds per pod of the lines were significant (P<0.01). K line (7.692) and 16-Z (7.283) produced more seeds/pod than the other lines. Bilgili *et al.* [7] reported average 3.34 numbers of seeds per pod from the pea.

CONCLUSION

Herbage yield, dry matter yield and seed yield of candidate varieties 16-DY and 16-K were determined to be higher than other lines. According to yield and yield components 16-DY and 16-K lines are found hopeful.

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ADDRESS OF AUTHORS

Ali Servet Tekeli; Ertan Ates: ertan_ates@tnn.net

Department of Field Crops, Agriculture Faculty,
Trakya University, Tekirdag, TURKEY
Tel: +902822931442
Fax: +902822931454

