

**YIELD AND YIELD COMPONENTS OF SOME COMMON VETCH (*Vicia sativa* L.)
VARIETIES IN ECOLOGICAL CONDITIONS OF CEYLANPINAR**

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ABSTRACT

This study was conducted to determine yield and yield components of common vetch (*Vicia sativa* L.) varieties grown in semi-arid ecological conditions in southeastern Turkey. Field experiment was established at Ceylanpinar district in Şanlıurfa province, and carried out in winter season of 2014-2015. Experimental layout was a complete randomized block design with three replications. Registered 11 common vetch varieties were used in the experiment. All traits investigated, except for pod numbers per plant, were significantly ($P<0.05$) different among the varieties. The results indicated that plant height ranged from 77.47-91.77 cm, fresh forage yield from 1749-2701 kg da⁻¹, dry forage yield from 408.1-643.6 kg da⁻¹, crude protein ratio from 16.46-24.22%, pod numbers per plant from 17.50-21.70 pods, seed numbers per pod from 6.57-5.43, seed yield from 130.2-186.7 kg da⁻¹, 1000-seed weight from 45.77-63.20 g. Green forage yield, dry forage yield and seed yield characteristics, which are the most important traits for common vetch, of Ürkmez variety was superior compared to the other 10 common vetch varieties. However, the results revealed that Özveren variety came to the fore in terms of plant height and 1000-seed weight in Ceylanpinar ecological conditions.

Keywords: Common vetch, fresh forage yield, dry forage yield, seed yield, crude protein ratio

1. INTRODUCTION

Vetch (*Vicia sativa* L.) is an annual legume forage crop that is cultivated in plant-animal production systems to obtain green or dry hay and grain; thus, is widely used for feeding the livestock in many parts of the world (Ramos et al., 2000; Açıkgöz, 2001; Cabellero et al., 2001; Chowdhury et al., 2001; Han, 2010). Vetch is of great importance in providing quality forage and concentrated feed required by animal husbandry in Southeast Anatolia Region of Turkey (Tosun, 1974). The vetch has about 150 species in the world and the most widely cultivated species is common vetch (*Vicia sativa* L.). Climbing growth nature and high protein content of common vetch are the main reasons why many farmers extensively prefer vetch in intercropping with cereals (Dhima et al., 2007).

Various studies have been conducted to investigate the yield and yield components of the common vetch, an annual legume forage crop. Seydoşoğlu (2014) reported that the plant height of common vetch was between 33.9 and 62.6 cm, green hay yield was between 1522.0 and 3232.3 kg da⁻¹, dry hay yield between 308.0 and 919.5 kg da⁻¹ and seed yield 92.2 and 293.7 kg da⁻¹. Kökten et al. (2018) reported that the average plant height, green hay yield and dry hay yield of bitter vetch, which is an annual legume forage crop was 31.1 cm, 412.8 kg da⁻¹ and 95.7 kg da⁻¹. Similarly, Kökten et al. (2019) reported that the average crude protein content in bitter vetch genotypes was 7.3%.

Most of the pastures in Southeastern Anatolia region are included in the weak pasture class (Seydoşoğlu ve ark. 2018; Seydoşoğlu ve Kökten, 2019), reported that forage crops are important.

This study was carried out to investigate the production potential and yield components of some commercial common vetch varieties breed in recent years in Ceylanpinar district of Şanlıurfa province, Turkey.

2. MATERIAL AND METHODS

This research was conducted in a farmer field located at Yüksektepe village of Ceylanpınar district, Sanliurfa province in 2014-2015 production season. The registered Alper, Cumhuriyet-99, Selçuk-99, Özveren, Ürkmez, Yücel, Gökem, Albayrak, Doruk, Bakır-2001 and Alınoğlu-2001 common vetch varieties were used as materials.

Soil samples were collected from 0-30 cm depth of the plots to determine some chemical characteristics of the experimental field. The analysis of soils revealed that soil in the experimental field was very calcareous (12.31%), high in available potassium (316 kg ha⁻¹), low in organic matter (1.49%) and very low in plant-available phosphorus (50.4 kg ha⁻¹) (Ülgen and Yurtseven, 1995).

Total annual rainfall during vegetation period of common vetch was slightly higher than the average for long-term. Meteorological data indicated a very high rainfall (100.8 mm) in February 2015. The average monthly temperature and relative humidity during the vegetation period were close to the average for long term (Table 1). Precipitations in April and May, which were flowering and broad bean periods were 24.3 and 10.3 kg m⁻¹, respectively. Precipitation during this period was not adequate, therefore plants were irrigated twice at field capacity with a sprinkler system.

Table 1. Meteorological data of the experiment site during experiment and long-term (Anonymous, 2018)

Time	Average temperature (°C)	Relative humidity (%)	Precipitation (mm)
November 2014	12.1	53.9	78.6
November Long-Term	12.8	59.9	44.2
December 2014	9.5	79.4	55.4
December Long-Term	7.5	69.9	78.7
January 2015	6.2	65.6	82.5
January Long-Term	5.6	70.3	84.8
February 2015	7.6	74.3	100.8
February Long-Term	7.0	66.9	71.0
March 2015	11.7	58.9	79.0
Long-Term	10.9	60.4	66.1
April 2015	15.7	49.7	24.3
March Long-Term	16.2	56.2	49.2
May 2015	22.8	38.0	10.3
May Long-Term	22.1	44.9	29.1
June 2015	27.7	35.3	0.7
June Long-Term	28.1	32.8	4.0

3. METHODS

The experiment was established in the last week of December. The experimental was laid out according to a randomized block design with 3 replications. Each plot consisted of 6 rows with 8 m length and 20 cm interrow spacing. The amount of seed used for each variety was determined by considering 1000-grain weights (8-10 kg da⁻¹). The plot size was 1.2m×8m = 9.6 m² and treatments were separated by 1 m buffer zone from each other. The first and the last rows of each plot and the first and last 50 cm of each row were not included in the harvest and observations to eliminate the side effect. Half of each plot (2 rows) was harvested for observations on hay yield and the other half (2 rows) was harvested for observations on seed yield. Basal fertilizer as 30 kg pure nitrogen per hectare and 60 kg pure phosphorus per hectare was applied at seed sowing (Çil et al., 2004; Yücel et al., 2008). During the growing period of vetch, irrigation (twice), hoeing and other necessary maintenance operations were performed. Green hay was harvested at 50% flowering stage and the grain harvest was performed by hand at the full ripening stage when the lower pods become brown color (Sahar, 2006).

Plant length was determined by the average of the distance between the soil surface and the last bud of 10 plants randomly selected from each plot. The average values were recorded by counting the number of pods and number of seeds per 10 plants selected from each plot. The yield of green hay harvested from each plot was determined by weighing the weights of green hay at field conditions. The yield values determined per plot were converted to yield per decare. A portion of (0.5 kg) green hay harvested from each plot was dried in an oven at 70 °C for 48 hours (Anonymous, 2016). The dried hay samples were weighed and dry hay yields of different vetch varieties were determined. The dried

hay yield values determined per plot were converted to yield per decare. Plant samples taken from dry hay were ground in a mill with a sieve diameter of 1 mm and used for analysis. The raw ash content of the feeds was determined by burning hays in an ash oven at 550 °C for 8 hours. The Kjeldahl method was used to determine the nitrogen (N) content of the samples. The crude protein ratio was calculated by multiplying the N ratio by 6.25 (AOAC, 1990).

4. STATISTICAL ANALYSIS

The differences in properties investigated among the vetch varieties were assessed by one-way analysis of variance (ANOVA). Treatment means of varieties were separated by using the least significant test (LSD) at $P < 0.05$ level of confidence. All statistical analyses were carried out using the SPSS 20.0 software.



Figure 1. The study area Ceylanpinar district of Sanliurfa (in Turkey)

5. RESULTS AND DISCUSSION

The differences in plant size, yields of green hay, dry hay and seed were statistically significant among vetch varieties (Table 2). Mean plant height varied between 77.47 cm and 91.77 cm. The lowest plant height was recorded in Almoğlu-2001 variety, whereas the difference in plant height among the rest of 10 vetch varieties was not statistically significant.

Table 2. Some characteristics of the varieties examined in the experiment

Varieties	Plant height (cm)	Green hay yield (kg da ⁻¹)	Dry Hay yield (kg da ⁻¹)	Seed yield (kg da ⁻¹)
Alper	84.53ab ^{&}	1987.0b-e	506.32bc	184.45a
Cumhuriyet -99	91.70a	2298.0a-c	515.03b	172.78ab
Selçuk-99	84.57ab	1855.3c-e	408.07d	144.22bc
Özveren	91.77a	2457.67ab	499.29bc	184.11a
Albayrak	84.53ab	2054.00b-e	463.53b-d	175.33ab
Görkem	79.63ab	2124.67b-e	472.20b-d	136.33ab
Almoğlu-2001	77.47b	1749.00e	422.60cd	130.22c
Doruk	83.83ab	1805.00de	454.53b-d	176.89ab
Ürkmez	89.60a	2701.00a	643.56a	186.67a
Bakır-2001	83.93ab	2196.00b-e	516.65b	172.33ab
Yücel	89.60a	2294.67a-d	503.62bc	181.56a
Mean	85.56	2138.39	491.40	167.71
LSD	8.23**	491.22**	84.94**	14.18**

& Different letters in a column indicate significant differences ($P < 0.05$) among vetch varieties, ** Significant at $P \leq 0.01$.

The mean green hay yield ranged between 1749.00 and 2701.00 kg da⁻¹. The highest green hay yield (2701.00 kg da⁻¹) was obtained with Urkmez variety, however, the difference between Urkmez, Ozveren, Cumhuriyet-99 and Yucel varieties were not statistically significant. The lowest green hay

yield was recorded in Alnoğlu-2001 variety. The mean yields of common vetch varieties ranged from 408.07 to 643.56 kg da⁻¹. The highest hay yield was obtained from Ürkmez cultivar while the lowest hay yield was recorded in Selçuk-99 cultivar (Table 2). The mean grain yield of the varieties ranged from 130.22 kg da⁻¹ to 186.67 kg da⁻¹. Ürkmez, Alper, Cumhuriyet, Özveren, Albayrak, Doruk, Copper and Yücel varieties had higher grain yield compared to the grain yields of other varieties. The grain yields of Görkem and Alnoğlu-2001 varieties were lower than the other varieties (Table 2).

Crude protein ratio and the number of seeds per pod among common vetch varieties were significantly different, however, the difference in the number of pods per plant among vetch varieties was statistically insignificant. The mean crude protein ratio ranged from 16.46 to 24.22%. The highest protein ratio among the common vetch varieties was obtained in Albayrak cultivar with 24.22%, while the lowest protein ratio was recorded in Cumhuriyet-99 cultivar with 16.46% (Table 3).

The mean number of seeds per pod among common vetch varieties ranged from 5.43 to 6.57. Yücel, Özveren and Cumhuriyet -99 varieties were included in a group with the highest number seeds per pod while the lowest number of seeds per pod was recorded in Albayrak variety. Several studies have been conducted to investigate the characteristics of common vetch and other legume forage crops and reports have been published. Seydoşoğlu et al. (2015) conducted a study on grasspea (*Lathyrus sativus* L.) varieties and reported that plant height varied between 39.25 and 59.17 cm, green hay yield was between 1379.50 and 3154.17 kg da⁻¹, hay yield was between 330.67 and 767.38 kg da⁻¹ and seed yield was between 181.00 and 269.83 kg da⁻¹.

Table 3. Some characteristics of the varieties examined in the experiment

Varieties	Crude protein ratio (%)	Number of seed per pod (piece)	Number of pods per plant (piece)
Alper	19.42c	5.53de	19.6
Cumhuriyet -99	16.46d	6.20a-c	20.1
Selçuk-99	20.07bc	5.57de	21.3
Özveren	20.14bc	6.43ab	20.8
Albayrak	24.22a	5.43e	21.7
Görkem	21.68b	6.00b-d	20.3
Alnoğlu-2001	16.58d	5.83c-e	20.8
Doruk	20.63bc	5.77c-e	19.1
Ürkmez	20.13bc	5.63de	21.7
Bakır-2001	19.89bc	5.90c-e	21.2
Yücel	19.71c	6.57a	17.5
Mean	19.90	5.90	20.4
LSD	1.84**	0.53	Non-significant

& Different letters in a column indicate significant differences (P<0.05) among vetch varieties, ** Significant at P≤0.01.

Albayrak et al. (2005) reported that the average seed yield of some common vetch genotypes was 122.3 kg da⁻¹ and the number of seeds per pod was 6.17. Kaplan (2013) found that ADF ratio in some common vetch genotypes ranging between 26.28 and 45.43%, NDF rate was between 32.32 and 49.56%, green hay yield was between 1212.1 to 4386.0 kg da⁻¹, dry hay yield was between 213.7 to 709.6 kg da⁻¹ and crude protein ratio was between 17.21 and 24.76%. Yücel et al. (2012) reported that crude protein ratio of vetch genotypes grown under different ecologies varied between 14.68 and 24.60%.

The results obtained in this study show similarities and differences with the findings of the aforementioned studies. Dhima et al. (2007) indicated that types of cultivars, seeding ratio and many other factors significant impact on growth and performances of crops grown in a region. The differences in finding can be attributed to the materials used in experiments, sowing times and ecological conditions of the experimental sites.

6. CONCLUSION

Yield and yield characteristics of some common vetch (*Vicia sativa* L.) varieties grown as winter intermediate crop in Southeastern Anatolia Region, Turkey were determined. Green and dry hay yields Urkmez variety were superior to other varieties. Similarly, grain yields of Alper, Cumhuriyet, Özveren, Albayrak, Doruk, Bakır and Yücel varieties in addition to Ürkmez variety were higher compared to the rest of the vetch varieties. The results of the study revealed that superior varieties obtained in this research should be preferred for common vetch cultivation in semi-arid environmental conditions such as Ceylanpinar district and similar ecologies.

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