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# Study of Genotype x Environment Interaction on Agricultural and Quality in Sainfoin (*Onobrychis sativa*) Genotypes

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**Abstract:** This research was conducted to determine yield, yield components and quality characteristics of sainfoin genotypes in two locations which were consisted from Selcuk University, Agricultural Faculty trial field (Konya) and Turkoba Village (Polatli/Ankara) according to the Randomized Blocks Design with 4 replications. Some traits such as plant height (cm), stem thickness (cm), green herbage yield (t $ha^{-1}$), dry herbage yield (t $ha^{-1}$), crude protein content (%), crude protein yield (kg $ha^{-1}$) and ash content (%) were examined. The characteristics of dry herbage yield, crude protein content and crude protein yield which are known as the most important properties in forages were found as fallowing; 3.275-4.958 t $ha^{-1}$, 10.08-13.55% and 355.00-602.25 kg $ha^{-1}$, respectively.

**Key words:** Ash, dry herbage, sainfoin, yield, crude

## INTRODUCTION

Excessive and early pasturage of meadows and grasslands, destruction owing to negligence of maintenance being more favorable to intensive and semi-intensive growing of the animals which are introduced from abroad or obtained by breeding exposed a high value of deficiency in roughage in Turkey. Namely, the animals in intensive systems are fed intensively in shelters which cause to an important and growing demand for the forages. Sainfoin is one of the important plants to recover the deficit.

Sainfoin (*Onobrychis sativa*) a multi-year legume crop (Elci *et al*., 1995) is highly resistant to drought and especially cold and the plant is able to good growing in the barren and limy soils where the other forages are not able to grow. Herbage of sainfoin is as nutritious as alfalfa, has a high ratio of protein, rich of minerals and it does not cause to swelling unlike alfalfa. One of the other importances of sainfoin is growing in early periods of the spring which is an advantage for pasturage. Thus, sainfoin provides the bait for the animals before the other forages. Besides that it is one of the important plants for soil improvement. Additionally, it is an artificial grassland plant, a source of the honey for bee and a good rotation crop in barren soils. The recent data showed that sainfoin was grown a total of 153,646 ha arid lands and production quantity of green herb was 1,571,606 tons in Turkey.

Many researches related to sainfoin growing under different growing conditions were made formerly (Tomic *et al*., 2006; Hosaininejadmir *et al*., 2011).

However, the trials of the new developed lines in different locations are important in terms of the country incomes. The present research was made in Konya and Polatli-Ankara conditions during the both years of 2006 and 2007 by using of two sainfoin species and 1 population to determination of the high yield and quality genotypes in Central Anatolian conditions.

## MATERIALS AND METHODS

In this research, the sainfoin species of Peschanyj 1251 and two local species were used. Among these species, the local sainfoin genotype which is in the property of population is grown very common. The other species Ozerbey-2003 is a certified sainfoin line.

The trials were established on 5th and 7th of 2005 in trial field of Selcuk University, Agricultural Faculty (Konya) and Turkoba Village (Polatli-Ankara). Irrigation was made shortly after sowing to provide a healthy plant growing for Winter. The trial location of Konya has an altitude of 1130 m and the soil characteristics were clayey-loamy, slightly alkaline (pH: 7.8) and low organic (1.3%) matter while the trial soil characteristics of Ankara were clayey-loamy, pH: 7.5, short of organic matter (1.5%) and has an altitude of 760 m. According to the mean of long periods, climatically data is 370 mm of total precipitation per year in Ankara and 270 mm in Konya.

Establishment of the trials and data collecting were made according to the Technical Instructions for Measuring of Agricultural Values which set out by Ministry of Agricultural and Rural Affairs. Data

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collections were made both of the years 2006 and 2007, harvest times were 15.05.2006 and 10.05.2007 in Ankara and 20.05.2006 and 15.05.2007 in Konya. The collected data were subjected to variance analysis and LSD test was made according to significance level.

## RESULTS AND DISCUSSION

**Plant height:** There were not statistically importances between the genotypes in terms of plant height. But the year x location interaction was significant (Table 1). The lowest plant height was obtained on the year of 2006.

**Stem thickness:** Means of the year and location showed the highest (6.3 mm) stem thickness on the sainfoin genotype of Peschanyj 1251. At the same time, thickness of stem was changed by the years and locations (year x location interaction).

**Green herbage yield:** The highest (17.09 t $ha^{-1}$) green herb was obtained from the genotype Peschanyj 1251. Differences between the controls were insignificant. Year x location interaction was also significant; the highest (18.97 t $ha^{-1}$) value was obtained from the year of 2007 and Konya location.

**Dry herbage yield:** The highest (4.27 t $ha^{-1}$) dry matter yield was obtained from the genotype Peschanyj 1251. Interaction of year x location was significant that the year of 2006 showed the lowest (3.43 t $ha^{-1}$) value in Konya location while Ankara showed the lowest value on the year of 2007 (4.15 t $ha^{-1}$).

**Crude protein content:** Crude protein ratio did not showed significant differences in terms of the genotypes. The protein ratios of the genotypes were ranged from 11.6-12.7%. Interaction was observed for year and location.

**Crude protein yield:** Crude protein yield did not showed significant differences in terms of the genotypes. Interaction of year x location was found as significant.

**Ash content:** Both of the location x genotype interaction and year x location interaction were significant by view of crude ash content. But the differences among the genotypes were insignificant according to the 2 years.

Plant height of sainfoin is significantly affected by ecology and row space distances, irrigation and cultural techniques. Additionally, yield increases by increasing of the plant height (Delgado *et al*., 2008). Plant height of sainfoin was found by Turk in between 64.52-70.56 and 60.5-108.3 cm by Erkovan and Tan.

Stem thickness of sainfoin has a positive correlation with dry matter yield (Delgado *et al*., 2008). Some researchers were found the stem thickness a range of 6.0-9.1 mm and 3.03-3.30 mm in sainfoin.

Turk and Celik (2006) reported that green herbage yield in sainfoin is affected by plant density and amount of the seed who determined the green herb yield as a range of 29.17-45.55 t $ha^{-1}$.

Dry herbage yield is varies depend on variety, plant density, the used amount of the seed in sowing and regime of precipitation (Stevovic *et al*., 2012). In some researches, dry herb yield in sainfoin was found with a

Table 1: Replication values of the agricultural value measuring trials in the sainfoin for the years of 2006 and 2007

| Location | Years | Genotypes | Plant height (cm) | Stem thickness (mm) | Green herbage yield (t $ha^{-1}$) | Dry herbage yield (t $ha^{-1}$) | Crude protein content (%) | Crude protein yield (kg $ha^{-1}$) | Ash content (%) |
|---|---|---|---|---|---|---|---|---|---|
| Konya | 2006 | Peschanyj 1251 | 55.9 | 5.150 | 14.38 | 3.595 | 10.08 | 361.25 | 6.68 |
| | | Population | 55.2 | 4.500 | 13.72 | 3.430 | 12.60 | 430.25 | 7.10 |
| | | Ozerbey-2003 | 51.9 | 4.700 | 13.10 | 3.275 | 10.81 | 355.00 | 6.70 |
| | 2007 | Peschanyj 1251 | 79.2 | 4.550 | 19.83 | 4.958 | 11.69 | 581.25 | 4.95 |
| | | Population | 74.6 | 4.550 | 18.31 | 4.578 | 13.09 | 602.25 | 4.91 |
| | | Ozerbey-2003 | 72.0 | 4.450 | 18.78 | 4.695 | 12.86 | 599.25 | 5.71 |
| Ankara | 2006 | Peschanyj 1251 | 75.8 | 5.100 | 16.20 | 4.050 | 12.67 | 510.50 | 6.03 |
| | | Population | 73.4 | 4.780 | 15.27 | 3.818 | 13.55 | 515.00 | 5.77 |
| | | Ozerbey-2003 | 75.3 | 4.500 | 15.15 | 3.788 | 12.09 | 458.75 | 5.42 |
| | 2007 | Peschanyj 1251 | 84.9 | 10.35 | 17.94 | 4.485 | 12.34 | 556.25 | 6.01 |
| | | Population | 77.9 | 7.480 | 16.02 | 4.005 | 11.60 | 467.75 | 5.77 |
| | | Ozerbey-2003 | 81.2 | 8.130 | 15.80 | 3.950 | 10.81 | 427.25 | 5.67 |
| CV (%) | | | 7.78 | 18.66 | 9.84 | 9.84 | 14.06 | 18.27 | 7.06 |
| | | | ---------- | ---------- | ---------- | Probability | ---------- | ---------- | ---------- |
| LSD (genotype) | | | - | p<0.05 = 0.774 | p<0.05 = 116.3 | p<0.05 = 29.09 | - | - | - |
| LSD (year x location) | | | p<0.01 = 6.345 | p<0.01 = 1.211 | p<0.01 = 182.1 | p<0.01 = 45.51 | p<0.05 = 1.423 | p<0.01 = 10.19 | p<0.01 = 0.4749 |
| LSD (location x genotype) | | | - | - | - | - | - | - | p<0.05 = 0.4292 |

range of 3.40-7.26 t $ha^{-1}$ by Turk, 3.73-8.69 t $ha^{-1}$ by Erkovan and Tan, 1.43-1.78 t $ha^{-1}$ by Stevovic *et al.* (2012).

Crude protein content of the forages is an important quality criterion in terms of animal feeding (Tomic *et al.*, 2006). Some researchers were found protein content as fallowing: 11.39-17.70% by Kaplan (2011), 18.54-19.94% by Stevovic *et al.* (2012).

Crude protein yield is significantly affected by cultural practices and dry matter yield. Formerly researches showed that crude protein ratio was found in a range of 570-1223 kg $ha^{-1}$ by Turk, 280-330 t $ha^{-1}$ by Stevovic *et al.* (2012).

Increasing of the ash content which is enough generally in the forages is one of the main purpose in forage breeding program due to its antagonistic and synergistic relations with herb yield. Related researches in the sainfoin showed that the ratio of ash was found in a range of 10.65-11.92% by Manga, 5.21-7.30% by Kaplan (2011).

The results of the performed research generated some similarities and differences with earlier findings. The conviction is that these situations may be based on climate and soil characteristics.

## CONCLUSION

In the present research, there was not any lodging or dead during winter in the sainfoin genotypes. However, the drought and root feeding insects cause to a decreasing on plant density. The main purpose of sainfoin growing is production of quality roughage. According to the present data, the sainfoin genotype Peschanyj 1251 may be the most favorable genotype for this purpose.

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