Current Trends in Natural Sciences
Vol. 8, Issue 16, pp. 205-211, 2019
Current Trends in Natural Sciences (on-line) Current Trends in Natural Sciences (CD-Rom)
ISSN: 2284-953X ISSN: 2284-9521
ISSN-L: 2284-9521 ISSN-L: 2284-9521

VARIATION IN HAY YIELD AND QUALITY OF HUNGARIAN VETCH (*Vicia pannonica* Crantz) GENOTYPES

Mahmut Kaplan [1,*], Kagan Kokten [2], Selim Ozdemir [3]

[1] University of Erciyes, Faculty of Agriculture, Department of Field Crops, Kayseri, Turkey
[2] University of Bingol, Faculty of Agriculture, Department of Field Crops, Bingol, Turkey
[3] University of Bingol, Vocational School of Technical Sciences, Department of Plantal and Animal Production, Bingol, Turkey

Current Trends in Natural Sciences

Abstract
Objectives of the present study were to determine the variations in hay yield and hay quality of different Hungarian vetch genotypes. Experiments were conducted for three years in 2014-2015 and 2016 in randomized blocks design with three replications. A total of 5 Hungarian vetch cultivars and 5 local Hungarian vetch were used as the plant material of the experiments. Genotypes on hay yield and hay quality of Hungarian vetch were found to be highly significant (P<0.01) and the years were on yield and chemical composition were found to be highly significant (P<0.01).
Present finding revealed that that plant height of the Hungarian vetch genotypes varied between 90.16 cm and 105.20 cm, green herbage yield between 1429.58 kg/da and 1936.22 kg/da, hay yield between 298.28 kg/da and 380.66 kg/da, crude protein yield between 50.81 kg/da and 77.06 kg/da, crude protein ratios between 15.50% and 20.89%, crude ash ratios between 7.32% and 8.75%, acid detergent fiber (ADF) ratios between 34.32% and 40.74%, neutral detergent fiber (NDF) ratios between 46.36% and 50.01%, dry matter digestibility (DMD) ratios between 57.17% and 62.16%, dry matter intake (DMI) ratios between 2.41% and 2.60% and relative feed value (RFV) between 106.73 and 124.65 depending on the cultivars. Local Hungarian vetch genotypes were found to be prominent with yield and crude protein ratios and they will be use to breeding program.

Keywords: chemical composition, genotype, hay yield, Hungarian vetch,

1. INTRODUCTION

Forage legumes not only supply forage for livestock feeding but also enrich soil organic matter content and leave better soil conditions for subsequent crops (Basbag and Gul, 2005). Vetch species (Vicia spp.) are commonly grown to feed livestock in regions with annual precipitations of 200-350 mm (Larbi et al., 2011) and used to grazing, dry herbage, green herbage and silage for livestock (Berhane and Eik, 2006; Haddad, 2006). Hungarian vetch is highly resistant against cool winter and therefore it is widely cultivated in various parts of world for grain and hay forage (Uzun et al., 2004; Albayrak et al., 2011).

Yield and quality in forage crops are under effects of soil and climate conditions, genetics and agricultural applications (Albayrak and Töngel, 2006; Harmanlıoglu, 2019). Genotypes have quite diverse nutritional compositions, thus nutritional composition of different species should be investigated (Ulger and Kaplan, 2016). NDF, ADF, crude ash and crude protein contents have been widely used to evaluate the potential nutritive value of forage crops (Uke et al., 2017). Objectives of

*Corresponding author, E-mail address: mahmutkaplan5@hotmail.com

Current Trends in Natural Sciences (on-line)
ISSN: 2284-953X
ISSN-L: 2284-9521

Current Trends in Natural Sciences (CD-Rom)
ISSN: 2284-9521
ISSN-L: 2284-9521

the present study were to determine the variations in hay yield and hay quality of different Hungarian vetch genotypes.

2. MATERIALS AND METHODS

Ten Hungarian vetch genotypes were used as the plant material of the study. Experiments were conducted over the experimental fields of Research and Implementation Center of Bingöl University Agricultural Faculty for three years in 2014, 2015 and 2016 growing seasons. Soil samples were taken before the experiments and soils were analyzed for physical and chemical characteristics at Soil Analysis Laboratory of Bingöl University Agricultural Faculty. Soil of the experimental site is unsaline (0.0066%), calcareous "loam" texture, slight acidic reaction (pH 6.37), "middle" available phosphorus (7.91 kg/da), "low" potassium (24.45 kg/da) and "low" organic material content (1.26%). Average temperature was 12.3 oC, total precipitation was 950.8 mm and relative humidity was 56.9% according long terms (1990-2016) climatic data. Experimental years generally had similar temperatures and relative humidity to long-term averages but precipitations were lower than the long-term averages.

Experiments were conducted in randomized blocks design with 3 replications. Each plot had 6 rows with 20 cm row spacing, total plot area was 6 m2. Based on soil analysis results, 3 kg/da N and 6 kg/da P2O5 were applied at sowing. Side rows and 50 cm sections from the top and bottom of the plots were removed at harvest as to consider side effects. In both years, sowing was performed at the last week of September and Harvest was performed at the second week of May.

Hungarian hay samples were dried in an oven at 70 °C for 48 hours to find dry matter ratio. Dried samples were then ground in a mill with 1 mm sieve and made ready for chemical analyses. Dry matter, crude protein and crude ash analyses were performed in accordance with the methods specified in AOAC (1990). NDF and ADF analyses were carried out in accordance with the methods specified in Van Soest and Wine (1967) and Van Soest (1963), respectively by using an ANKOM 200 Fiber Analyzer (ANKOM Technology Corp. Fairport, NY, USA).

Relative feed value (RFV) of Hungarian vetch samples was calculated from the estimates of dry matter digestibility (DDM) and dry matter intake (DMI) (Rohweder et al., 1978).

DMD % = 88.9 - (0.779 x ADF %);

DMI % of BW = 120 / NDF %;

RFV = (DDM % x DMI %) /1.29

The three-year experimental data were subjected to variance analysis with SAS (SAS Inst., 1999) software. Differences between mean values were tested by Duncan's multiple range test.

3. RESULTS AND DISCUSSIONS

Plant height of Hungarian vetch genotypes is provided in Figure 1. Plant height varied between 90.16 and 105.20 cm. While the lowest plant height was obtained from Hat-16 genotype, the highest value was observed in Ağrı populasyon. Various plant heights were observed in different studies carried out under different ecological condition. While the findings of present study are similar to the ones observed by Kendir (1999) but higher than that obtained by Uzun et al. (2004). Differences in plant height were mainly because of differences soil, amount of rainfall and variety (Kendir, 1999).

Green herbage yield of Hungarian vetch genotypes is provided in Figure 1. The lowest green herbage yield was observed in Hat-23 with 1429.58 kg/da. The highest green herbage yield was seen at Agrı populasyon with 1936.22 kg/da. Green herbage yields of the current study were similar to of Sayar et al. (2012); Kusvuran et al. (2014a) and Hashalici et al. (2017).

*Corresponding author, E-mail address: mahmutkaplan5@hotmail.com

Current Trends in Natural Sciences (on-line)
ISSN: 2284-953X
ISSN-L: 2284-9521
Current Trends in Natural Sciences (CD-Rom)
ISSN: 2284-9521
ISSN-L: 2284-9521

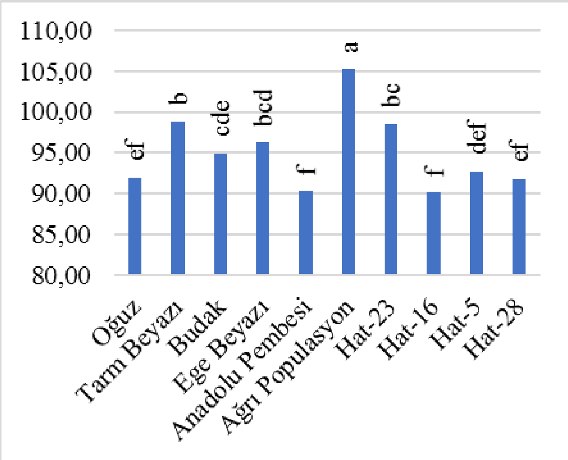

Figure 1. Plant height of Hungarian vetch genotypes

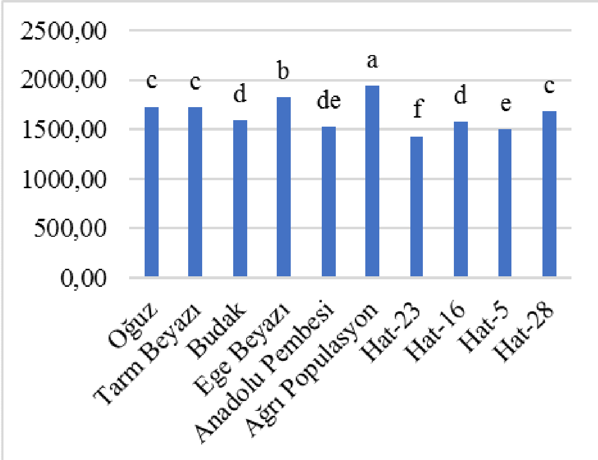

Figure 2. Green herbage yield of Hungarian vetch genotypes

While the lowest dry herbage yield of Hungarian vetch genotypes was obtained from Hat-23 (298.28 kg/da) and Hat-5 (299.33 kg/da), the highest value was observed in Ege Beyazı (380.66 kg/da), Ağrı poplasyon (375.30 kg/da) and Oğuz (373.56 kg/da) genotypes (Figure 3). Dry herbage yields of the current study were similar to Bakoglu et al. (2010); Sayar et al. (2012) and Hashalici et al. (2017). Green and dry herbage yields can be different in genotypes. Differences in green and dry herbage yields were mainly due to differences in climate conditions and different responses of genotypes against different conditions (Kaplan et al., 2015).

Crude protein yield varied between 50.81 and 77.06 kg/da. The lowest crude protein yield was obtained from Hat-5, the highest value was observed in Ağrı populasyon genotype (Figure 4). These findings are in agreement with the results of Kusvuran et al. (2014a); Hashalici et al. (2017) but higher than that obtained by Balabanlı and Türk (2006) and Yolcu et al. (2012). The difference in crude protein yield is due to variety and growing conditions.

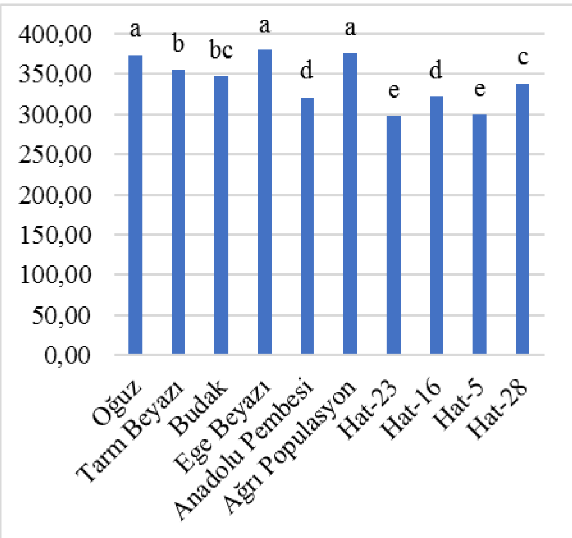

Figure 3. Dry herbage yield of Hungarian vetch genotypes

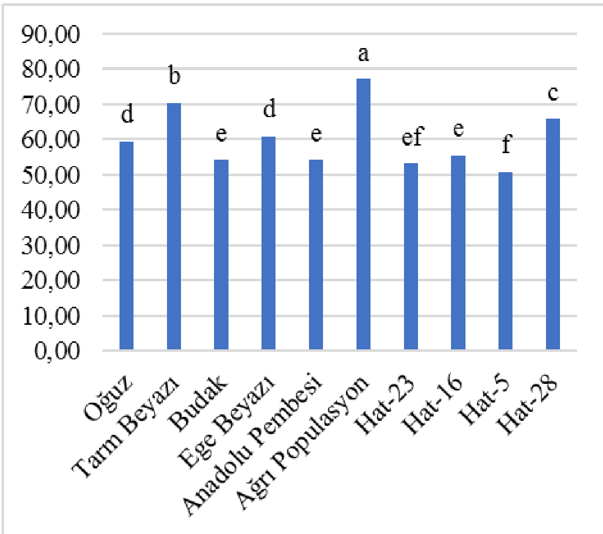

Figure 4. Crude protein yield of Hungarian vetch genotypes

*Corresponding author, E-mail address: mahmutkaplan5@hotmail.com

Current Trends in Natural Sciences
Vol. 8, Issue 16, pp. 205-211, 2019
Current Trends in Natural Sciences (on-line)
ISSN: 2284-953X
ISSN-L: 2284-9521
Current Trends in Natural Sciences (CD-Rom)
ISSN: 2284-9521
ISSN-L: 2284-9521

As can be seen in Figure 5 the lowest crude protein ratio was observed in Budak cultivars with 15.50%. The highest crude ratio was seen in Ağrı populasyon genotype with 20.89%. Crude protein content is a too significant indicator of feed quality (Assefa and Ledin, 2001). It was reported that differences in crude protein contents of different varieties can be resulted from genetics of the plants and such values can also vary depending on leaf, spike and stem ratios, ripening periods, fertilization, climate and soil conditions (Ball et al., 2001). Number of leaves and thus leaf/stalk ratios decrease with the progress of ripening. Crude protein results are in line with the findings of Albayrak et al. (2011), Yolcu et al. (2012) and Acar et al. (2017).
The lowest crude ash ratio was observed in Ege Beyazı cultivar with 7.32%. The highest crude ash ratio was seen at Tarm Beyazı cultivar with 8.75% (Figure 6). Although crude ash content was considerably lower than that obtained by Unal et al. (2011) and Hashalici et al. (2017) but these result are in agreement with the results Kusvuran et al. (2014a).

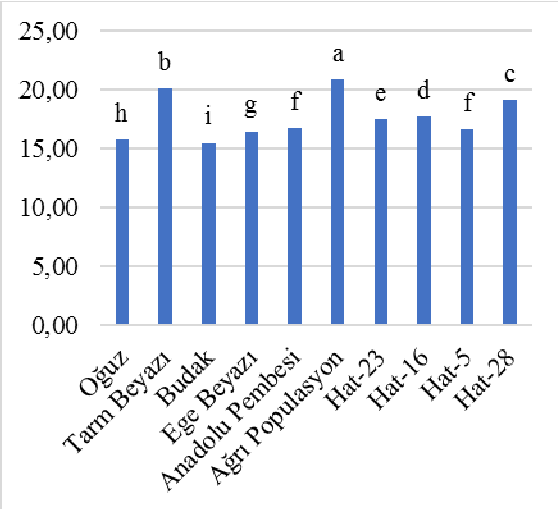

Figure 5. Crude protein ratio of Hungarian vetch genotypes

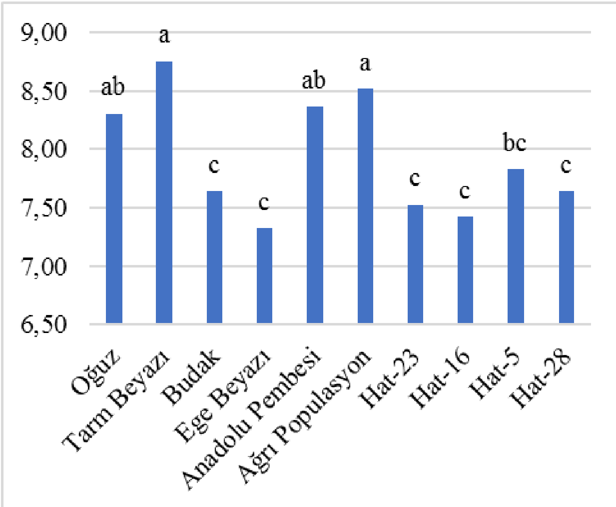

Figure 6. Crude ash ratio of Hungarian vetch genotypes

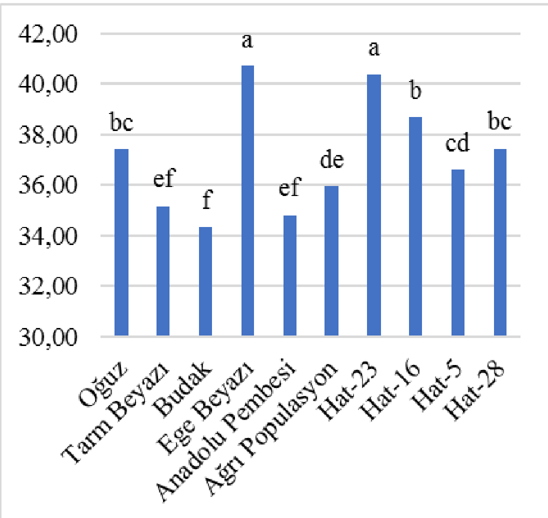

Figure 7. Acid detergent fiber of Hungarian vetch genotypes

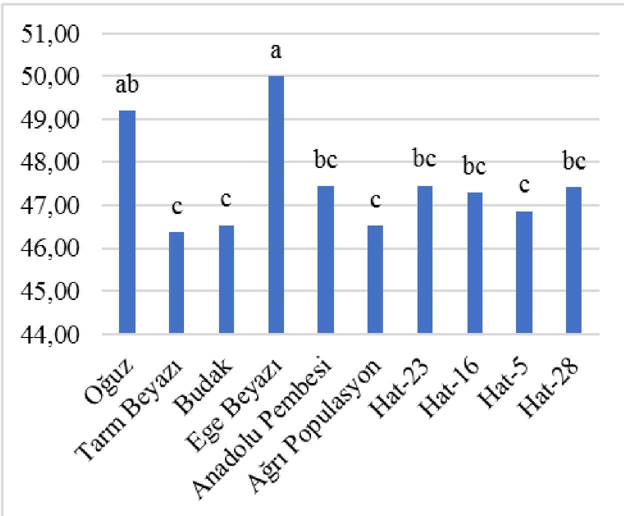

Figure 8. Neutral detergent fiber of Hungarian vetch genotypes

*Corresponding author, E-mail address: mahmutkaplan5@hotmail.com

Current Trends in Natural Sciences (on-line)
ISSN: 2284-953X
ISSN-L: 2284-9521

Current Trends in Natural Sciences (CD-Rom)
ISSN: 2284-9521
ISSN-L: 2284-9521

ADF ratio of Hungarian vetch genotypes were given at Figure 7, NDF ratio were given at Figure 8. ADF ratio varied between 34.32% and 40.74%, NDF ratio between 46.36% and 50.01%. The lowest ADF and NDF ratios were seen at respectively Budak and Tarm Beyazı, the highest ADF and NDF ratios were seen at Ege Beyazı cultivar. ADF and NDF content are very important quality characteristics of forages or feeds (Albayrak et al., 2011). The differences in stem and leaf ratios in forage crops result in differences also in crude protein contents, ADF and NDF ratios (Kaplan et al., 2015). ADF and NDF ratios of the present study were similar to values reported by Yolcu et al. (2012) and Kusvuran et al. (2014b).

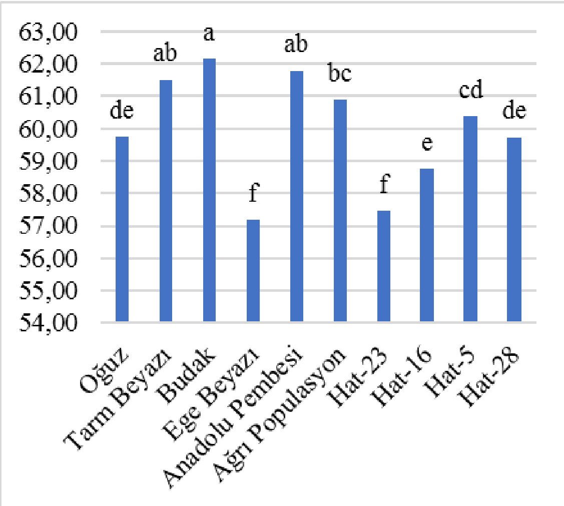

Figure 9. Dry matter digestibility of Hungarian vetch genotypes

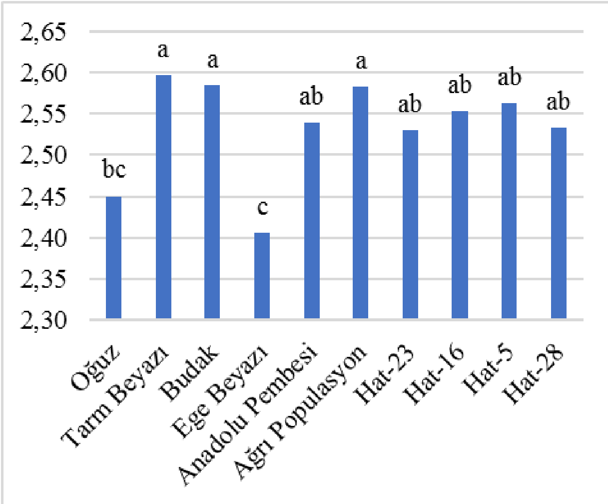

Figure 10. Dry matter intake of Hungarian vetch genotypes

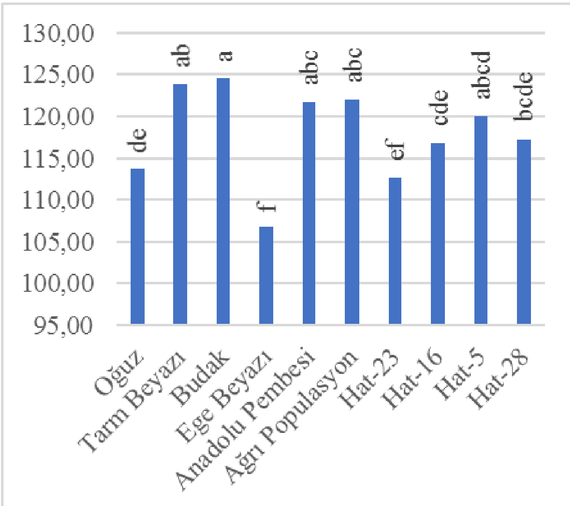

Figure 11. Relative Feed Value of Hungarian Vetch Genotypes

Dry matter digestibility of Hungarian vetch genotypes is provided in Figure 9. The lowest dry matter digestibility was respectively Ege Beyazı and Hat-23 genotypes with 57.17% and 57.44%. The highest dry matter digestibility was observed in Budak cultivar with 62.16%. Dry matter intake of Hungarian vetch genotypes is provided in Figure 10. Dry matter intake ratios varied between

*Corresponding author, E-mail address: mahmutkaplan5@hotmail.com

Current Trends in Natural Sciences (on-line) Current Trends in Natural Sciences (CD-Rom)
ISSN: 2284-953X ISSN: 2284-9521
ISSN-L: 2284-9521 ISSN-L: 2284-9521

2.41% and 2.60%. The lowest dry matter intake was seen at Ege Beyazı cultivar and the highest dry matter intake was seen at Tarm Beyazı cultivar.
Relative feed value of Hungarian vetch genotypes was given at Figure 11. The lowest relative feed value of Hungarian vetch genotypes was observed in Ege Beyazı with 106.73. The highest relative feed value of Hungarian vetch genotypes was observed in Budak cultivar with 124.65. Relative feed value is an index that is used to predict the intake and energy value of the forages and it is calculated from the estimates of dry matter digestibility and dry matter intake (Albayrak et al., 2011). All Hungarian vetch hays were classified as second quality (Rohweder et al., 1978).

4. CONCLUSIONS

This study investigated the effects of genotypes on yield and quality parameters in Hungarian vetch. All Hungarian vetch genotypes have height nutritional quality values. Local Hungarian vetch genotypes were found to be prominent with yield and crude protein ratios and they will be use to breeding program. The local Hungarian vetch Ağrı population was found to be prominent with height herbage yield, hay yield and crude protein yield and low ADF and NDF.

6. REFERENCES

Acar, Z., Gulumser, E., Asci, O. O., Basaran, U., Mut, H., & Ayan, I. (2017). Effects of sowing ratio and harvest periods on hay yields, quality and competitive characteristics of Hungarian vetch-cereal mixtures. *Legume Research*, 40(4), 677-683.

Albayrak, S., & Töngel, Ö. (2006). Path analyses of yield and yield-related traits of common vetch (Vicia sativa L.) under different rainfall conditions. *Anadolu Tarım Bilimleri Dergisi*, 21(1), 27-32.

Albayrak, S., Turk., Mevlüt, & Yuksel, O. (2011). Effect of row spacing and seeding rate on Hungarian vetch yield and quality. *Turkish Journal of Field Crops*, 16(1), 54-58.

AOAC. 1990 Official Method of analysis. 15th. edn. Association of Official Analytical Chemist, Washington, DC. USA,

Assefa, G., Ledin, I. (2001). Effect of variety, soil type and fertilizer on the establishment, growth, forage yield, quality and voluntary intake by cattle of oats and vetches cultivated in pure stand and mixtures. *Animal Feed Sci. Technol.*, 92: 95-111.

Bakoğlu, A., Kökten, K., Karadavut, U. (2010). Bazı Macar fiği hat ve çeşitlerinin Bingöl kuru şartlarına adaptasyonu üzerine bir araştırma [A study on adaptation of some Hungarian vetch lines and varieties to Bingöl dry conditions]. III. Bingöl Sempozyumu. Eylül, 17-19, 2010, Bingöl-Türkiye.

Balabanlı, C., Türk, M. (2006). The effects of different harvesting periods in some forage crops mixture on herbage yield and quality. *J Biol Sci*., 6(2), 265-8.

Ball, D.M., Collins, M., Lacefield, G.D., Martin, N.P., Mertens, D.A., Olson, K.E., Putnam, D.H., Undersander, D.J., Wolf, M.W. (2001). Understanding forage quality. American Farm Bureau Federation Publication 1-01, Park Ridge, IL.

Başbag, M., Gül, İ. (2005). Determination of yield and yield components of some bitter vetch (Vicia ervilia (L.) willd.) lines under Diyarbakır conditions. *J. Agric. Fac. HR.U.* 9 (1), 1-7.

Berhane, G., Eik, L.O. (2006). Effect of vetch (*Vicia sativa*) hay supplementation to Begait and Abergelle goats in northern Ethiopia. I. Milk yield and composition. Small Rumin. Res., 64, 241-246.

Haddad, S.G. (2006). Bitter vetch grains as a substitute for soybean meal for growing lambs. *Livest. Sci.*, 99, 221-225.

Harmanlioglu, O. (2019). Determination of hay yield and quality of different alfalfa cultivars under Kayseri conditions. Erciyes University Institute of Natural and Applied Sciences Graduate Thesis, June 2019.

Hashalıcı, S., Satı, Uzun., Özaktan, H., & Kaplan, M. (2017). Determination of Forage Yield and Quality of Some Hungarian Vetch Cultivars at Kayseri Arid Conditions.Erciyes Üniversitesi Veteriner Fakültesi Dergisi, 14(2), 113-123.

Kaplan, M., Yilmaz, M.F., Kara, R. (2015). Variation in hay yield and quality of new triticale lines. *Journal of Agricultural Sciences*, 21, 50-60.

Kendir, H. (1999). Determination of some yield components of winter vetch species (*Vicia* spp.) grown in Ankara conditions. *Tarim Bilimleri Dergisi*, 5(2), 85-91.

*Corresponding author, E-mail address: mahmutkaplan5@hotmail.com

Current Trends in Natural Sciences (on-line) ISSN: 2284-953X ISSN-L: 2284-9521
Current Trends in Natural Sciences (CD-Rom) ISSN: 2284-9521 ISSN-L: 2284-9521

Kusvuran, A., Kaplan, M., & Nazli, R. I. (2014b). Intercropping of Hungarian vetch (*Vicia pannonica* Crantz.) and barley (*Hordeum vulgare* L.) under different plant varieties and mixture rates. *Legume Res*., 37(6), 590-599.

Kuşvuran, A., Kaplan M., Nazlı, R. (2014a). Effects of mixture ratio and row spacing in Hungarian vetch and annual ryegrass intercropping system on yield and quality under semiarid dimate conditions. *Turk J Field Crops*., 19 (1), 118-28.

Larbi, A., Abd El-Moneim, A.M., Nakkoul, H., Jammal, B., Hassan, S. (2011). Intra-species variations in yield and quality determinants in Vicia species: 1. Bitter vetch (*Vicia ervilia* L.). *Animal Feed Science and Technology*, 165, 278–287.

Üke., Ö., Hasan, Kale., Kaplan, M., & Kamalak, A. (2017). Effects of Maturity Stages on Hay Yield and Quality, Gas and Methane Production of Quinoa (*Chenopodium quinoa* Willd.). Kahramanmaraş Sütçü İmam Üniversitesi Doğa Bilimleri Dergisi, 20(1), 42-46.

Rohweder, D.A., Barnes, R.F. and Jorgensen, N. (1978). Proposed hay grading standards based on laboratory analyses for evaluating quality. *Journal of Animal Science*, 47, 747-759.

SAS. (1999). SAS User's Guide: Statistic. Statistical Analysis Systems Institute Inc., Cary, NC.

Sayar, M.S., Karahan, H., Han, Y., Tekdal, S., Başbağ, M. (2012). Determination of forage yield, its affecting components and relationships among traits of some Hungarian vetch (Vicia pannonica CRANTZ.) genotypes in Kızıltepe ecological conditions. *Tarım Bilimleri Araştırma Dergisi* (TABAD), 5(2), 126-130.

Uzun, A., Bilgili, U., Sincik, M., & Açıkgöz, E. (2004). Effects of seeding rates on yield and yield components of Hungarian vetch (Vicia pannonica Crantz.). *Turkish Journal of Agriculture and Forestry*, 28(3), 179-182.

Ülger, İ., Kaplan, M. (2016). Variations in Potential Nutritive Value, Gas and Methane Production of Local Sainfoin (*Onobrychis sativa*) Populations. *Alinteri Journal of Agriculture Sciences*, 31(2), 42-47.

Ünal, S., Mutlu, Z., Fırıncıoğlu H.K. 2011. Performances of winter hungarian vetch accessions (*Vicia pannonica* Crantz.) on the highlands of Turkey. *Turk J Field Crops*, 16 (1), 1-8

Van Soest, P.J. (1963). The use of detergents in the analysis of fibre feeds. II. A rapid method for the determination of fibre and lignin. *Journal of the Association of Official Analytical Chemists*, 46, 829-835.

Van Soest, P.J., and Wine, R.H. (1967). The use of detergents in the analysis of fibrous feeds. IV. Determination of plant cell wall constituents. *Journal of the Association of Official Analytical Chemists*, 50, 50-55.

Yolcu, H., Gunes, A., Gullap, M. K., & Cakmakci, R. (2012). Effects of plant growth-promoting rhizobacteria on some morphologic characteristics, yield and quality contents of Hungarian vetch. *Turkish Journal of Field Crops*, 17(2), 208-214.

*Corresponding author, E-mail address: mahmutkaplan5@hotmail.com