Journal of Animal and Veterinary Advances 12 (4): 487-490, 2013
ISSN: 1680-5593

Determination of Yield and Quality Characteristics of Alfalfa (*Medicago sativa* L.) Varieties Grown in Different Locations

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Abstract: This research was made in Konya and Polatli-Ankara ecological conditions during the years of 2006 and 2007 according to Randomized Blocks Design with three replications. The used alfalfa species were: Verko, Sunter, Hemedan, Elci and Planet varieties and Kayseri population. In the study, the fallowing characteristics were determined: plant height (cm), stem thickness (mm), green herbage yield (t ha^{-1}), dry matter yield (t ha^{-1}), crude protein content (%) and crude protein yield (t ha^{-1}). As the means of 2 years and two locations, the genotypes showed the fallowing values: 62.0-68.2 cm for plant height, 3.0-3.2 mm for stem thickness, 83.8-89.1 t ha^{-1} for green herbage yield, 20.9-22.3 t ha^{-1} for dry matter yield, 18.5-19.4% for crude protein content and 4.02-4.22 t ha^{-1} for crude protein yield. The main goal of alfalfa farming is production of high quality and abundant roughage. Kayseri population showed the highest dry matter yield (22.29 kg/da/year) and it was followed by the Verko (22.25 kg/da/year) variety. The Verko variety had higher yield than Elci and partially more than Hemedan variety.

Key words: Alfalfa, herbage yield, protein, goal, year

INTRODUCTION

Feeding of the animals in Turkey is usually provided by meadow and grassland and, the yield and quality decreases due to excessive pressure. Growing of provender plants in field agriculture is recommended to supply the animal demand for quality roughage. Researches for plant adaptation which focused on high adaptation ability, yield and quality characteristics should be done. For an economic production, selection of the plants that in the property of high quality, high yielded, resistant to insect, diseases, cold and drought, adaptive to the grown ecology is quite. Alfalfa is the first one between these plants. The alfalfa which is the first grown plant in the world called as queen of the forages. Alfalfa has a wide range of adaptation ability at Siberia and Alaska in the Northern Hemisphere such cold regions, North Africa and Arab Peninsula Provinces where under Africa hot climate. The plant have importance on animal feeding because of using in silage and pellet (Fick and Mueller, 1989) beside its high yield, protein, carotene and low fiber content.

As it seen over the world, alfalfa is also the primary forage in Turkey. Recent data showed that alfalfa has an area of 558,552 ha and 12,076,159 tons of fresh herbage production quantity in Turkey. There are many researches about alfalfa in different ecologies of the world (Meyer, 2005; Tucak *et al*., 2008). Multiple location trials are important for the new developed varieties by means of economic incomes of the countries. This research was made in Konya and Polatli-Ankara ecological conditions with 5 alfalfa varieties and Kayseri population during the year of 2006 to 2007 to determine the adaptive genotype for Central Anatolian Region in terms of high yield and quality.

MATERIALS AND METHODS

The alfalfa genotypes of Verko, Kayseri, Sunter, Hemedan, Elci and Planet were used as material. Sowings were made on 27th of September 2005 in the trial field of Selcuk University, Agricultural Faulty-Konya and on 30th of July 2005 in Turkoba Village, Polatli-Ankara. Irrigation was made following sowing to provide healthy plants for winter. The trial field of Konya has an altitude of 1130 m above sea level, soil characteristics were clay-loamy, pH: 7.8, low organic matter (1.3%). The trial field of Ankara has an altitude of 760 m above sea level, soil characteristics were clay-loamy, pH: 7.5 and low organic matter (1.5%). Average precipitation for long terms of years is 370 mm in Ankara and 270 mm in Konya.

The observations were made according to Technical Instructions for Survey Trials of Agricultural Values which is prepared by Ministry of Agricultural and Rural Areas. Observations were made during the years of 2006 and 2007. Table 1 shows the dates of alfalfa mowing. The moving was made during 10% flowering time on the plants.

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Table 1: Dates of Alfalfa Harvest in Ankara and Konya locations

	Konya		Ankara	
Movings	2006	2007	2006	2007
1st	24.05.2006	23.05.2007	21.05.2006	20.05.2007
2nd	10.07.2006	02.07.2007	08.07.2006	01.07.2007
3rd	18.08.2006	08.08.2007	16.08.2006	05.08.2007
4th	25.09.2006	10.09.2007	24.09.2006	09.09.2007

The recorded data were subjected to variance analysis and LSD test. Results of LSD and CV (%) were given under the related tables. Lettering was made for only implication the difference of the genotypes.

RESULTS AND DISCUSSION

Plant height: Statistical analysis and means of two locations, 2 years and genotypes were given in Table 2. Plant height for location, year, genotype and location x year x genotype interaction were important in the level of $p<0.01$ (Table 2). Means of 2 years and 2 locations showed that the Sunter was the highest (68.2 cm) and followed by Hemedan (67.9 cm), Kayseri (67.4 cm) and Elci (66.2 cm) while these values were not important ($p<0.05$).

Thickness of stem: Location, year, location x year interaction, genotype and location x genotype interaction were important in the level of $p<0.01$ (Table 2) for means of stem thickness. Verko (3.2 mm) had the highest value and fallowed by Sunter (3.1 mm) and Planet (3.1 mm) while these values were not important ($p<0.05$).

Green herbage yield: Location, year, year x genotype interaction were important in the level of $p<0.01$; genotype, location x genotype interaction and location x year x genotype interaction were important in the level of $p<0.05$ (Table 2) for means of green herbage yield. Highest value was observed on Kayseri (89.14 t ha^{-1}) and followed by Verko (88.99 t ha^{-1}), Sunter (88.96.2 t ha^{-1}) and Planet (85.55 t ha^{-1}) while these values were not important.

Dry matter yield: Location, year and year x genotype interaction were important in the level of $p<0.01$; genotype, location x genotype interaction and location x year x genotype interaction were important in the level of $p<0.05$ (Table 2) for means of dry matter yield. Kayseri had the highest value (22.29 t ha^{-1}) and followed by Verko (22.25 t ha^{-1}), Sunter (22.24 t ha^{-1}) and Planet (21.39 t ha^{-1}) while these values were not important.

Crude protein content: Location was important in the level of $p<0.01$; year x genotype interaction and location x year x genotype interaction were important in the level of $p<0.05$ (Table 2) for means of crude protein content. There were not differences between the genotypes.

Crude protein yield: Location and year were important in the level of $p<0.01$; year x genotype interaction and location x year x genotype interaction were important in the level of $p<0.05$ (Table 2) for means of crude protein yields. The highest value was observed on Verko while there were not differences between the genotypes.

Plant height in the alfalfa is under the effect of environment conditions especially precipitation and temperature which are also determining harvest time (Meyer, 2005). Besides that plant height is an important yield criteria and it is an indicator in early period selection as a yield component in alfalfa breeding program (Tucak *et al*., 2008). Plant height in alfalfa was reported by Altinok and Karakaya (2002) between 46.0-60.0, 62.4-94.1 cm by Sengul (2002) and 54.7-60.8 cm by Tucak *et al.* (2008) reports.

Bowley *et al.* (2007) reported that stem thickness in alfalfa depend on genotype and there is not a relation between stem thickness and yield in terms of green herbage yield. Although, that Volonec *et al.* (1987) put forth that stem thickness increases the yield but it decreases the quality. Stem thickness is found as 1.65-3.38 cm by Demiroglu. The findings of the present research are in parallel with older researches.

Green herbage yield in alfalfa is affected by environment, plant density and genotype (Lamb *et al*., 2003). Green herbage yield in alfalfa was found as 84.7-122.8 t ha^{-1} by Lamb *et al.* (2003), 35.2-47.9 t ha^{-1} by Saruhan ve Kusvuran.

Dry matter yield in alfalfa is effected by environment (Sharratt *et al.* 1986), time of harvest and plant height (Ottman and Rogers, 2000). The yield of dry matter in alfalfa was found as 8.53-13.85 t ha^{-1} by Bowley *et al.* (2007) and 9.93-12.50 t ha^{-1} by Ottman and Rogers (2000).

The result of the crude protein content was statistically unimportant in the present research. This finding is in accordance with Stanisavljevic *et al.* (2008). Earlier researches were found the crude protein content as 15.0-25.0% by Altinok and Karakaya (2002) 18.57-19.82% by Stanisavljevic *et al.* (2008).

Data of crude protein yield in the present research was between 4.02 and 4.22 t ha^{-1} values. Related researches were determined this value as 2.54-3.21 t ha^{-1} by Sengul *et al.* (2003) and 37.25-52.23 g/plant by Kir ve Soya reports.

Table 2: Means, F, LSD and CV values the trial of alfalfa agricultural values

Locations	Years	Genotype	Plant height (cm)	Thickness of stem (mm)	Green herbage yield (t ha^{-1})	Dry matter yield (t ha^{-1})	Crude protein content (%)	Crude protein yield (t ha^{-1})
Konya	2006	Kayseri	61.3	2.8	61.63	15.41	18.6	2.87
		Sunter	59.5	2.9	59.88	14.97	17.2	2.58
		Verko	58.8	2.9	63.15	15.78	18.7	2.95
		Hemedan	58.4	2.9	61.17	15.29	17.5	2.68
		Elçi	58.7	2.8	64.01	16.00	19.5	3.11
		Planet	56.4	3.2	67.09	16.77	18.9	3.19
		Mean	58.9	2.9	62.82	15.71	18.4	2.90
	2007	Kayseri	66.0	2.8	70.40	17.60	18.4	3.26
		Sunter	73.5	2.8	78.76	19.69	18.1	3.59
		Verko	66.2	2.9	74.50	18.62	17.7	3.30
		Hemedan	75.0	2.8	73.65	18.41	19.0	3.49
		Elci	73.2	2.7	72.34	18.09	17.8	3.22
		Planet	66.2	2.8	69.84	17.46	20.1	3.50
		Mean	70.0	2.8	73.25	18.31	18.5	3.39
Konya Ortalamasi			64.4	2.9	68.03	17.01	18.5	3.15
Ankara	2006	Kayseri	65.5	3.7	101.25	25.31	19.7	4.98
		Sunter	64.8	3.8	104.87	26.22	19.0	4.98
		Verko	55.8	3.9	105.43	26.34	19.9	5.24
		Hemedan	63.4	3.6	98.58	24.64	18.4	4.52
		Elci	61.3	3.7	89.19	22.30	19.7	4.40
		Planet	56.4	3.4	106.74	26.69	19.0	5.05
		Mean	61.2	3.7	101.01	25.25	19.3	4.86
	2007	Kayseri	76.9	2.8	123.28	30.82	18.5	5.71
		Sunter	74.9	2.7	112.32	28.08	19.2	5.39
		Verko	77.2	3.2	112.88	28.22	19.2	5.41
		Hemedan	74.6	2.6	105.23	26.31	20.5	5.38
		Elci	71.7	2.8	109.48	27.37	20.1	5.49
		Planet	69.0	2.9	98.51	24.63	19.6	4.82
		Mean	74.1	2.8	110.28	27.57	19.5	5.37
Mean of Ankara			67.6	3.3	105.64	26.41	19.4	5.11
Mean of 2006			60.0	3.3	81.91	20.50	18.8	3.88
Mean of 2007			72.0	2.8	91.77	22.94	19.0	4.38
General mean			66.0	3.1	86.84	21.71	18.9	4.13
Kayseri			67.4^{AB}	3.0^{B}	89.14^{A}	22.29^{A}	18.8	4.20
Sunter			68.2^{A}	3.1^{AB}	88.96^{AB}	22.24^{AB}	18.4	4.13
Verko			64.5^{BC}	3.2^{A}	88.99^{AB}	22.25^{AB}	18.9	4.22.
Hemedan			67.9^{AB}	3.0^{B}	84.66^{BC}	21.17^{BC}	18.9	4.02
Elci			66.2^{AB}	3.0^{B}	83.76^{C}	20.94^{C}	19.3	4.06
Planet			62.0^{C}	3.1^{AB}	85.55^{ABC}	21.39^{ABC}	19.4	4.14
F			**	*	*	*	NS	NS
LCD^{+}			3.42	0.13	44.6	11.6	-	-
CV (%)			5.50	6.21	7.27	7.27	6.48	9.20

*p<0.05; **p<0.01; NS: Not Significant; +: Means of the genotypes

CONCLUSION

In this study, there was not lodging in any of the alfalfa genotype, none of dead due to disease, insect or winter. Main purpose of alfalfa growing is production of high quality roughage. The genotype Verko (22.25 t ha^{-1}) had the highest dry matter yield and it followed the highest yielded Kayseri (22.29 t ha^{-1}) genotype. The genotype Verko showed higher yield than Elci and partially higher than Hemedan genotype.

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