

Yield Properties of Some Alfalfa Cultivars in East Anatolia Region of Turkey

¹Bilal Keskin, ¹Ibrahim H. Yilmaz, ²Seyda Zorer and ¹Ösmetullah Arvas

¹Department of Agronomy, Faculty of Agricultural, Iğdir University, Iğdir, Turkey

²Department of Agronomy, Faculty of Agricultural, Yüzüncü Yil University, Van, Turkey

Abstract: This research was conducted in Van located Eastern Anatolia Region of Turkey for 3 years from 2001-2003. In the research, twelve alfalfa cultivars (Bilensoy, Elci, Kayseri, MA-324, Prosementi, Desica, MA-414, Gara, Prista, Hemedan, P-5693 and MA-525) were used as treatment material. Experimental design was completely block with three replication. As a result of experiment, Bilensoy, Desica, Elci, MA-414, MA-324 and MA-525 cultivars produced more forage and crude protein yield compared to the other six alfalfa cultivars. Clearly, the results indicated that Bilensoy and Desica cultivars had the highest crude protein rate and crude protein yield; therefore, they seemed more promising in forage production in the area.

Key words: Alfalfa, forages, alfalfa cultivars, bilensoy, desica, Turkey

INTRODUCTION

Alfalfa, often called queen of the forages is one of the most important forage plants in the world. It has highest feeding value for farm animals of all commonly grown hay crops. It produces more protein per hectare than the other forage or grain crops. Alfalfa has a high mineral content and contains at least 10 different vitamins; therefore, it is an important source of vitamins (Barnes *et al.*, 1995).

Alfalfa originated near Iran and East Anatolia region of Turkey, but related forms and species are found as wild plants scattered over Asia and into Siberia. Alfalfa can survive temperatures below -25°C in cool region of world and above 50°C in hot region of world. Alfalfa is also highly drought tolerant, it becomes dormant during periods of severe drought and resumes growth when moisture conditions become favorable (Hall *et al.*, 1988).

Alfalfa grows well on irrigated, fertile soils in the dry climates of the Turkey. It is also one of only a few crops grown in every region of Turkey. However, herbage and grain yields of alfalfa cultivars change depending on environmental conditions of region. Therefore, the best alfalfa cultivars or ecotypes for each region of Turkey should be determined (Avcioglu and Soya, 1977).

Sengul *et al.* (1992) reported that green herbage and hay yield of different alfalfa cultivars in East Anatolia region change between 395.8-744.4 and 98.79-193.8 kg ha⁻¹, respectively. Besides, Tahtacioglu *et al.* (1996) reported 129.1-178.1 kg ha⁻¹ hay yields at different alfalfa cultivars in same region. On the other hand, Serin *et al.* (1998) determined 109.78 kg ha⁻¹ hay yield at some alfalfa cultivars in Erzurum, which is also located in East Anatolia region.

There is a little information on the yield properties of different alfalfa cultivars in East Anatolia region of Turkey. Most of farmers in Van, located in same region, usually plant Kayseri cultivar of alfalfa, but there is lack of information about performance of this cultivar. Also, some other cultivars may fit this environment better. The aim of this research is to determine the best alfalfa cultivars fit this area.

MATERIALS AND METHODS

Experiment was conducted at the field of Van Industry district from 2001-2003. Twelve alfalfa cultivars (Bilensoy, Elci, Kayseri, MA-324, Prosementi, Desica, MA-414, Gara, Prista, Hemedan, P-5693 and MA-525) provided from different seed companies were used in the experiment.

Soil of research area was clay-loam texture and poor in organic matter content. It was slightly alkali, phosphorous content of soil was middle level (5.58 ppm) and nitrogen levels were pretty low. Besides, salinity ratio of soils was determined as low (Table 1).

Some climatic values were presented in Table 2. Long term average precipitation in Van is 380.4 mm, while total precipitation in the 1st year of experiment (2002) was 369.1 mm; it was 429.6 mm in the 2nd year of experiment (2003). Average temperature was pretty similar in both years (9.6 and 9.9°C); average percent humidity was 60.5 and 66.7% in 2002-2003 years, respectively.

Experimental design was completely block with three replication. Each experimental unit was 9 m² with 5 m length and 1.8 m width and row spacing was 30 cm. Planting was made on April 23, 2001 by parcel sowing

Table 1: Some physical and chemical properties of research area soil

Texture	Depth (cm)	Org. matter (%)	Nitrogen (%)	Phosphorous (ppm)	Lime (%)	Salt (%)	pH
Sandy-clay-loam	0-20	0.56	0.04	5.58	12.97	0.08	7.9
Sandy-clay-loam	20-40	0.35	0.05	4.33	14.16	0.07	7.8

Table 2: Some climatic values in 2002-2003 years and long term averages in Van

Months	Rainfall (mm)			Average temperature (°C)			Average humidity (%)		
	2002	2003	Long term	2002	2003	Long term	2002	2003	Long term
January	30.8	26.1	38.3	-3.3	-1.4	-4.0	68.1	68.3	70.0
February	7.7	54.5	33.4	-0.8	-1.4	-3.6	71.7	66.3	70.0
March	3.4	83.4	45.1	3.4	0.1	0.7	68.6	71.9	69.0
April	107.4	78.8	54.4	6.9	8.4	7.2	69.5	73.0	63.0
May	54.8	6.4	46.3	12.3	14.5	12.9	57.6	64.2	67.0
June	20.4	50.2	18.4	17.9	18.2	17.8	49.5	61.5	50.0
July	3.1	-	5.1	22.6	23.1	22.0	46.4	53.4	44.0
August	-	15.7	3.9	22.2	22.8	21.5	39.5	56.2	42.0
September	6.4	16.4	10.5	18.1	17.0	17.0	48.7	64.5	43.0
October	58.8	23.6	45.4	12.8	13.0	10.3	63.4	71.0	59.0
November	56.7	59.6	47.5	3.8	4.5	4.3	70.9	74.4	67.0
December	19.6	14.9	32.1	0.4	0.2	-1.1	72.8	76.7	69.0
Total	369.1	429.6	380.4	-	-	-	-	-	-
Average	-	-	-	9.6	9.9	8.8	60.5	66.7	59.4

Source: Van meteorology district records

machine. Planting density was 2.5 kg for per decar (Tosun, 1974). As fertilizer, 4 kg nitrogen and 8 kg phosphorous per decar was applied during planting. Besides in 2nd and 3rd years of experiment 8 kg decar⁻¹ phosphorous was applied.

Research was conducted in irrigated conditions and plants were irrigated regularly by sprinkles. The plants were harvested by hand 3 times each year. Cutting was done when plants were beginning of flowering stage (1/10 flowering) at 8-10 cm stubble height. Six rows in each parcel, except edge rows, were harvested. A 500-600 g plant samples were taken from each experimental unit in order to determine hay yield. Plant samples were dried at 78°C for 24 h, later dry matter ratio was found by using dry plant samples weight. Hay yield was calculated by using dry matter ratio and green herbage weight. Besides, crude protein rate was determined by using this dry plant samples by Wendee analyze procedure (Akyildiz, 1984). Data were analyzed by using SAS statistic program and means were compared with Duncan test (Steel and Torrie, 1980; SAS, 1985).

RESULTS AND DISCUSSION

Green herbage and hay yield: Green herbage and hay yields of 12 alfalfa cultivars were given in Table 3. Green herbage yield of alfalfa cultivars changed between 749.42 and 486 kg ha⁻¹ in 2002 and Desica cultivar had the highest yield. In 2003, yield varied between 832.81 and 494 kg ha⁻¹. Bilensoy and Elci cultivars produced the highest green herbage yields. On the other hand, Elci, Bilensoy and Desica cultivars had the highest average green herbage yield, while Gara and Prosementi

cultivars having the lowest yield value. Besides, average green herbage yield of cultivars was higher in 2003 (663.48 kg ha⁻¹) than the value obtained in 2002 (623.81 kg ha⁻¹). Sengul *et al.* (1992) reported that green herbage yields of alfalfa cultivars changed between 395.8-744.4 kg ha⁻¹ similar to the results.

Average dry matter of alfalfa cultivars was pretty similar in 2002 and 2003 years. Hay yield of cultivars changed between 138.32-186.07 kg ha⁻¹ in 2002 and Elci cultivar had the highest value. In 2003, hay yield of cultivars was determined between 141.54-193.04 kg ha⁻¹ and Bilensoy cultivar had the greatest value. On the other hand, Bilensoy, Elci and MA-324 cultivars produced the highest average green herbage yield (183.86, 181.09 and 177.91 kg ha⁻¹, respectively), while Gara and Prosementi cultivars having the lowest average hay yield. The results obtained from the experiment are pretty similar to previous hay yield results determined in East Anatolia region of Turkey. Sengul and Tahtacioglu (1996) determined that hay yield of some alfalfa cultivars varied between 98.24-179.68 kg ha⁻¹ in Erzurum conditions. Sengul *et al.* (1992) reported that average hay yield of Bilensoy cultivar in Erzurum was 156.03 kg ha⁻¹. Also, Tahtacioglu *et al.* (1996) reported hay yield of Bilensoy as 161.80 kg ha⁻¹.

Crude protein rate and crude protein yield: Crude protein rate and crude protein yield of 12-alfalfa cultivars are given in Table 4. As can be shown in Table 4, Desica cultivar had the highest crude protein rate and Bilensoy cultivar followed it in 2002 and 2003 years while Prista and Elci cultivars having the lowest crude protein rate in the both year. Same results were observed in the

Table 3: Green herbage and hay yield of different alfalfa cultivars

Cultivars	Green herbage yield (kg ha ⁻¹)			Hay yield (kg ha ⁻¹)		
	2002	2003	Average	2002	2003	Average
Bilensoy	731.88a	832.19a	782.03a	174.68a-c	193.04a	183.86a
Elci	737.11a	832.81a	784.96a	186.07a	176.12b	181.09ab
Kayseri	535.93c	612.01de	573.97d	157.75de	163.16c-f	160.46d
MA-324	635.59b	657.16c	646.37c	175.38a-c	180.44b	177.91a-c
Prosementi	518.22cd	520.50f	519.36e	145.07fg	150.74gh	147.91f
Desica	749.42a	731.11b	740.26b	179.28ab	172.82bc	176.05bc
MA-414	714.81a	727.94b	721.37b	178.53ab	170.60b-e	174.57bc
Gara	486.00d	494.00f	490.00f	138.32g	141.54h	139.93g
Prista	491.16d	602.78de	546.97d	149.19e-g	153.48fg	151.33ef
Hemedan	623.95b	636.86cd	625.41c	163.87cd	161.38d-e	162.63d
P-5693	540.80c	577.26e	559.03d	155.77d-e	160.88ef	158.32de
MA-525	730.88a	737.14b	734.01b	172.85bc	171.27b-d	172.06c
Average	623.81b	663.48a	-	164.74a	166.29a	-

Table 4: Crude protein ratio and yield of different alfalfa cultivars

Cultivars	Crude protein rate (%)			Crude protein yield (kg ha ⁻¹)		
	2002	2003	Average	2002	2003	Average
Bilensoy	16.5b	15.7b	16.1b	28.87b	30.40a	29.64a
Elci	13.6g	13.4e	13.5g	25.37de	23.64e	24.50cd
Kayseri	14.8ef	14.2d	14.5ef	23.36e	23.15e	23.26d
MA-324	15.3cd	14.9c	15.1d	26.91b-d	26.94b	26.9b
Prosementi	14.5f	13.8de	14.1f	21.07f	20.89gf	20.98e
Desica	17.2a	17.0a	17.1a	30.96a	29.46a	30.21a
MA-414	15.7c	15.4bc	15.5c	28.06c	26.34bc	27.20b
Gara	14.8ef	14.8c	14.8de	20.45f	20.99f	20.72e
Prista	13.6g	13.5e	13.6g	20.43f	20.77f	20.60e
Hemedan	15.1de	15.2bc	15.1d	24.83de	24.5c-e	24.69c
P-5693	14.9d-f	14.8c	14.9d	23.26e	23.94de	23.60cd
MA-525	15.2de	15.0c	15.1d	26.29cd	25.72b-d	26.00b
Average	15.1	14.8	-	24.99	24.73	-

In a column, values indicated with different letters are significantly different at p<0.05

average values. Besides, average crude protein values of cultivars in 2002 and 2003 were pretty similar (15.1 and 14.8).

Desica and Bilensoy cultivars had the highest crude protein yield in 2002 and 2003 years. Also, their average crude protein yield was the greatest compared to the other cultivars. On the other hand, Prista, Gara and Prosementi cultivars produced the lowest crude protein yields. Besides, average crude protein yield of 12 alfalfa cultivars in 2002 and 2003 were very close to each other (249.9 and 247.3). Crude protein yield findings in this research were pretty similar to previous studies conducted in same region of Turkey. Sengul and Tahtacioglu (1996) reported that crude protein yields of alfalfa cultivars changed between 16.72-32.37 kg ha⁻¹. Similarly, Tahtacioglu *et al.* (1996) reported crude protein yields between 20.68-30.32 kg ha⁻¹ in different alfalfa cultivars growing in East Anatolia region of Turkey.

Plant height: Plant height values of alfalfa cultivars were presented in Table 5. Bilensoy, Hemedan and MA-525 cultivars had the highest average plant height as 85, 84 and 83.7 cm, respectively and Prosementi, Elci, Kayseri cultivars followed them. On the other hand, MA-414, Gara

Table 5: Plant height values of different alfalfa cultivar

Cultivars	Plant height (cm)		
	2002	2003	Average
Bilensoy	85.8a	84.3a	85.0a
Elci	81.9ab	81.6a-c	81.8bc
Kayseri	85.6a	77.5d	81.6bc
MA-324	81.7ab	78.4cd	80.0c
Prosementi	84.6a	80.2b-d	82.4bc
Desica	78.1bc	82.6ab	80.3c
MA-414	76.3c	71.9e	74.1d
Gara	75.6c	68.4f	72.0de
Prista	78.8bc	80.6b-d	79.7c
Hemedan	83.6a	84.4a	84.0ab
P-5693	70.4d	72.1e	71.2e
MA-525	83.1a	84.3a	83.7ab
Average	80.4a	78.8b	-

In a column, values indicated with different letters are significantly different at p<0.05

and P-5693 cultivars had the lowest plant height. Besides, average plant height of cultivars in 2002 and 2003 years was pretty close to each other.

CONCLUSION

As a result of this experiment, Bilensoy, Desica, Elci, MA-414, MA-324 and Ma-525 cultivars showed the best performance and their green herbage, hay and

crude protein yields were determined higher than the other six alfalfa cultivars. Since alfalfa is considered as protein source for animals, we can conclude that Desica and Bilensoy cultivars are the best cultivars among alfalfa cultivars tested, because they produced the highest crude protein yield in East Anatolia region of Turkey.

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