

УДК 633.37:631:552

DOI 10.26897/978-5-9675-1762-4-2020-27

THE EFFECT OF CULTIVAR DIFFERENCE IN THE YIELD AND QUALITY OF ALFALFA

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Abstract: *The legume alfalfa is briefly introduced. The yield and quality characteristics of the different alfalfa cultivars in different years of study is given. The comparison and significant difference among cultivars of alfalfa is briefly presented.*

Key words: *alfalfa, cultivars, nutritive value, yield, quality.*

Аннотация: *Кратко представлена бобовая люцерна. Приведены урожайные и качественные характеристики различных сортов люцерны в разные годы исследований. Кратко представлено сравнение и существенные различия между сортами люцерны.*

Ключевые слова: *люцерна, сорта, питательная ценность, урожайность, качество.*

Leguminosae plant is one of the largest family of flowering plants and it includes totally about 800 genera and 20,000 species [12]. Forage legumes can be classified as members of the Fabaceae (Leguminosae) which have sections of the plant other than separated grain used to feed ruminant animals [9]. They are normally grazed or offered as silage or hay and may be planted as monocultures or mixtures with other plants, most commonly grasses [14]. Alfalfa (Latin. Medicágo) is a genus of the legume family (Fabaceae) that includes economically important forage species like *M. sativa*, *M. falcata*, *M. borealis*, *M. varia* Mart *M. polychroa* and others [3]. It can be grown widely in a temperate climate [18]. It has varieties developed for harsh climatic conditions in very cold places, such as Alaska and Siberia, where winter colds exceed -50°C , and Death Valley in California, where summer temperatures rise to 60°C and it has also varieties having the potential to grow from sea level to 3000 m at varying altitudes [19]. Alfalfa is generally a heterogeneous crop and has fairly high levels of genetic variation within stands because it is an insect-pollinated with a high outcrossing tetraploid and less tolerance to inbreeding [6] similarly there is also much diversity between alfalfa cultivars [10]. Because of its rich and variable genetic base, it has good adaptability to different environmental conditions and large growing area, and is now cultivated in more than 80 countries on every continent of the globe over an area of more

than 35 million ha[16].The Russia region covered by alfalfa reaches about 2.3–2.5 million ha[17]. Researches in the breeding of alfalfa and developing of new cultivars in different regions of Russia has started long years ago. As a result, many new varieties such as Agnes, Selena, Sonata, Naxodka, Lada, Pasture 88, Meadow 67, etc. have developed [1,2].

Many findings have confirmed that there is a high variation of nutritive value among different alfalfa cultivars. Geleti et al. [8] has reported a significant difference in dry matter, ash, crude protein(CP), neutral detergent fibre(NDF), acid detergent fibre(ADF) in a study of five alfalfa cultivars (Table 3). Magna 788 had the highest CP (19,56%) and the lowest NDF (36,86 %), ADF (20,71%) which reflects as the best quality alfalfa among the other varieties (Table 1).

Table 1 - Chemical composition of alfalfa cultivars in the years 2012-2013[8]

Cultivars	Dry matter (g/kg)	Ash (g/kg)	Crude Protein (g/kg)	Neutral detergent fibre (g/kg)	Acid detergent fibre (g/kg)
<i>FG10-09(F)</i>	892	106.9	184.3	388.5	225.9
<i>FG9-09(F)</i>	891.4	105.2	188.7	392.8	216.7
<i>Magna 801-FG(F)</i>	890.9	106.3	186.6	376.9	214.9
<i>Magna 788</i>	884.2	104.6	195.6	368.6	207.1
<i>Hairy Peruvian</i>	894.0	100.3	181.5	435.3	261.9
SE	0.22	0.16	0.45	1.09	1.3
P-level	*	*	*	*	*

*Note: SE, standard error; * significant at P ≤0.05*

A study with seven different alfalfa cultivars in Turkey in the years of 2007-2009 has shown a significant difference in terms of all quality characters among alfalfa varieties in crude protein (CP), Acid detergent fibre(ADF), Neutral detergent fibre(NDF), dry matter yield, digestible dry matter and leaf stem ratio. A significant higher CP content was found with cultivars *Magnum 5* (19.6 %) and *MA 414* (19.4%) as compared to other cultivars (Table 2). ADF and NDF concentration varies significantly in the alfalfa cultivars and Cultivar *Magnum 5* has shown the lowest ADF (36.8%) and NDF (44.8%) which is statistically significant different from the other cultivars (Table 2). The highest digestible dry matter (60.2 %) was observed in *Magnum 5* and the lowest in the cultivar *Nimet* 57.4 and 108% respectively, which identifies *Magnum 5* as the high quality cultivar. Cultivars with higher dry matter yields has shown a lower nutritive value (Table 2). Yield and quality are inversely related which is usually the highest yielding cultivars have the lowest quality (higher in ADF), and the lowest yielding cultivars have the highest quality (lowest in ADF) [15].

Table 2 - Averaged value for alfalfa cultivars tested in 2007 -2009[5]

Cultivars	Dry Matter Yield (t ha-1)	Leaf Stem Ratio	Crude Protein (%)	Neutral Detergent Fiber (%)	Acid Detergent Fiber (%)	Digestible Dry Matter (%)
<i>Calfa</i>	24.351	0.71	17.9	48.5	39.4	58.2
<i>Kalender</i>	23.925	0.76	17.9	49.2	40.1	57.7
<i>MA 525 HQ</i>	23.955	0.75	18.4	48.5	39.7	58
<i>Verdor</i>	23.999	0.8	17.8	47.8	39.7	58
<i>Nimet</i>	25.969	0.7	17.6	49.6	40.4	57.4
<i>MA 414</i>	22.07	0.97	19.4	46.9	38.3	59
<i>Magnum 5</i>	20.361	1.08	19.6	44.8	36.8	60.2
Mean	23.519	0.82	18.4	47.9	39.2	58.4
P-value	*	*	*	*	*	*

* significantly different according to Duncan Test at $P \leq 0.05$ probability level.

A field trial conducted at the experimental fields in Turkey (2006 – 2007) in the four cultivars of alfalfa (*TT-2008*, *TT-2009*, *P-5683* and *Elci*) has shown a significant difference in the yield and forage quality of alfalfa [11]. *TT-2008* and *P-5683* cultivars had better performances as compared to other cultivars.

Marinova *et al.* [13] observed some difference in the crude protein content of the seven different alfalfa varieties studied in northern Bulgaria from a year 2012–2015 with a maximum (20.32 %) and minimum (19.39%) CP content as dry matter basis. Further study by Szumacher-Strabel *et al*[18] (2019) in Poland in the year 2014 in the chemical composition of ten fresh alfalfa varieties has shown also a significant difference in crude protein content (19.8 – 23.0%), with some variations among the cultivars in the contents of organic matter (79.9 – 82.8 %), ash (11.0 - 11.9%), crude fibre (25.3- 29.5%), crude fat (ether extract) (1.17 -14.9 %) as in dry matter basis.

A study in alfalfa cultivars (2014 – 2016) in Turkey has reported that a significant difference was determined in the quality characteristics of sixteen different alfalfa cultivars [7]. The cultivar *Gea* can be recommended as a promising alfalfa cultivar with the highest green (3591.0 kg/ha), dry herbage (1227.3 kg/ha) and crude protein (301kg/ha) yield and also with the lowest acid detergent fibre (18.7%) and neutral detergent fibre (27.1%) (Table 3 and Fig. 1).

Table 3 - Average yield and ratio of different alfalfa cultivars [7]

Cultivars	Green herbage yield (Kg/ha)	Dry herbage yield (Kg/ha)	Crude protein ratio (%)	Crude protein yield (Kg/ha)	Acid detergent fibre (ADF) (%)	Neutral detergent fibre (NDF) (%)
<i>Alsancak</i>	2762.3	1018.5	24.5	239.5	20.0	28.6
<i>Basbag</i>	2856.3	1039.7	24.0	241.9	21.2	30.2
<i>Bilensoy-80</i>	3011.5	1134.3	25.4	275.7	19.7	29.2
<i>Elci</i>	2905.1	1130.1	23.9	262.9	23.0	32.2

<i>Gea</i>	3591.0	1227.3	25.2	301.1	18.7	27.1
<i>Gozlu-1</i>	2735.3	924.1	24.7	219.1	21.2	30.0
<i>Kayseri</i>	2918.7	1089.0	25.2	262.8	20.1	29.0
<i>Magna-601</i>	3555.4	1201.8	25.0	292.8	21.3	29.7
<i>Magnum-V</i>	3300.5	1127.6	25.9	281.2	20.5	28.8
<i>Nimet</i>	3075.0	1054.6	25.6	258.7	19.1	27.5
<i>Omerbey</i>	3424.7	1200.2	25.4	292.7	20.2	29.2
<i>Ozpinar</i>	2913.6	1061.9	24.8	254.5	19.7	27.7
<i>Savas</i>	2909.3	995.9	25.0	242.8	22.7	31.9
<i>Sunter</i>	3289.1	1132.9	25.4	276.5	18.9	27.4
<i>Verdor</i>	3267.2	1146.1	24.7	275.8	20.2	28.5
<i>Verko</i>	3186.2	1156.5	25.0	280.9	19.5	28.4
P-value	*	*	*	*	*	*

*Significant at $P \leq 0.05$

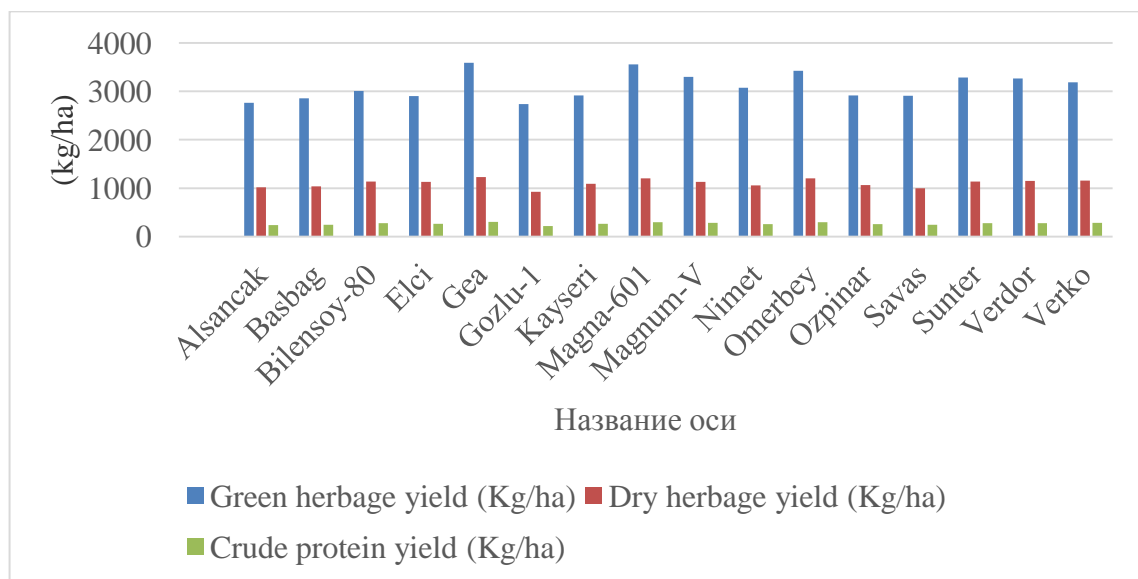


Fig.1. Average Green, dry and crude protein yield of alfalfa cultivars (year 2014-2016)

A study carried out in Turkey for three years (1997-1999) has shown that there were statistically significant differences among the cultivars regarding crude protein content in the first cut, and green and dry matter yields in the second and third cuts of the third year (1999) (Table 4). Cultivar *Mesa-sirsa* had highest crude protein content (22%) and cultivars *Kayseri* and *Peru* with the highest green and dry matter yield. Even though there were no statistically significant differences among cultivars in the first cut but *Bilensoy-80* and *Bitlis* had the highest green yield (1646 and 1729kg/ha respectively) and dry matter yield (540 and 532kg/ha respectively).

Table 4 - Forage yields of alfalfa cultivars (1999) [4]

	First cut	Second cut	Third cut
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Cultivars	Green yield (Kg/ha)	Dry matter yield (Kg/ha)	Crude protein content (%)	Green yield (Kg/ha)	Dry matter yield (Kg/ha)	Green yield (Kg/ha)	Dry matter yield (Kg/ha)
<i>Elci</i>	1295	405	20	1331	425	1032	328
<i>Kayseri</i>	1490	470	20	1645	504	1055	333
<i>Mesa-sirsa</i>	1088	326	22	1517	494	1039	316
<i>Fortress</i>	1205	442	19	623	231	254	94
<i>Bilensoy-80</i>	1646	540	20	1502	489	1040	325
<i>5638/Miral</i>	1434	454	19	1000	373	672	237
<i>Peru</i>	1360	475	20	1370	440	1031	336
<i>Bitlis</i>	1729	532	17	712	231	379	130
P-value	NS	NS	*	*	*	*	*
Mean	1406	456	19	1213	399	810	262
C.V.(%)	23.5	19.1	7.7	34.4	32.0	39.1	35.2

**significant at $P \leq 0.05$, NS = Non significant*

Conclusion

Alfalfa is very rich in nutritive value which are very important as ruminant's diet. It is higher in dry matter, protein, and minerals than many other forages. However, the yield and quality can be affected by many factors such as climate, soil type, moisture, stage of maturity, cultivar difference etc. As many studies have confirmed a significant difference exists among different varieties of alfalfa in the yield and quality. This shows that the existence of genetic variation in the cultivars could be a good indicator for selecting the best alfalfa cultivars for future breeding programmes in boosting the yield and quality of alfalfa.

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