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STUDIES ON QUALITY OF MULTIFOLIOLATE ALFALFA

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Abstract

Breeding programs are focused on developing varieties with higher productivity, improved quality of green mass, resistance to diseases and pests, durability, quick recovery after cutting and etc. In the selection of varieties with high quality For this purpose the breeders use methods that directly influence protein and fiber content or increasing the percentage of leaf with more than 3 leaflets per leaf. The development of new alfalfa generation – multifoliolate is the achievement in this direction. In this paper the results from studies on Bulgarian multifolilate alfalfa variety (Mnogolistna 1) are presented. Studied genotypes differ in content of crude protein, amino acids and neutral and acid-detergent fiber and digestibility of dry matter in different parts of plants.

Key words: *alfalfa, multifoliolate , forage quality.*

INTRODUCTION

Breeding programs of many countries have focused on developing varieties with higher productivity, improved quality, resistance to diseases and pests, quick recovery after cutting, and etc. [1]. Multifoliolate alfalfa (with more than 3 more leaflets per leave) are new generation of alfalfa varieties that have higher nutritional value and better *in vitro* digestibility compared to standard trifoliolate varieties [2, 4, 6, 7]. There a lot of studies about multifoliolate genotypes but the dates about proving their better quality are still under discussions [3, 5, 6, 8].
The objective of this study was to compare forage quality of Bulgarian trifoliolate and multifoliolate alfalfa genotypes.

MATERIAL AND METHOD

Forage quality of two Bulgarian trifoliolate varieties (Nadezda 2 and Victoria) and three Bulgarian multifoliolate genotypes – variety Mnogolistna 1, AX-93-5 (dominate 5 leaflets/leave), AX-93 (3+5+7) was studied.
The field experiment was carried out in the research field of Agricultural University-Plovdiv in a randomized block design in four replications and size of 10 m^2. The soil was alluvial-meadow type, having pH from 6.5 to 7.1 (in H_2O) and average supply of basic nutritive elements.
Chemical analyses were performed on average samples taken in the second year of the crop life. Samples for the whole plant analysis were taken from spaced plants of all genotypes. Sample weight was 500 g of green forage. Plant materials were dried at 60°C for about 48 hours.
The analyses for crude protein (CP), crude fiber (CF) and amino acids were carried out by using standard methods in Acreditated laboratory of Agricultural University – Plovdiv.
The analyzes for neutral detergent fiber (NDF), acid detergent fiber (ADF) and in vitro dry matter digestibility (IVDDM) were performed in the lab of Plant Breeding Institute, Belgium.

RESULTS AND DISCUSSIONS

The studied trifoliolate varieties and multifoliolate genotypes differed significantly in chemical composition.
In our study it was found (Tabl. 1 and 2) that multifoliolate alfalfa genotypes in all cuts contain more protein in dry matter in comparison with trifoliolate varieties, regardless of the year of the crop. Multifoliolate genotypes have the highest protein content in all cuts.

Table 1.Crude protein and fiber (% of dry matter) – first year alfalfa crop

Variety	Ist cut		IId cut		IIId cut	
	CP	CF	CP	CF	CP	CF
Nadezda	20.62	27.11	18.75	31.35	21.43	27.98
Victoria	19.78	27.86	18.99	31.67	21.12	27.76
Mnogolistna	22.75	22.08	23.31	30.09	23.12	26.69
AX-93-5	21.62	23.67	22.68	29.37	22.37	27.61
AX-93 (3+5+7)	22.00	23.97	23.50	29.15	22.43	27.77

Table 2.Crude protein and fiber (% of dry matter) – second, third and fourth year alfalfa crop

Variety	Ist cut		IId cut		IIId cut	
	CP	CF	CP	CF	CP	CF
Nadezda	20.25	24.83	18.06	28.81	18.75	32.47
Victoria	19.22	25.11	18.10	29.88	18.06	33.56
Mnogolistna	22.81	24.88	20.37	26.54	21.25	28.35
AX-93-5	19.25	24.67	19.00	31.60	20.06	30.69
AX-93 (3+5+7)	19.68	24.88	20.37	28.88	19.25	30.18

The protein content of the variety Mnogolistna 1 is 22.75% in first cut, 23.31% in second cut and 23.12% in third, that is respectively 2.13%, 3.75% and 1.69% more the standard variety Nadezda 2. The studies genotypes differed in crude fiber contains for all cuts. All multifoliolate genotypes contain less fiber than standard variety Nadezda 2. Perhaps the higher protein and lower fiber contain in dry matter due to the higher leave ratio in the total herbage.
All studied genotypes differed in content of crude protein, neutral- and acid-detergent fiber and in vitro dry matter digestibility in different parts of the plant (Table 3). All multifolilate genotypes compared with trifoliolate varieties. They had higher protein content in both leaves and stems and lower levels of neutral-detergent fiber and acid detergent fiber in the same parts of the plant. Low content of fiber (neutral-and acid-detergent) in total biomass is not related to multifoliolate expression. Leaves from all genotypes accumulate high contents of crude protein (from 30.27 to 32.87). Also, the fiber content (NDF and ADF) is significantly lower in alfalfa leaves than in stems. Neutral detergent fiber mean values in leaves ranged from 17.31 (variety Victoria) to 19.64 (AX-93-3,5,7) with no significant differences observed among genotypes. These results proves the importance of leaves preservation during storage of alfalfa for high quality of hay and haylage. The same tendency was observed for the concentration of NDF and ADF for the stems and total herbage. The lower NDF and ADF, the more feed an animal can digest. Low values are desirable and are associated with increased dry matter intake.
This is confirmed by our other results obtained by harvesting trifoliolate and multifoliolate alfalfa genotypes in different phases. In bud stage multifolilaote genotypes contain more crude protein (220-224 g/kg in dry m) compared with variety Nadezda (206-207 g/kg in dry matter), which reduces during the flowering where, again Mnogolistna 1 had higher protein content in herbage [3].
Our results for the quality of alfalfa leaves, stems and whole plants are in agreement with those from previous studies[8].
Our dates showed that leaves and stems of all multifoliolate genotypes had higher in vitro dry matter digestibility compared to sdandard varieties.

Table 3. Crude protein, NDF, ADF and IVDDM (%)

Genotypes	Plant parts	CP	NDF	ADF	IVDDM
Nadezda 2	Leaves	30.27	18.36	14.74	75.67
	Stems	10.89	65.34	51.57	40.79
	Total herbage	21.26	49.03	38.82	-
	Leaves	30.76	17.31	14.18	74.97
Victoria	Stems	11.50	62.93	52.28	42.38
	Total herbage	19.20	44.67	37.04	
	Leaves	30,87	18,80	15,04	75.92
Mnogolistna 1	Stems	12.28	59.30	47.40	45.34
	Total herbage	23.19	41.40	33.09	
	Leaves	31,08	18,77	15,25	74.72
AX-93-5	Stems	11.94	59.64	48.93	45.10
	Total herbage	23.08	48.18	33.80	
	Leaves	31.75	19.64	15.66	75.81
AX-93-3,5,7	Stems	11,35	62,81	50,38	43.68
	Total herbage	21,45	47,62	34,09	

Our results confirmed conclusions of the other authors that the decrease of digestibility is the consequence of the reduction of the highly digestible component (leaves) because of an increase of the less digestible component (stems) and the decreasing average digestibility of the stem component, with more NDF and lignin [9, 10].

Multifoliolate genotypes had a higher content of essential amino acids than the standard variety Nadezda and higher content of lysine, leucine and phenylalanine, but lower content of glycine and proline (Table 4).

Variety Mnogolistna had the highest content of lysine – 1.61 % of dry matter.

Similar results were obtained from other studies [1], which established a high content of glutamic acid, leucine and phenylalanine and lower levels of glycine, alanine and proline in multifoliolate genotypes than standard trifoliolate varieties.

Table 4. Amino acids content (% in dry matter)

Genotypes Aminoacids	Nadezda 2	AX-93-5	Mnogo listna 1	AX-93 (3,5,7)
Lysine	1.55	1.58	1,61	1.60
Threonine	1.10	1.12	1.14	1.12
Valine	1.11	1.12	1.12	1.11
Methionine	0.12	0.13	0.13	0.13
Isoleucine	0.87	0.92	0.94	0.89
Leucine	1.75	1.78	1.81	1.76
Phenylalanine	1.16	1.20	1.21	1.22
Total:	***7.66***	***7.85***	***7.88***	***7.83***
Histidine	0.53	0.55	0.56	0.57
Arginine	1.20	1.22	1.26	1.20
Asp.acid	2.87	2.98	3.00	3.00
Serine	1.02	1.0 4	1.06	1.03
Glutamic acid	2.39	2.40	2.42	2.37
Proline	1.38	1.31	1.31	1.30
Glycine	1.06	0.96	0.96	0.93
Alanine	1.25	1.20	1.21	1.20
Cystine	0.12	0.12	0.13	0.13
Tyrosine	0.85	0.86	0.87	0.86
Total	**20.33**	**20.49**	**20.66**	**20.41**

CONCLUSIONS

The contents of proteins, crude fiber, NDF, ADF and IVDDM varied among the studied genotypes and plant part.

In all studied genotypes high content of crude protein was registered in alfalfa leaves, while significantly high fiber content (NDF, ADF) were registered in alfalfa stems.

Significant differences were observed am components.

Multifoliolate genotypes had higher content of protein and essential amino acids and lower content of fiber compared to standard trifoliolate varieties.

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