

BIOCHEMICAL TRAITS AND CORRELATION ASSOCIATIONS BETWEEN CHEMICAL COMPOSITION AND SOME PARAMETERS YIELD IN BIRDSFOOT TREFOIL

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Abstract. The field trial was conducted during the period 2002–2005 in the Experimental field of the IMSA Troyan for determination of the biochemical traits and correlation associations between chemical composition and some parameters yield in birdsfoot trefoil.

There were included for study varieties Targovishte 1–St (Bulgaria) and 4 specimens of birdsfoot trefoil: local population (Hungary), K–30 (Serbia), Pulavskii (Poland) and Viking (USA).

The studied accessions birdsfoot trefoil differed in chemical composition. The variety Viking (19.07%) was characterized with highest content of crude protein and lowest values of crude fiber (27.75%).

Was positive correlation between the height of stems ($r = 0.6229$) and dry mass yield ($r = 0.5271$) and weak strength of correlation between the content of crude protein and the height stems ($r = 0.4238$).

The registered quality traits a forage of birdsfoot trefoil formed under conditions of set on light grey pseudo podzolic are interest in the breeding.

Key words: birdsfoot trefoil, varieties, populations, chemical composition, correlation associations

Introduction

Birdsfoot trefoil is forage–grass crop by great potential capabilities for increase of forage productivity and quality [MARLEY et al., 2006; PELIKAN, 2002].

The studies on productivity and qualities traits of introduced varieties in different soil–climatic conditions was important to their correct regionalization and improvement of their technology for cultivation [ILIEVA and KYUCHUKOVA, 2009; RADOVIC et al., 2003].

According Kyuchukova (2009) the studied varieties and populations of birdsfoot trefoil differed significantly between them the regard to formed dry mass.

Manifestation of morphological, biological and quality attributes of varieties and birdsfoot trefoil populations is determined by the relationship between genotype and soil and climatic conditions [PELIKAN, 2002]. The investigations confirmed weak strength of correlation between the height of the dry mass yield and correlation of which was moderate between numbers of stems [KYUCHUKOVA, 2008].

The objective of this study was to determine the biochemical traits and correlation associations between chemical composition and some parameters yield in birdsfoot trefoil

Material and methods

The field trial was conducted during the period 2002–2005 in the Experimental field of the IMSA Troyan. There were included for study variety Targovishte 1–St (Bulgaria) and 4 specimens of birdsfoot trefoil: local population (Hungary), K–30 (Serbia), Pulavskii (Poland) and Viking (USA). The trial was laid out by the block method with 4 plot of 5 m². The soil was set on light grey pseudo podzolic.

The agro technical management over the growing season was carried out in accordance with the biophysiological and technological requirements of the birdsfoot trefoil. The sowing was performed manually, at a depth of 0.5–1.0 cm and sowing rate 12.0 kg/da⁻¹. The phosphorous and potassium fertilizers were applied as reserve at a rate of 320 kg/da⁻¹ a. i., while nitrogen was applied at one dressing 60 kg/da⁻¹ a. i., before sowing.

The samples for chemical analyses taken at the stage of budding–early flowering

The biochemical analysis included the traits: content of crude protein (by the Kjeldahl method), crude fiber (by the Heteron and Jensen), Crude ash (muffle incineration at t 550°C), calcium (complexometrically by Stotz), and



phosphorus (colorimetrically by the Gerike and Curmis).

The statistics analyses were performed by the variation–statistics method [LIDANSKI, 1988]. Average arithmetical (\bar{x}), minimum (min) and maximum (max) values,

variation coefficient (CV %), Standard deviation (SD). Correlation coefficients between biochemical traits and yield components were calculated by using Microsoft Excel.

Results and discussion

Table 1.

Chemical composition of dry mass yield, % of varieties and populations on average for the period

Varieties and populations	Crude protein	Crude fibber	Crude ash	Crude fat	Ca	P	Non extract matter
Targovishte 1	17.06	28.65	7.17	3.03	1.79	0.218	36.80
Local population (Hungary)	16.24	29.02	8.09	2.98	1.72	0.168	37.23
K–30 (Serbia),	16.88	28.05	8.00	2.76	1.80	0.174	37.15
Pulavskii (Poland)	15.57	30.29	7.54	3.86	2.45	0.172	35.83
Viking (USA)	19.07	27.75	7.61	3.34	1.81	0.181	35.10

The results of the chemical analysis (*Table 1*) showed that the studied varieties and populations differed in their chemical composition. The range of protein content is between 16.24 populations (Hungary) and 19.07% (variety Viking). The highest crude protein content was observed for variety Viking – 19.07%, when it exceeded the standard by 2.01 percentage points. The variation in relation the crude protein content could be explained with the different response of the cultivar to the climatic conditions during the period of formation of various undergrowth. The variety Viking had the lowest values of

Crude fibber as compared to the standard. There were not found considerable differences about the trait Crude ash between the studied accessions birdsfoot trefoil. The content of oils in forage from birdsfoot trefoil was from 2.76 to 3.86%, as the differences between the maximum and minimum value was 1.1 points. The highest content of calcium was observed for variety Pulavskii–2.45%, followed by variety Viking–1.81%.

Phosphorus quantity in dry mass varied within narrow limits. It was the lowest at population from Hungary and the highest at the standard variety (0,218%). The value of

trait Non extract matter varies from 35.10 to 37.23%, and was the highest with population from Hungary (37.23%). Data obtained for Non extract matter with variety Viking and Pulavskii were close values.

The values of crude fibber and Not extract matter varied within wide limits (*Table 2*): 18.05 (min)–37.97% (max) on 25.44 (min)–45.09% (max). The average crude protein content for all accessions was 16.98% and the range is between 14.58 and 26.5%, with lowest variation (CV–13.09%). This coefficient of variation for the mean period indicated that the varieties and populations showed their quality traits on climatic conditions during the years of study as a result of their origin. The average crude ash content for all accessions was 7.57%, crude fat – 3.20%, calcium – 1.80% and phosphorus – 0.18%. The values of the calcium were characterized by similar maximum and minimum values – 0.96 and 2.54%. The Not extract matter, crude protein, crude fibber and crude ash are with lowest variation and comparatively CV– 12.61; 13.09; 17.0 и 18.09%. The content of phosphorus shows the biggest values of CV%.

Table 2.

Statistical quantities of biochemical indicators of species and populations birdsfoot trefoil

Varieties and populations	min	max	x	SD	CV
Crude protein	14.58	26.5	16.98	2.22	13.09
Crude fibre	18.05	37.97	28.75	5.20	18.09
Crude ash	5.44	9.70	7.57	1.29	17.00
Crude fat	2.30	6.13	3.20	0.84	26.22
Calcium	0.96	2.54	1.80	0.50	27.94
Phosphorus	0.035	0.429	0.18	0.13	70.07
Non extract matter	25.44	45.09	36.43	4.60	12.61

The performed correlation analysis (Table 3) showed that the content of crude fiber is in strong relation to the height of stems ($r = 0.6229$) and dry mass yield ($r = 0.5271$). The quality of birdsfoot trefoil forage to large extent is dependent on the plant leafiness as a quantity from the total biomass. Moderate strength of the degree of correlation was found between the content of phosphorus

and percentage of leaves ($r = 0.5271$). The established correlation coefficients between the content of crude fat and dry mass yield showed slight relation between the content crude fiber and % stems ($r = 0.3240$). The yield of dry mass is positively correlated with the content of crude fiber ($r = 0.5271$) and crude fat ($r = 0.3754$).

Table 3.

Correlations between biochemical parameters and dry mass yield, height and percentage of stems and leaves in varieties and populations birdsfoot trefoil

Biochemical indicators	Dry mass yield t.ha ⁻¹	Height, cm	Stems,%	Leaves,%
Crude protein	-0.2046	0.4238	0.1560	-0.1997
Crude fibre	0.5271	0.6229	0.3240	0.3883
Crude ash	-0.6404	-0.4499	-0.0799	0.1399
Crude fat	0.3754	-0.0208	-0.0124	-0.0396
Calcium	-0.2656	0.3590	0.2816	-0.3154
Phosphorus	-0.5309	-0.7338	-0.4486	0.5116
Non extract matter	-0.2818	-0.6976	-0.3664	0.4465

The found is weak strength of correlation between the content of crude protein and height stems ($r = 0.4238$).

The correlation analysis of the results showed strong negative relation between phosphorus content and height of stems ($r = -0.7338$) and between content of crude ash dry mass yield ($r = -0.6404$).

Conclusions

The studied accessions birdsfoot trefoil differed in chemical composition. The variety Viking was characterized with highest content of crude protein and lowest values of crude fiber.

The was positive correlation between the height of stems ($r = 0.6229$) and dry mass yield ($r = 0.5271$) and weak strength of correlation between the content of crude protein and the height stems ($r = 0.4238$).

The registered quality traits a forage of birdsfoot trefoil formed under conditions of set on light grey pseudo podzolic are interest in the breeding.

References

1. Ilieva A., A. Kyuchukova, 2009. Content of crude protein and condensed tannins in varieties of birdsfoot trefoil (*Lotus corniculatus* L.). *Journal of Mountain Agriculture on the Balkans*, vol. 12, 1, 121-130.
2. Kyuchukova, A., 2008. Forage yield and



some of its elements in birdsfoot trefoil (*Lotus corniculatus* L.) accessions. *Journal of Mountain Agriculture on the Balkans*, vol. 11, 2, 286–295.

3. Kyuchukova A., **2009**. Productive capacities and morphological characteristics of varieties and populations of birdsfoot trefoil (*Lotus corniculatus* L.). *Journal of Mountain Agriculture on the Balkans*, vol. 12, 5, **1045–1056**.

4. Marley C. L, R. Fychan and R. Jones, **2006**. Yield, persistency and chemical composition of *Lotus* species and varieties (birdsfoot trefoil and greater birdsfoot trefoil) when harvested for silage in the UK. *Grass and Forage Science*, 1, 134–145

5. Pelikan J., **2002**. Yield evaluation of varieties from the world collection of birdsfoot trefoil (*Lotus corniculatus*). *Rostlinna vyrova*, 48, 6: 265–270.

6. Radovic, J., B. Dinic, V. Pudio, 2003. Productivity and Quality of some Birdsfoot Trefoil (*Lotus corniculatus*) varieties. *European Grassland Federation*, Pleven, 26–28 may, 118–121

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