

# MORPHOLOGICAL COMPOSITION AND RATE OF GROWTH OF THE SWARD FROM BIRDSFOOT TREFOIL (*Lotus corniculatus* L.) TREATED WITH ORGANIC FERTILIZER ALFALFA BLEND

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**Abstract:** The study was conducted during the 2007-2009 period in the experimental field of IMSA-Troyan. The aim was to determine the influence of the organic product alfalfa blend on the rate of growth of the sward from the birdsfoot trefoil. The organic preparation alfalfa blend was tested on a candidate variety of birdsfoot trefoil with the following factors and fertilizing rates: Factor A – dates of harvesting:  $a_1$  – budding stage,  $a_2$  – early flowering stage, Factor B – rates of fertilizing with leaf fertilizers:  $B_0$  – no fertilizing,  $B_1$  – leaf fertilizing at the dose of 1 l/ha,  $B_2$  – leaf fertilizing at the dose of 2 l/ha,  $B_3$  – leaf fertilizing at the dose of 3 l/ha. The birdsfoot trefoil treatment with an organic fertilizer as a cultivar factor exerted an effect on the height and morphological composition of the sward. As in the three years of study and on average over a significant influence on plant height was the stage of harvest than the dose of organic fertilizer. In flowering stage and during the three experimental years and three doses of the plants are higher than those harvested in the phase budding treated with the same doses.

The strong positive correlation established between the height and the leaves ( $r = 0.5734$ ) and low positive correlation between the leaves and the generative organs ( $r = 0.3370$ ); between dry mass yield and the height ( $r = 0.2740$ ) and the stems.

**Key words:** birdsfoot trefoil, alfalfa blend, organic fertilizer; morphological composition, rate of growth

## Introduction

Birdsfoot trefoil is fodder legumes, which occupies an important place in the structure of agricultural production (Chourkova, 2010). In recent years, paying special attention to fertilization of crops with organic fertilizers (Cahill et al. 2010;

*Lingorski, 2000; Lingorski, 2001*), As the main agronomic factors to guide growth, productivity (*Lingorski and Chourkova, 2010*) and quality of forage plants. An increasing interest is the search for alternative methods to increase access to plant nutrients, affecting the implementation of new forms, doses and routes of entry (*Tian et al., 2010*). The leaf fertilization recently played an important role in stimulating the biological potential of plants (*Kizewski et al., 2010; Pachev et al., 2011*). The favorable combinations of micro and macronutrients determine the balanced diet (*Lingorski, 2008*).

The aim of the study was to determine the influence of the organic product Alfalfa Blend on the rate of growth of the sward from the birdsfoot trefoil.

## Materials and Methods

The study was conducted during the 2007-2009 period in the experimental field of IMSA-Troyan. The trial was laid out by the block method with 4 replications and a size of harvest plot of 5 m<sup>2</sup> on light grey pseudopodzolic soil. The organic preparation Alfalfa Blend was tested on a candidate variety of birdsfoot trefoil with the following factors and fertilizing rates: Factor A – dates of harvesting: a<sub>1</sub> – budding stage, a<sub>2</sub> – early flowering stage, Factor B – rates of fertilizing with leaf fertilizers: B<sub>0</sub> – no fertilizing, B<sub>1</sub> – leaf fertilizing at the dose of 1 l/ha, B<sub>2</sub> – leaf fertilizing at the dose of 2 l/ha, B<sub>3</sub> – leaf fertilizing at the dose of 3 l/ha. Alfalfa Blend is combinations of the total nitrogen 5%, available phosphate acid 8.0%, soluble potash 8.0%, boron 0.1%, copper 0.1%, iron 0.5%, molybdenum 0.02%.

Soil treatment included deep ploughing, disking and rotary cultivation according to the technology adopted in IMSA, Troyan for establishment of artificial swards. We conducted the birdsfoot trefoil sowing at the sowing rate of 0.12 t ha<sup>-1</sup>, by hand, broadcast, with rolling before and after sowing. We applied the leaf fertilizer in early spring at the beginning of vegetation with a working solution of 3-4 l ha<sup>-1</sup>.

The following characteristics were recorded: plant height (cm) per years and mean for the period, and morphological composition of sward (%) by years. Mathematical processing of data was performed by the methods of *Shanin, 1977*. The degree of variation of parameters was determined though variation coefficient according to the scheme of *Mamaev (Lidanski, 1988)*: up to 7% - very low, 7.1 to 12% low, 12.1 to 20% moderate; 20.1 - 40% high: over 40% - very high. Correlations of Brave and Pirson (*Lidanski, 1988*) were calculated to prove the relations between the different characteristics and their influence on productivity as well as between them. The data was processed by Microsoft Excel.

## Results and Discussion

Table 1 present date on plant height at the moment of harvesting of sward in the three years of study the rate of growth and development at different stages of harvest and doses of treatment is different. In the first year was the greatest height.

The birdsfoot trefoil harvested in flowering stage and untreated leaf manure, respectively 47.7 cm, with an average value 40.1 cm. In the second year the growth rate of the birdsfoot trefoil was considerably larger than that in the first year (from 30.6 to 47.7 cm), with peak height values were recorded at harvesting stage birdsfoot trefoil in buttoning and leaf fertilization with manure at 1 l ha<sup>-1</sup>. In 2009, the height values in untreated variants in both phases of harvesting are relatively similar (36.0 and 37.0 cm). As in the three years of study and on average over a significant influence on plant height was the stage of harvest than the dose of organic fertilizer. So in flowering stage and during the three experimental years and three doses of the plants are higher than those harvested in the phase budding treated with the same doses. This is explained by different duration of forming undergrowth in two phases and influence of different weather conditions during the years of experimental period. According to the values of the variation coefficient on the attribute level in the first and second year degree of variability is the mean (CV - 17.4% and 13.0%) in the third year and the mean for the period - low (CV - 8.4 and 10.1%). The results show that application of organic fertilizer stimulates nitrogen fixation and a positive growth and development of plants. This is due to the presence of molybdenum in the preparation, with the result that nitrates are converted into amino acids and protein.

**Table 1. Plant height (cm) at the moment of harvesting of sward per years and for the period**

Variants	2007	2008	2009	Mean for the period
a <sub>1</sub> + B <sub>0</sub>	30.6	36.8	36.0	34.5
a <sub>1</sub> + B <sub>1</sub>	36.0	57.7	36.7	43.5
a <sub>1</sub> + B <sub>2</sub>	35=1	52.5	38.1	41.9
a <sub>1</sub> + B <sub>3</sub>	33.1	45.9	43.9	41.0
a <sub>2</sub> + B <sub>0</sub>	47.7	50.7	37.0	45.0
a <sub>2</sub> + B <sub>1</sub>	45.0	54.4	42.5	47.3
a <sub>2</sub> + B <sub>2</sub>	47.1	49.7	40.5	45.8
a <sub>2</sub> + B <sub>3</sub>	45.6	54.7	44.2	48.2
X	40.1	50.3	39.9	43.4
Min	30.6	36.8	36.0	34.5
Max	47.7	57.7	44.2	48.2
SD	6.4	6.5	3.4	4.4
CV	17.4	13.0	8.4	10.1

The data on Table 2 showed that the use alfalfa blend preparation at different doses of administration influences the morphological composition of the sward. In the first year of test period with the highest percentage participation of the leaves showed variations in sward composition treated with 200 ml t ha<sup>-1</sup> and harvest flowering stage (61.7%). Birdsfoot trefoil harvested at flowering stage in variants 5,6,7 and 8 showed a higher presence of leaves in the harvested sward composition of the variants in stage budding. A significant difference in the percentage contribution of leaves in the application of organic fertilizer in various doses in harvesting the star stage budding. The dose of application of organic fertilizer for flowering harvesting stage is less pronounced effect among options. In terms of the stems was recorded average value  $\bar{x} = 37.95\%$  and minimum value - 31.3% in harvesting the birdsfoot trefoil in the flowering stage, without fertilization, a maximum in nontreated option harvested in sward composition and stage budding treated organic fertilizer at a dose of 3 l/ha (48.9%). Generative organs ranged from 2.5 to 9.4 %. The degree of variability in terms of leaves is low, the stems - medium, and the generative organs - very high.

**Table 2. Morphological composition in the sward (%) per years**

Variants	Leaves			Stems			Generative organs		
	2007	2008	2009	2007	2008	2009	2007	2008	2009
a <sub>1</sub> + B <sub>0</sub>	48.5	48.2	47.1	48.9	49.7	52.1	2.6	2.1	0.8
a <sub>1</sub> + B <sub>1</sub>	51.3	52.4	48.6	44.8	45.1	48.6	3.9	2.5	2.8
a <sub>1</sub> + B <sub>2</sub>	49.7	58.6	57.1	40.9	38.6	42.4	9.4	2.8	0.5
a <sub>1</sub> + B <sub>3</sub>	43.6	60.8	60.0	48.9	35.3	39.9	7.5	3.9	0.1
a <sub>2</sub> + B <sub>0</sub>	61.5	62.1	50.0	31.3	32.0	49.1	7.2	5.9	0.9
a <sub>2</sub> + B <sub>1</sub>	60.2	65.5	53.3	33.7	29.7	46.0	6.1	4.8	0.7
a <sub>2</sub> + B <sub>2</sub>	61.7	68.4	53.3	32.3	27.4	46.4	6.0	4.2	0.3
a <sub>2</sub> + B <sub>3</sub>	59.6	63.3	57.1	37.0	26.6	42.7	3.4	4.1	0.2
$\bar{X}$	56.3	60.7	49.6	37.9	35.5	46.9	5.7	3.8	0.8
MIN	48.5	48.2	20.0	31.3	26.6	40.1	2.5	2.1	0.1
MAX	61.7	69.3	60.0	48.9	49.7	52.8	9.4	5.9	2.8
SD	5.6	7.4	12.7	6.3	8.5	4.0	2.3	1.3	0.9
CV	9.1	12.3	25.6	16.7	23.6	8.6	40.9	33.5	109.5

In the second year cumulative foliage was greater than that in the first year. In stage variants harvested budding the percentage contribution of leaves increases with increasing dose of treatment. Thus, in non treated variants 1 it is 48.2 %, and in that treated at a dose of 3 l ha<sup>-1</sup>- 60.8%. The same trend was observed in variants harvested in flowering stage. The proportion of leaves in swards composition increased from 62.1 to 69.3 %, the increase is proportional to the increase in the dose of treatment. Reported averages values were 60.7% for leaves, for stems - 35.5% and generative organs - 3.8%. The degree of variability

(CV) for the indicator leaves was - mean (CV = 12.3%), stems and generative organs - high (CV = 23.63% and 33.5%).

During the third year of test period, the nontreated control is characterized by the lowest part of the leaves (47.1%) in sward composition. The substantial differences was established in regard to the doses of treatment with birdsfoot trefoil leafiness in the treatment at a dose  $1 \text{ l ha}^{-1}$ , it is reported difference of 6.2 points in favor of harvested flowering stage. The plants from treated with Alfalfa Blend variants have lower participation in sward composition stems from non treated, it has tended to reduce the shareholding of the stems with increasing dose of treatment. The variants treated at a dose of  $3 \text{ l ha}^{-1}$  (var.4) were stems 39.1% at 52.1% in non treated variant (var.1) harvested in the flowering stage and 42.7% in the variants treated with the same dose, but harvested in the flowering stage against 49.1% in the non treated variant (var.5). The generative organs in sward in all variants were significantly lower than the previous two years. The dates showed that in regard to the generative organs the does not affect either factor dose of leaf manure or harvesting stage of the sward. According to the variation coefficient of the degree of variability in terms of leaves was high (CV = 25.6%), the stems very low - (CV = 8.6%), and the generative organs, very high (CV = 109.5%).

There was strong negative correlation (Table 3) between the stems and leaves in the sward ( $r = -0.89615$ ); between the stems and the generative organs ( $r = -0.64137$ ); dry mass yield and the generative organs ( $r = -0.6882$ ) and the height and the generative organs ( $r = -0.5421$ ). The strong positive correlation established between the height and the leaves and low positive correlation between the leaves and the generative organs ( $r = 0.3370$ ); between dry mass yield and the height ( $r = 0.2740$ ) and the stems.

**Table 3. Correlation coefficients between the studied characteristics**

Indicators	Height (cm)	Stems (%)	Leaves (%)	Generative organs (%)
Dry mass (t/ha)	0.2740	0.2333	0.0194	- 0.6882
Height (cm)		- 0.5421	0.5734	0.0964
Stems (%)			- 0.8961	- 0.6413
Leaves (%)				0.3370

## Conclusion

The birdsfoot trefoil treatment with an organic fertilizer as a cultivar factor exerted an effect on the height and morphological composition of the sward. As in the three years of study and on average over a significant influence on plant height was the stage of harvest than the dose of organic fertilizer. In flowering

stage and during the three experimental years and three doses of the plants are higher than those harvested in the phase budding treated with the same doses.

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## **Morfološke karakteristike i nivo porasta travnjaka sa žutim zvezdanom (*Lotus corniculatus* L.) tretiranog organskim lucerkinim đubrivom**

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### **Rezime**

Ispitivanja su izvedena u toku 2007-2009. godine na eksperimentalnom polju IMSA u Trojanu. Cilj istraživanja bio je da se odredi uticaj organskog đubriva, lucerkinog miksa, na travnjak sa žutim zvezdanom. Ispitivani su sledeći faktori: Faktor A – rok kosidbe: a1 – faza pupoljerna, a2 – faza početka cvetanja, Faktor B- nivo lucerkinog đubriva (miks): b0- bez đubrenja, b1- lucerkino đubrivo (miks) u količini od 1 l ha<sup>-1</sup>, b2- lucerkino đubrivo (miks) u količini od 2 l ha<sup>-1</sup>, b3- lucerkino đubrivo (miks) u količini od 3 l ha<sup>-1</sup>. Đubrenje travnjaka sa žutim zvezdanom sa lucerkinim miksom, imalo je uticaja na morfološke karakteristike i porast. Kako po godinama istraživanja tako i po prosečnim vrednostima, značajniji uticaj na visinu biljaka imala je faza kosidbe u odnosu na količinu organskog đubriva. U fazi cvetanja u toku tri eksperimentalne godine i tri doze đubrenja biljke su bile više nego one koje su se kosile u fazi pupoljenja.

Visoka pozitivna korelacija ostvarena je između visine i listova ( $r = 0.5734$ ), niska pozitivna korelacija između listova i generativnih organa ( $r = 0.3370$ ) i između prinosa suve materije i visine ( $r = 0.2740$ ).

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