

# Impact of Applying Organic and Mineral Fertilisers on Dry Matter in Bird's-foot-trefoil (*Lotus corniculatus* L.)

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## Abstract

Applying nitrogen fertilisers in legume species has been subjected to scientific research due to the efficacy of these fertilisers on yield (symbiotic atmospheric nitrogen fixation). In general, applying high rates of nitrogen fertilisers on legume species does not correlate directly with green matter production because these species take the necessary nitrogen from the atmosphere. This feature is specific also to bird's-foot-trefoil, which fixes important amounts of atmospheric nitrogen during vegetation. This paper presents the impact of the interaction between organic and mineral fertilisers on bird's-foot-trefoil within a bifactorial experiment. Differences in yield at both unilateral effect of the factors and at that of the interaction of the factors are statistically ensured.

**Keywords:** common bird's-foot-trefoil (*Lotus corniculatus* L.), organic and mineral fertilisers, dry matter.

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## 1. Introduction

Applying fertilisers is a technological factor important in increasing pasture fodder crop yields, including bird's-foot-trefoil. Using organic or mineral fertilisers on perennial legume crops depends on the soil agro-chemical features and on the nitrogen-fixing capacity of the species.

In general, the response of legumes to fertiliser application is lower than that of perennial gramineae [1-11].

The paper presents the effect of the interaction between organic and mineral fertilisers on yield in bird's-foot-trefoil (*Lotus corniculatus* L.).

## 2. Materials and methods

Research was carried out between 2013 and 2014 on the experimental field of the Centre for Research in Grasslands and Fodder Crops of the Banat's University of Agricultural Science and

Veterinary Medicine "King Michael I of Romania" from Timisoara, Romania.

To do so, we used an experimental setting relying on a bifactorial experiment (3x5) made up of the following two factors: A. organic fertilisers (**a1** = no fertilisation, **a2** = 20 t/ha animal manure, **a3** = 40 t/ha animal manure); B. mineral fertilisers (**b1** = no fertilisation, **b2** = ammonia nitrate N100, **b3** = potassium nitrate N100, **b4** = complexes (13:10:15) N100, **b5** = superphosphate P100).

The 15 experimental variants were set with three replicates after the sub-divided plot method. Fertilisation with animal manure was done in the fall of 2013 (November) by incorporation in the soil with the basic tillage.

Fertilisation with mineral fertilisers was done in each vegetation year, at the beginning of spring and of vegetation in bird's-foot-trefoil.

The biological material used in sowing was the native bird's-foot-trefoil cultivar Danitim (*Lotus corniculatus* L.). Before sowing, we checked the seed germinating capacity and then established the seeding rate (20 kg/ha).

After sowing, in the second half of March, we rolled the soil with a ring roller.

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During the experiment, we made observations, measurements and analyses regarding the growth of the root system and of the aerial vegetative system.

We measured the weight of whole plants, of the aerial vegetative system and of the root system with KERN ABS digital scales.

We also took digital photos with a SONY – Cyber-shot type camera, 7.2 mega pixels, and we archived the photos for each plant.

The data thus obtained were statistically processed through variance analysis/F test, STUDENT test, DUNCAN test, and linear/square/multiple linear/square correlations.

### 3. Results and discussion

Variance analysis of the annual mean yields of dry matter shows a significant action of the factors studied and of the influence of their interaction.

On the average for the two production years, there was a statistically ensured increase in yield of 41.50% (i.e. 3.25 t/ha) after fertilising with animal manure compared to the variant not fertilised when we applied 40 t/ha animal manure (Table 1).

**Table 1.** Influence of organic fertilisers on dry matter yield in *Lotus corniculatus* L.

Organic fertilisers	Dry matter yield (t/ha) (%)		Difference (t/ha)	Signif.
a1 – no fertilisation (CONTROL)	7.83	100	control	
a2 – 20 t/ha animal manure	9.17	117.1	1.34	
a3 – 40 t/ha animal manure	11.08	141.5	3.25	**

DL 5% = 1.67 t/ha; DL 1% = 2.34 t/ha; DL 0.1% = 3.30 t/ha

Unilateral fertilisation with mineral fertilisers influences in different ways the production of dry matter in bird's-foot-trefoil depending on the type of fertiliser used (Table 2). Thus, both ammonia nitrate and potassium nitrate had a negative effect on yield – higher in the case of the ammonia nitrate where the difference to the control was

distinctly significant. Applying complex fertilisers had a positive influence on dry matter yield, but the increase was not significant. Among experimental variants, we noted the variant treated with superphosphate that yielded the most (10.29 t/ha), with a significant increase in yield (10.9%).

**Table 2.** Influence of mineral fertilisers on dry matter yield in *Lotus corniculatus* L.

Mineral fertilisers	Dry matter yield (t/ha) (%)		Difference (t/ha)	Signif.
b1 – no fertilisation (CONTROL)	9.28	100	control	
b2 – ammonia nitrate	8.15	87.8	-1.13	00
b3 – potassium nitrate (14:0:46)	9.21	99.2	-0.07	
b4– N:P:K complex (13:10:15)	9.88	106.5	0.6	
b5– superphosphate	10.29	110.9	1.01	*

DL 5% = 0.81 t/ha; DL 1% = 1.08 t/ha; DL 0.1% = 1.40 t/ha

The bird's-foot-trefoil crop responded positively to the combined application of organic and mineral fertilisers that yielded

statistically ensured dry matter yields (Table 3).

**Table 3.** Combined influence of organic and mineral fertilisers on dry matter yield in *Lotus corniculatus* L.

Organic fertilisers	Mineral fertilisers	Dry matter yield		Difference t/ha	Significance
		t/ha	%		
a1 – no fertilisation (CONTROL)	b1 – no fertilisation (CONTROL)	9.11	100	control	000
	b2 – ammonia nitrate	5.47	60.0	-3.64	
	b3 – potassium nitrate (14:0:46)	8.23	90.3	-0.88	
	b4– N:P:K complex (13:10:15)	7.42	81.4	-1.69	
	b5– superphosphate	8.92	97.9	-0.19	
a2 – 20 t/ha animal manure	b1 – no fertilisation (CONTROL)	8.25	100	control	*
	b2 – ammonia nitrate	8.47	102.6	0.21	
	b3 – potassium nitrate (14:0:46)	9.70	117.5	1.45	
	b4– N:P:K complex (13:10:15)			2.03	
	b5– superphosphate	10.28	124.6	0.91	
a3 – 40 t/ha animal manure	b1 – no fertilisation (CONTROL)	10.47	100	control	**
	b2 – ammonia nitrate	10.50	100.3	0.03	
	b3 – potassium nitrate (14:0:46)	9.70	92.6	-0.77	
	b4– N:P:K complex (13:10:15)	11.99	114.5	1.52	
	b5– superphosphate	12.77	122.0	2.30	

DL 5% = 1.41 t/ha; DL 1% = 1.87 t/ha; DL 0.1% = 2.43 t/ha

In the variants fertilised with 20 t/ha animal manure, there were higher increases in yield when applying potassium nitrate (1.45 t/ha, i.e. 17.5%) and complex fertilisers (2.03 t/ha, i.e. 24.6%). Doubling the rate of animal manure (40 t/ha) increased the yield in the variants treated with complex fertilisers (an increase in yield of 1.52 t/ha, i.e. 14.5%) and with superphosphate (an increase in yield of 2.30 t/ha, i.e. 22%).

#### 4. Conclusions

To increase the yield of dry matter in bird's-foot-trefoil (*Lotus corniculatus* L.) through fertilisation we recommend:

Organic fertilisers (a rate of 40 t/ha) to increase the dry matter yield with over 40%;  
Combined fertilisers (animal manure + mineral fertiliser) to increase dry matter yield with 14-25%.

#### 5. References

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