RESEARCHES REGARDING THE PRODUCTION CAPACITY AND QUALITY OF ALFALFA IN CRISURILOR PLAIN CONDITION

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ABSTRACT
Nitrogen supply through mineral fertilization affects nitrogen biological fixation process in legume plants, even though plants can directly absorb the mineral N. For species such as alfalfa, in addition to the inhibitory effect, mineral fertilization decreases the useful life of the crop and the quality of protein in the dry matter According to some authors there is a positive response in biomass production for N application only in excess of 100 kg ha^{-1} year.
The aim of this paper is to find conditions resulting in higher production of alfalfa under different variants of fertilisation in Batar conditions, Bihor county and the chemical analysis of this forage. The research was carried out in the experimental fields that belong to the society SC Frevest SRL from Batăr locality, Bihor county, the experiment being placed on a chernozem argiloiluvial soil. The experimental setup was randomized block design, in three repetitions, the plot surface being 45 m^2. Sowing was made on October 5th 2010. In order to determine the production, the harvesting was done at 61st phenophase (beginning of flowering: 10% of flowers open) of alfalfa (the extended BBCH-scale, general).
Considering the analyses regarding alfalfa production capacity the biggest production of green mass was obtained at $N_{50}P_{50}K_{50}$+ N_{100} fertilization variant of 47.00 t ha^{-1}. The differences are statistically assured as very significant and have been registered between alfalfa production obtained at variant $N_{50}P_{50}K_{50}$ (25.7 t ha^{-1}) and variant $N_{50}P_{50}K_{50}$ + N_{50} (42.3 t ha^{-1}); variant $N_{50}P_{50}K_{50}$ (25.7 t ha^{-1}) and variant $N_{50}P_{50}K_{50}$ + N_{100} (47.0 t ha^{-1}): variant $N_{50}P_{50}K_{50}$ + N_{50} (42.3 t ha^{-1}) and variant $N_{50}P_{50}K_{50}$ + N_{100} (47.0 t ha^{-1}).
Regarding the chemical composition of the yield of $N_{50}P_{50}K_{50}$+ N_{100} fertilization variant we can conclude: crude protein content is 178.7 g/kg, crude fiber content is 302.4 g/kg, NDF is 520.8 g/kg, ADF is 307.6 g/kg and ADL is 91.9 content on dry matter basis (kg DM).

Keywords: alfalfa, production, fertilisation, optimisation, chemical composition

INTRODUCTION

Nitrogen supply through mineral fertilization affects the process of biological nitrogen fixation in legume plants, even though plants can directly absorb the mineral N. For species such as alfalfa, in addition to the inhibitory effect, mineral fertilization decreases the useful life of the crop and the quality of protein in the dry matter (CIHACEK, 1994).
According to FONTES et al. (1992) and RAUN et al. (1999), there is a positive response in biomass production for N application only in excess of 100 kg ha^{-1} year. At these rates, the nitrogen added to the soil is preferentially absorbed and can negatively affect root nodule formation (BEKBULATOV et al., 1998), nodule size and weight (ZHU et al., 1998) and, as a consequence, the symbiotic process efficiency.
The fertilisation with a large quantity of nitrogen can guarantee a bigger alfalfa production. Such a fertilisation, besides the fact that reaches increased costs, can negatively influence the environment (STOUT et al., 2000).

MATERIAL AND METHOD

The aim of this paper is to find conditions resulting in higher production of alfalfa under different variants of fertilisation in Batăr conditions, Bihor county and the chemical analysis of this forage.
In this experiment three different fertilisation variants were applied:

- $N_{50}P_{50}K_{50}$
- $N_{50}P_{50}K_{50} + N_{50}$
- $N_{50}P_{50}K_{50} + N_{100}$

The research was carried out in the experimental fields that belong to the society SC Frevest SRL from Batăr locality, Bihor county, the experiment being placed on a chernozem argiloiluvial soil.
The experimental setup was randomized block design, in three repetitions, the plot surface being 45 m^2. Sowing was made on October 5th 2010.
In order to determine the production, the harvesting was done at 61st phenophase (beginning of flowering: 10% of flowers open) of alfalfa (the extended BBCH-scale, general; MEIER, 2001).
The chemical analyses have been realized at alfalfa hay obtained at $N_{50}P_{50}K_{50} + N_{100}$ fertilisation variant. Here we realized a set of chemical analyses such as: dry matter percentage, crude protein content, crude fiber content, acid detergent fiber (NDF), neutral detergent fiber (NDF), acid detergent lignin (ADL).
In this paper we take into consideration the results obtained in the experimental year 2012, that allow us to have a few conclusions on the capacity of alfalfa production under different types of fertilization in Crişurilor Plain conditions.
The statistical analysis has been performed by Statistica 8 package.

RESULTS

In *Figure 1* we present the total green mass production obtained in 2012 in alfalfa culture, at the three studied fertilisation varieties. The total green mass production obtained was between 25.7 t ha^{-1} at $N_{50}P_{50}K_{50}$ fertilisation variant and 47.0 t ha^{-1} at $N_{50}P_{50}K_{50} + N_{100}$ variant. The total green mass production obtained at $N_{50}P_{50}K_{50} + N_{50}$ fertilisation variant, was of 42.3 t ha^{-1} in this year.

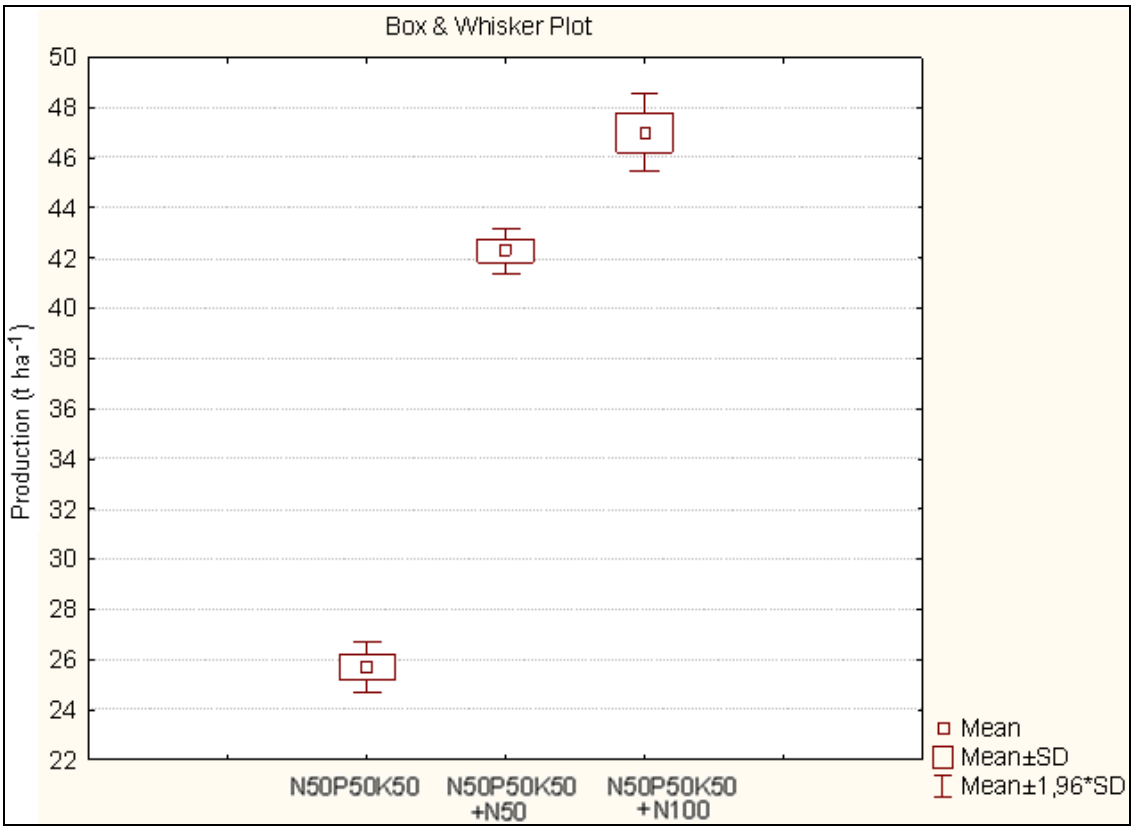

Figure 1. Box & Whisker diagram for the total production of alfalfa obtained in 2012 in different fertilisation variants

To compare the production capacity of alfalfa culture in different fertilisation variants, in the conditions of the year 2012, we have used Duncan test, for multiple comparisons (ANOVA).

In *Table 1* we can observe that there are statistically assured, very significant differences between alfalfa production obtained at $N_{50}P_{50}K_{50}$ fertilisation variant of 25.7 t ha^{-1} and that obtained at $N_{50}P_{50}K_{50} + N_{50}$ fertilisation variant resulting in a production of 42.3 t ha^{-1}.

Table 1. Duncan test for multiple comparisons between the fertilisation variants for the total production obtained in alfalfa in 2012

Variant	Variant $N_{50}P_{50}K_{50}$ 25,70 t.ha^{-1}	Variant $N_{50}P_{50}K_{50} + N_{50}$ 42,30 t.ha^{-1}	Variant $N_{50}P_{50}K_{50}+ N_{100}$ 47,00 t.ha^{-1}
$N_{50}P_{50}K_{50}$		0,000235	0,000113
$N_{50}P_{50}K_{50} + N_{50}$			0,000299
$N_{50}P_{50}K_{50} + N_{100}$			

The differences statistically assured as being very significant have been registered also between alfalfa production obtained at $N_{50}P_{50}K_{50}$ fertilisation variant of 25.7 t ha^{-1} and at $N_{50}P_{50}K_{50} + N_{100}$ fertilisation variant at which was obtained a production of 47.0 t ha^{-1}.

Also, statistically assured differences being very significant have been registered between alfalfa production obtained at $N_{50}P_{50}K_{50} + N_{50}$ fertilisation variant of 42.3 t ha^{-1} and $N_{50}P_{50}K_{50} + N_{100}$ fertilisation variant resulting in a production of 47.0 t ha^{-1}.

We have used regression equation $y=b_0+b_1x+b_2x^2$ to describe the dependency of alfalfa total production obtained in 2012 on the fertilization with nitrogen applied in spring.

Thus, in previously presented conditions, the alfalfa average production can be expressed in terms of nitrogen quantity applied in spring, by the equation:

$$y = 25.7 + 0{,}451*x - 0.0024*x^2$$

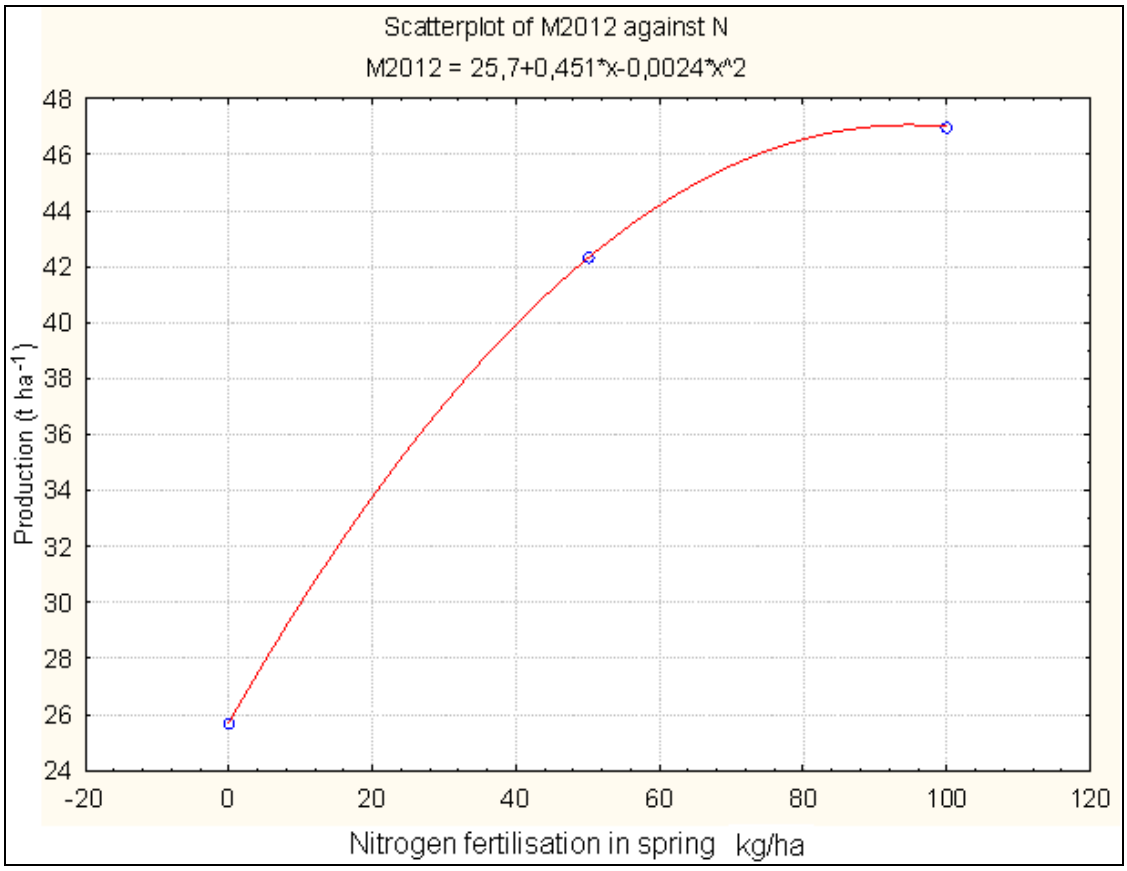

Figure 2. The influence of different fertilisation variants on the total production of green mass obtained in year 2012

The maximum production of 46.88 t ha^{-1} is estimated to be obtained at fertilisation with 93.95 kg/ha nitrogen.

This maximum (see *Figure 2*) was obtained as the local extremum of the quadratic function above and it was calculated by the vanishing of its first derivative.

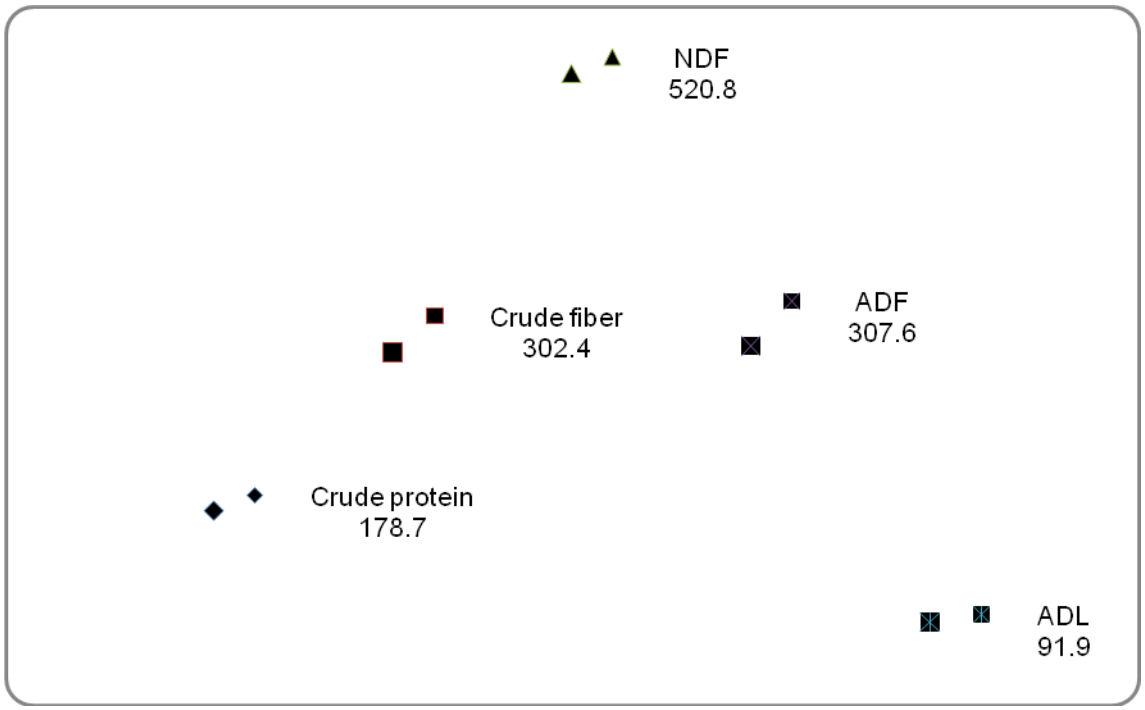

Figure 3. Chemical composition at alfalfa

Considering that the highest yield had been obtained at $N_{50}P_{50}K_{50}$ + N_{100} variant, here we realized a set of chemical analyses such as: dry matter percentage, crude protein content, crude fiber content, acid detergent fiber (ADF), neutral detergent fiber (NDF), acid detergent lignin (ADL).

From *figure 3* we can observe that: crude protein content is 178.7 g/kg, crude fiber content is 302.4 g/kg, NDF is 520.8 g/kg, ADF is 307.6 g/kg and ADL is 91.9 content on dry matter basis (kg DM).

CONCLUSIONS

Taking into consideration the analyses regarding the alfalfa production capacity, we can observe that the biggest production of green mass was obtained at variant $N_{50}P_{50}K_{50}$+ N_{100} of 47,00 t ha^{-1}.

Differences statistically assured as being very significant have been registered between alfalfa production obtained at $N_{50}P_{50}K_{50}$ variant (25,7 $t.he^{-1}$) and $N_{50}P_{50}K_{50}$ + N_{50} variant (42.3 t ha^{-1}); $N_{50}P_{50}K_{50}$ variant (25.7 t ha^{-1}) and $N_{50}P_{50}K_{50}$ + N_{100} variant (47.0 t ha^{-1}); $N_{50}P_{50}K_{50}$ + N_{50} variant (42.3 t ha^{-1}) and $N_{50}P_{50}K_{50}$ + N_{100} variant (47.0 t ha^{-1}).

Regarding the chemical composition we can conclude that: crude protein content is 178.7 g/kg, crude fiber content is 302.4 g/kg, NDF is 520.8 g/kg, ADF is 307.6 g/kg and ADL is 91.9 content on dry matter basis (kg DM).

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