INFLUENCE OF FERTILIZATION ON NITROGEN DYNAMICS AT THE SPECIES *Onobrychis viciifolia* Scop.

Gabriela SURMEI-BALAN[1] , Vasile VÎNTU [1]*, Costel SAMUIL[1], Mihai STAVARACHE[1]

email: mihaistavarache@uaiasi.ro

Abstract

Biological nitrogen fixation is one of the most important biochemical reaction for life on earth. This paper presents the influence of the simple mixtures of perennial grasses and legumes and of the fertilization on dry matter production, quantity of nitrogen biological fixed. In this respect, we have experienced three mixtures consisting of *Onobrychis viciifolia* with *Bromus inermis* in different proportions, which were applied to three types of mineral, organic and vinassa fertilizer. The results obtained showed that under experimental conditions, total dry matter yields ranged from 6.43-9.99 t ha^{-1}, the highest production was obtained from version A_3b_2, plant total nitrogen content (Nt) ranged from 3.09 - 3.47%, total nitrogen the specific consumption (CSTN) of culture *Onobrychis viciifolia* (Scop.) ranged from 43.65 to 47.31 kg t^{-1} DM, intake of specific nitrogen-fixing microorganisms (ASNF) ranged between 55.99 – 76.00 kg ha^{-1} and nitrogen remaining in the soil (NRS) ranged from 10.75 to 15.74 kg ha^{-1}.

Key words: grasses, legumes, fertilization, nitrogen symbiotic

Concerns for increased agricultural production, while switching to organic farming and reduction of fertilizer produced by industry, is one of the major problems of contemporary agriculture.

Temporary meadows are the most effective sources of fodder for livestock farms. Fertilization is one of the main measures to increase production on these pastures, so that by cultivating legumes in mixtures decreases the amount of fertilizers used on lawns to achieve high yields. Organic fertilization and rational use of fertilizers can produce substantial increases of the production and biodiversity and fodder quality improvement (Vintu et al. 2008).

Research aimed at studying and intensification of the fixation of atmospheric nitrogen by bacteria living in symbiosis with leguminous plants are of great importance (Hardarson et al. 1993).

The estimation of nitrogen fixed to permanent and temporary grasslands differs from one country to another, from one pasture to another and depending on the floristic composition of the pasture (Carlson et al. 2003, Danell Huss et al. 2007, Hansen et. al. 2002).

Biological N_2 fixation is regarded as a renewable resource for sustainable agriculture as it helps to reduce fertilizer N requirements and thus increases economic returns to producers (Hardarson et al. 2003; Jensen et al. 2003; Russelle et al. 2004; Walley et al. 2007). The substitution of forage legumes for inorganic-N fertilizer will save non-renewable resources required to manufacture and distribute fertilizer, provide deep-rooting systems and permanency of cover to improve soil structure, and hence reduce erosion, and limit the development of salinity in Mediterranean areas , and clean up soils suffering from excessive fertilization (Rochon et al., 2004).

The aim of this work was to follow mixing and fertilization influence on the amount of symbiotically fixed nitrogen, determined by indirect method, by species *Onobrychis viciifolia* Scop. is part of neophyte species commonly found in Moldavia, being a vegetable appreciated by large productions that are obtained (Sirbu, 2012).

Organic and mineral fertilizers administration on the meadows, induce major changes on made productions (Pacurar et al. 2012, Vintu et al. 2011).

Application of nitrogen fertilizer is indicated only in the establishment of vegetable crops in small doses to meet expectations of plants with symbiotic nodes that are not formed yet. High doses of nitrogen applied later are not effective because they reduce the activity and increase symbiotic nodules of production costs, while yields and quality remain the same (Oliveira et al., 2004).

[1] University of Agricultural Sciences and Veterinary Medicine, Iaşi
* Coordinator

MATERIALS AND METHODS

The research was conducted in Ezăreni Farm (47°05' - 47°10' north latitude and 27°28' - 27°33' longitude east) belonging to the Didactic Station of the University of Agricultural Sciences and Veterinary Medicine, during 2008-2010. Soil that the experiment was installed is a molded cambic with pH 6.7-6.8, with a humus content between 2.73-2.93%, 21-25 ppm PAL, KAL and 226-232 ppm calcium content of 112-139 ppm. Factors studied were: Factor A mixture of 3 graduations: A1-70% *Onobrychis viciifolia* + 30% *Bromus iner*mis, A2- 50% *Onobrychis viciifolia* + 50% *Bromus inermis*, A3- 20 % *Onobrychis viciifolia* - 80% *Bromus inermis*.

Factor B - fertilization with 4 graduations: blank B1, B2-N100P100 kg / ha, B3-5 t / ha vinassa, B4-30 t / ha manure.

Vinassa, manure and phosphorus fertilizer were applied in the fall of 2005, and nitrogen fertilizers were applied before sowing spring. Vinassa is a by-product obtained during production of bakery yeast. Vinassa has a complex chemical composition, being rich in total nitrogen (3.0 to 3.2%), very rich in potassium (5-7%) and low in phosphorus (0.3 to 0.5%). Chemical composition of manure was the following 5 kg N, 3 kg P_2O_5 and 7 kg K_2O per ton of garbage.

Mass production was determined by weighing green harvested area of 10 m2 and then reported to the hectare. Dry matter was determined by drying in an oven at 105 º C for 3 h (ISO 6496). Nitrogen content of plants was determined by the Kjeldahl method. Humus content in soil was determined by Walkley-Black method in changing Doughnut, wet oxidation method and dosage titration. Statistical calculation was performed by analysis of variance.

That way, were determined the total nitrogen the specific consumption of culture (*CSTN*), the specific contribution of nitrogen-fixing microorganisms (ASNF) and residual nitrogen in the soil (NRS) with relations (Borlan M. et al., 1994, Rusu M. et al., 2004):

- the total nitrogen the specific consumption of culture, $CSTN = 10 \cdot Nr + \frac{Ns}{Rs}$ (kg t^{-1} S.U.);

- the specific contribution of nitrogen-fixing microorganisms,

$$ASNF = \left(10 \cdot Nr + \frac{Ns}{Rs}\right) \cdot \frac{10 \cdot Nr \cdot Rs}{10 \cdot Rs + Ns} \text{ (kg ha}^{-1}\text{)};$$

- residual nitrogen in the soil, $NRS = \frac{Ns}{Rs}$ (kg ha^{-1});

where: N - nitrogen content of the hay produced (% of DM),

Rs - expected yield (t ha^{-1} DM),

Ns - the supply of nitrogen in the soil humus obtained by mineralization (kg ha^{-1} N),

amount of nitrogen intake produced by mineralization of humus soil (determined by nitrogen index - IN), is 20 kg ha^{-1} year (RUSU et al., 2004), plus the contribution made by applying nitrogen fertilizer: 100 kg ha^{-1} to version b2, 140 kg ha^{-1} variant b3, 15 kg ha^{-1} in version b4.

The biological material used was the variety of *Onobrychis viciifolia* Scop.- SPLENDID and variety of *Bromus inermis* L. - DOINA.

RESULTS AND DISCUSSION

The organic and mineral fertilizers cause significant changes in the structure of vegetation cover and production of temporary grassland (Nyfeler et al. 2008, Smit et al. 2008). Productions were similar to those obtained by Dragomir C., 2009 in similar conditions of culture. In all three types of mixtures studied were observed increases in dry matter production in fertilized compared to control variant versions. Thus, the mixture of 20% *Onobrychis viciifolia* Scop., production increased from 6.43 t ha^{-1} DM in variant without fertilization, the fertilization DM 7.42 to 5 t ha^{-1} vinassa and 7.64 t ha^{-1} DM in version N100P100 kg ha^{-1}.

While the mixture consisting of 50 % *Onobrychis viciifolia* Scop. and 50 % *Bromus inermis* L. dry matter production increased from 8.67 t ha^{-1} DM in variant without fertilization, to 8.72 t ha^{-1} DM to 30 t ha^{-1} manure, it went up to 9.35 t ha^{-1} DM at fertilization with N100P100 kg ha^{-1} (*figure 1*). After the mixture x fertilization interaction, the highest productions were obtained at the mixture of 70 % *Onobrychis viciifolia* Scop. the variant fertilized with N100P100 kg ha^{-1}.

The study analyzing the influence on total nitrogen content of plants shows that this index was positively influenced by the application of fertilizers (*figure 2*). Compared with variants without fertilization increased the percentage of nitrogen fertilization N100P100 kg ha^{-1} from 3.27 % to 20 % *Onobrychis viciifolia* Scop. mixture to 3.47 % at mixture with 70 % *Onobrychis viciifolia* Scop.. Fertilization with 5 t ha^{-1} vinassa total nitrogen content in plants was between 3.20 % to 20 % *Onobrychis viciifolia* Scop. mixture and 3.46 % to 70 % *Onobrychis viciifolia* Scop. mixture (Fig. 2).

Specific contribution of nitrogen-fixing microorganisms (ASNF) ranged from 65.4 - 75.97 kg ha^{-1}, the variant without fertilization (*figure 3*). After the mixture x fertilization interaction highest values were obtained from the mixture with 70% *Onobrychis viciifolia* Scop. on variant b2, namely 89.46 kg ha^{-1}. Vinassa fertilization and manure resulted in getting close to those amounts from fertilization $N_{100}P_{100}$ kg ha^{-1}.

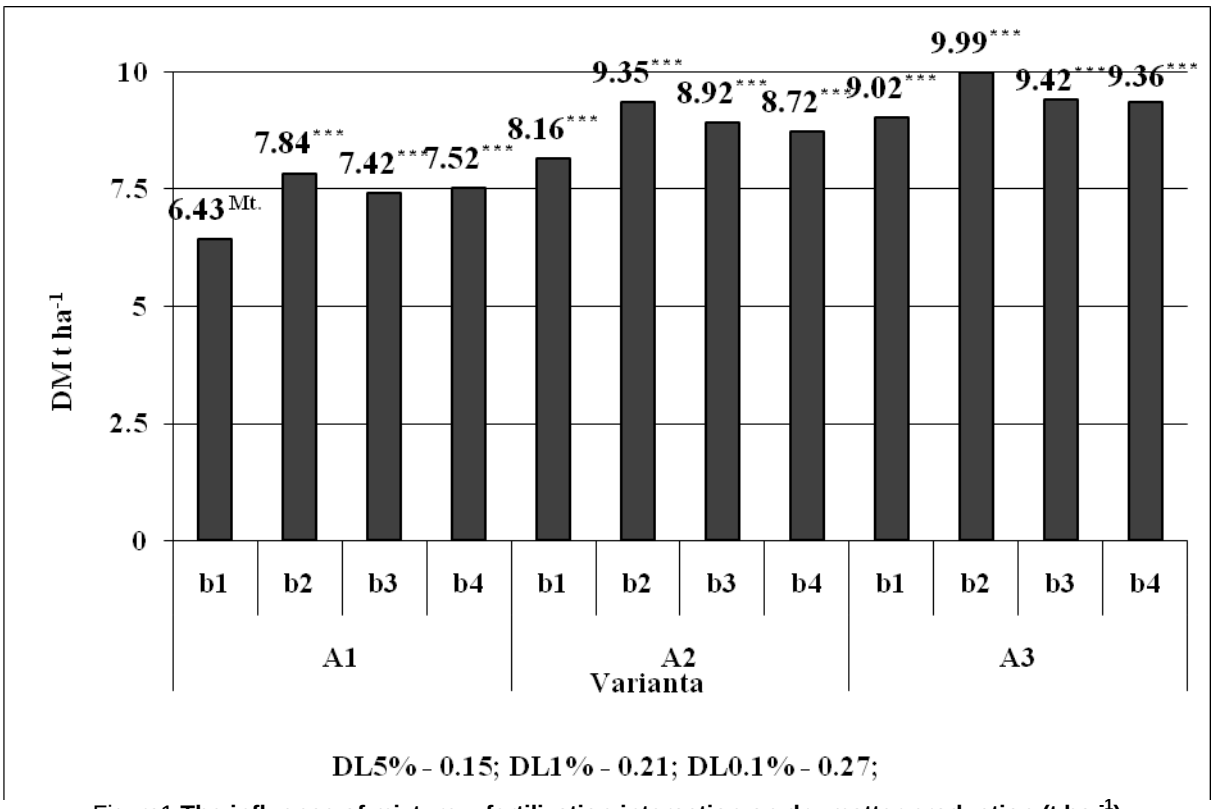

Figure1 **The influence of mixture x fertilization interaction on dry matter production (t ha $^{-1}$)**

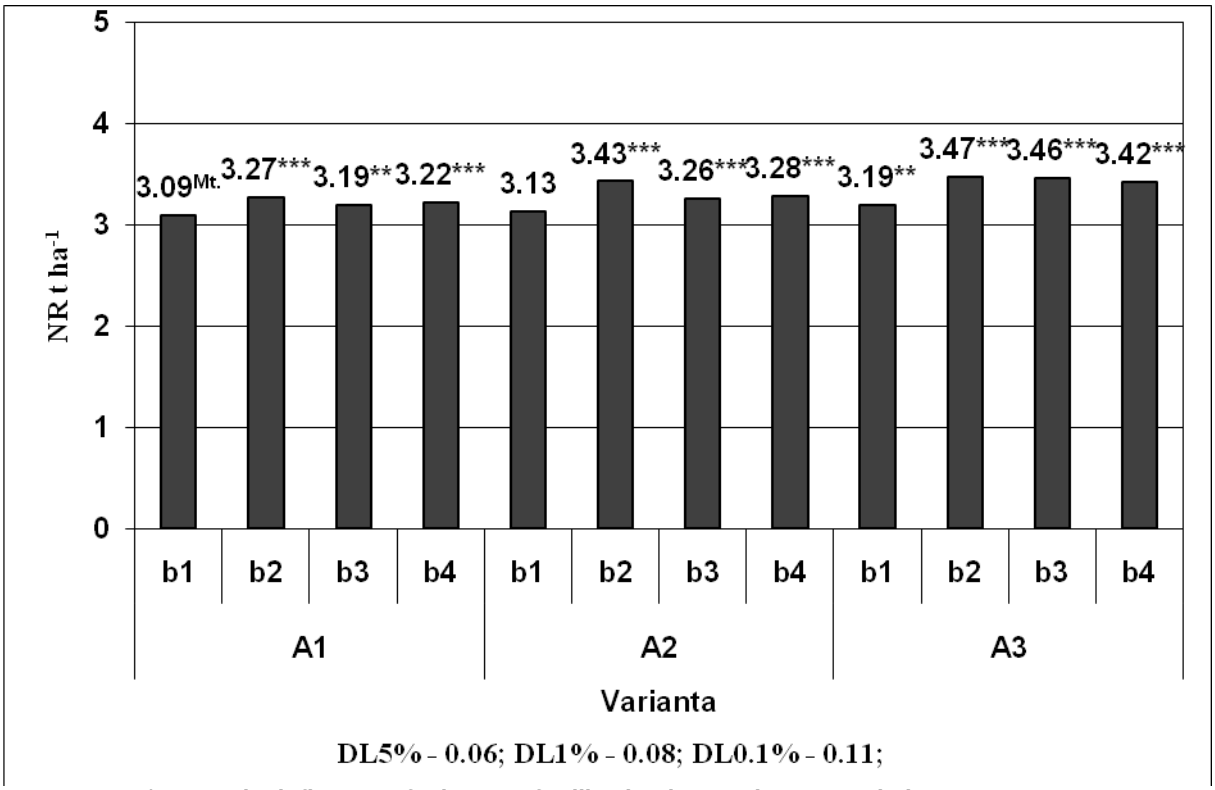

Figure 2 **The influence of mixture x fertilization interaction on total nitrogen content of feed in the first year of vegetation**

Application of fertilizers (organic or mineral) significantly reduced symbiotic activity which fixes atmospheric nitrogen, most of the plants using non symbiotic nitrogen so the efficiency of nodes is reduced. Total specific nitrogen consumption in leguminous culture (CSTN), the first year of vegetation, ranged from 43.65 to 47.31 kg t^{-1} DM (Fig. 4.). Application of organic fertilizers and caused a greater consumption of nitrogen to produce a kg of dry matter, to version control (unfertilized). At the

doses of fertilizer applied, CSTN differences are significant (*figure 4*).

Quantities of nitrogen remaining in the soil after the first year of vegetation, ranged from 10.75 - 15.74 kg ha^{-1}. The fertilized variants of residual nitrogen in the soil (NRS) were lower compared to the variant without fertilization in the first mixture (*figure 5.*).

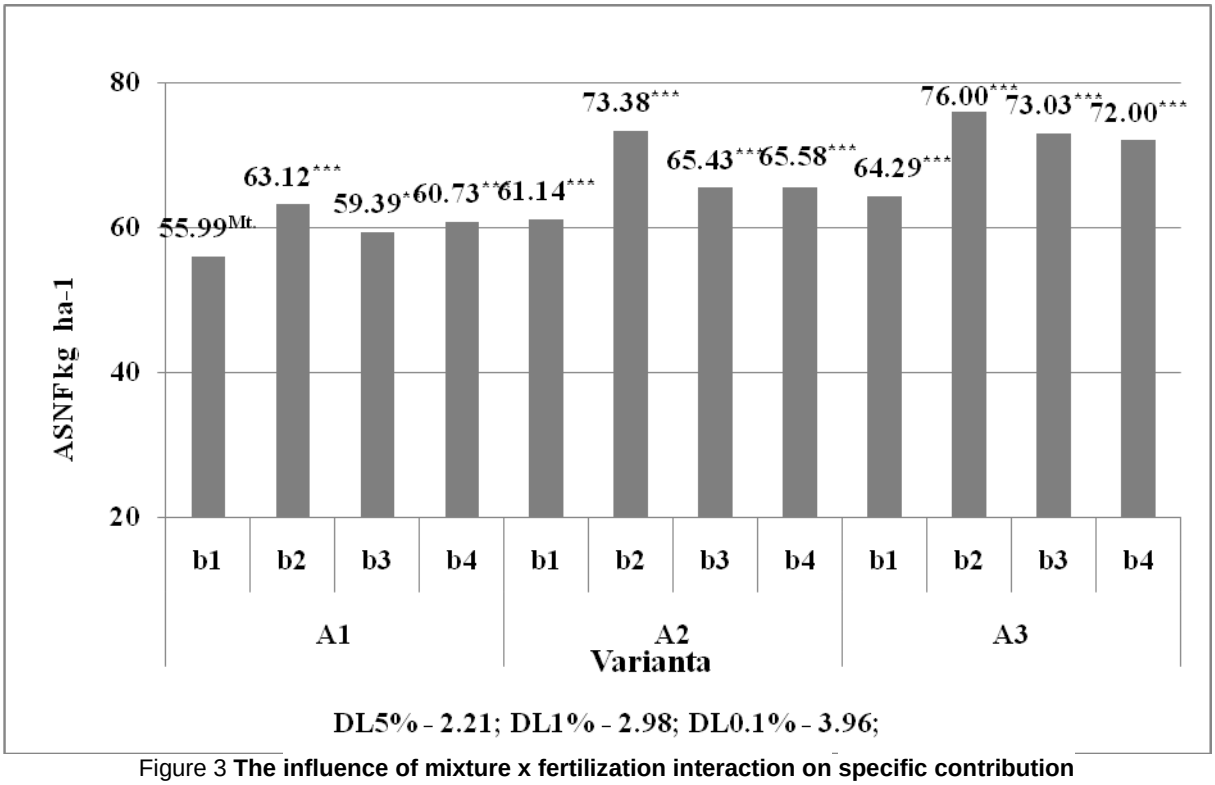

Figure 3 **The influence of mixture x fertilization interaction on specific contribution of nitrogen-fixing microorganisms (ASNF)**

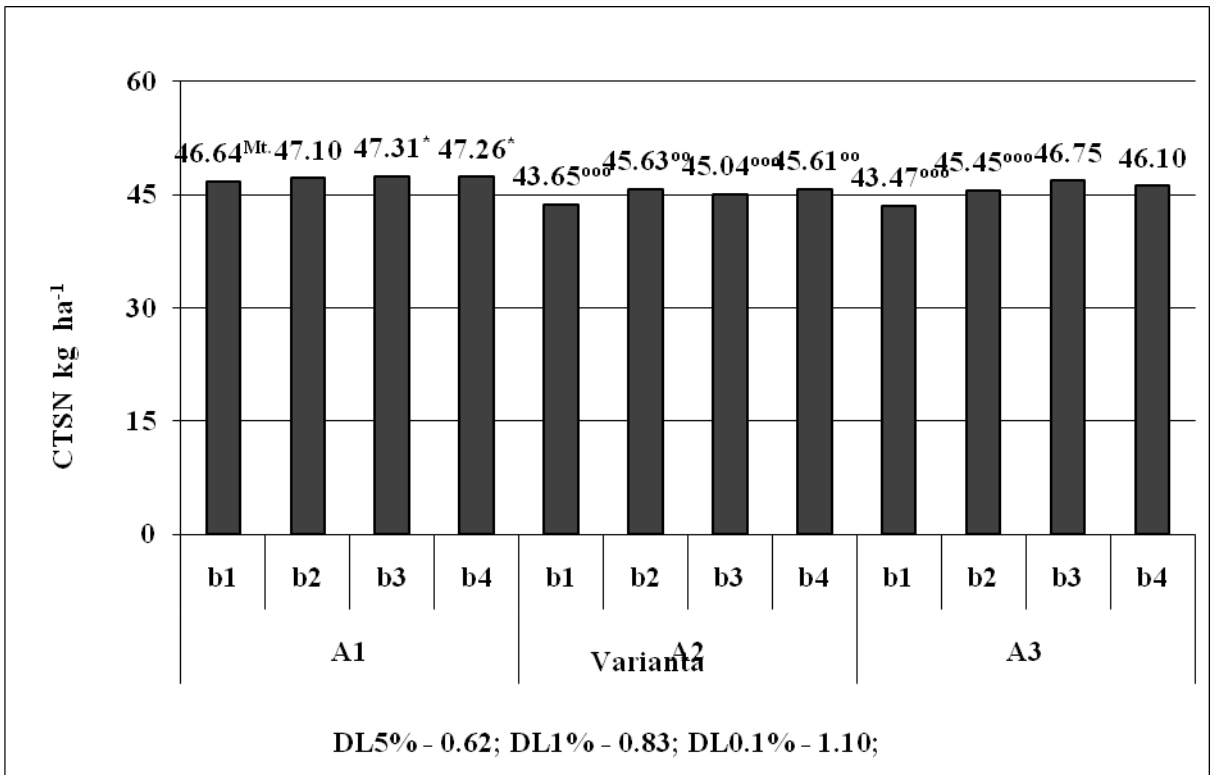

Figure 4. **The influence of mixture x fertilization interaction on total specific nitrogen consumption (CSTN), in first year of vegetation**

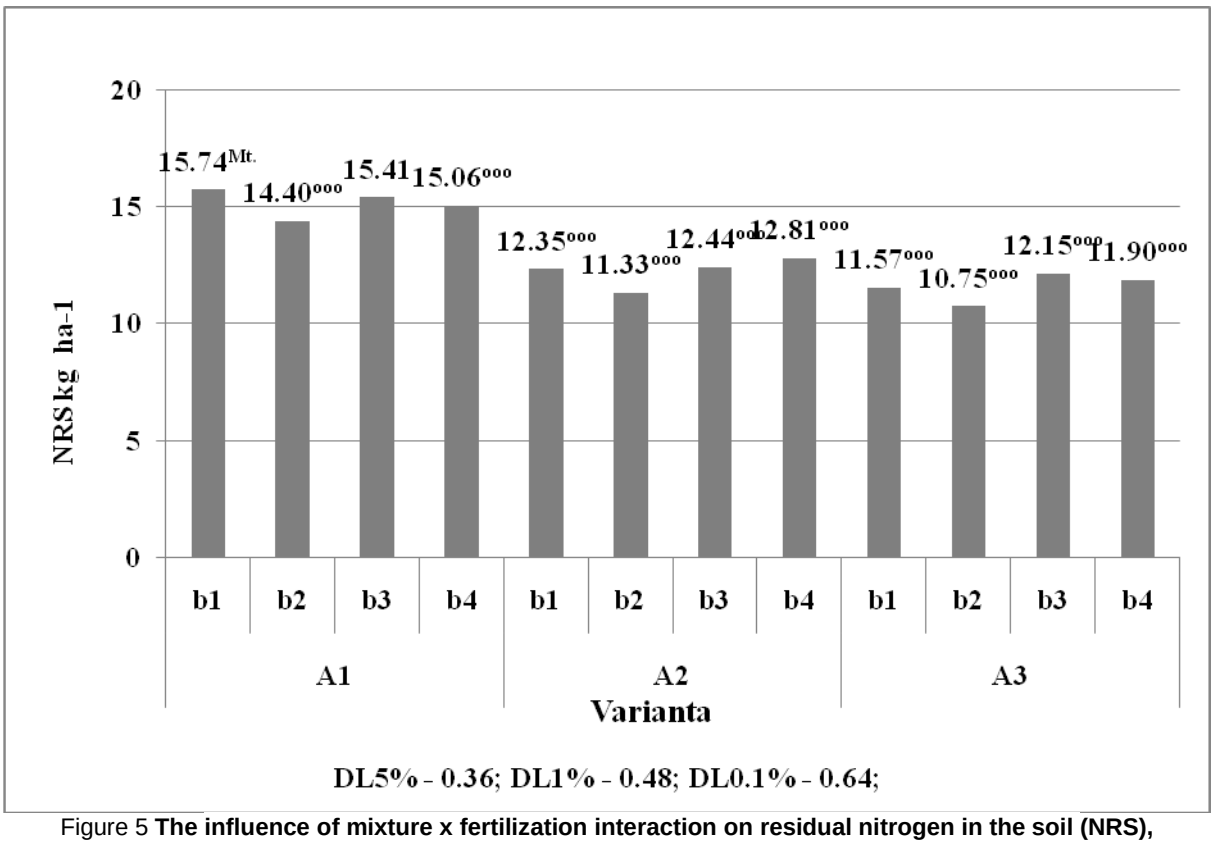

Figure 5 **The influence of mixture x fertilization interaction on residual nitrogen in the soil (NRS), in first year of vegetation**

At A2 and A3 mixtures, there were small differences between the amounts of nitrogen left in vinassa and manure fertilized variants of soil compared to b1. On the b2 variant the values obtained were lower compared to all mixtures studied in the variant without fertilization. At the amount of organic nitrogen fertilizer remaining in the soil, determined by calculation, is added the amount of nitrogen in manure because, in practice, the coefficient of nitrogen in manure is, in the application year, between 30-50%.

CONCLUSIONS

Analyzing the influence of mixture x fertilization interaction, the highest productions were obtained from the mixture with 70% *Onobrychis viciifolia* Scop. on variant with N100P100 kg ha^{-1}. Production increases were recorded for fertilization with manure and vinassa regardless of the percentage of legumes in the mixture. Following research observed that fertilization had a positive effect on the total nitrogen content of plants and specific contribution of nitrogen-fixing microorganisms (ASNF), specific consumption of culture total nitrogen (CSTN) and residual nitrogen in the soil (NRS). Symbiotically fixed nitrogen ranged from 50.19 to 76.3 kg ha^{-1} and nitrogen remaining in the soil after the first year of vegetation ranged from 10.75 - 15.74 kg ha^{-1}.

ACKNOWLEDGMENTS

This Work Was Cofinanced From The European Social Fund Through Sectorial Operational Programme Human Resources Development 2007-2013, Project Number Posdru/I.89/1.5/S62371 „Postdoctoral School In Agriculture And Veterinary Medicine Area”.

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