# TOTAL NITROGEN STORAGE IN A *Dichanthium ischaemum* (L.) Roberty MEADOW

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**Abstract**

*Nitrogen is an indispensable nutrient for plant growth, as it allows plants to produce proteins, chlorophyll, enzymes and vitamins. That is why it is the main factor for the growth of the plant, also determining its quality. Thus, effective methods of improving the nitrogen stock in the soil must be found. The researches carried out in the 2023-2024 agricultural year, within the Solesti location of the Research and Development Station for Meadows, Vaslui, was represented by the analysis of the applied management, over-seeding with simple mixtures of fodder perennial grasses and legumes, on the the total nitrogen stock (N), namely the amount of nitrogen in soil and plants (from roots and dry matter production) on a Dichanthium ischaemum* (L.) Roberty *meadow. Climate conditions have a decisive effect on the accumulation of biomass and must be taken into account when interpreting the obtained results. In general, the agricultural year 2023-2024 was rainy, but with an uneven distribution, affecting the growth and development of plants. The studied meadow had a vegetation structure dominated by species with very poor fodder value. The effect of over-sowing has manifested itself not only on the quality of grassland vegetation, but also on the amount of total nitrogen accumulated. Between plant production, root production and the amount of nitrogen accumulated there was correlation.*

***Key words**: **plant production, roots production, soil nitrogen production, correlation***

## INTRODUCTION

Natural meadows are one of the most complex ecosystems, in which the relation soil - microorganism - plant - animal - medium provides all the necessary nutrients for the functioning of the system and these interrelationships, which determine the cycling of nutrients, influence the productivity and quality of meadows feed. The growth and development of plants is conditioned by nitrogen (N) nutrition, which they absorb in mineral form (ammonium and nitrates) (**Dragomir N., 2018**; **Kuczuk A. and Pospolita J., 2019**).

The total nitrogen in the soil is influenced by the mineral nitrogen content produced by aerobic incubation and the intensity of mineralization and vice versa (**Tripathi N.N. and Mishra A., 2014**; **Dželetović Ž.S. and Mihailović N.L., 2017**; **Reimer M. et al, 2023**). Nitrogen enrichment is known to impact plant diversity globally. Background deposition rates could be used to better evaluate the species richness and biodiversity index (**Soons M.B. et al, 2017**; **Li W. et al, 2022**).

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## MATERIALS AND METHODS

The studied meadow had a vegetation structure dominated by species with very poor fodder value.

Experimental factor - applied management, with five graduations (figure 1): $v_1$ - abandonment; $v_2$ - harvested by mowing (control variant); $v_3$ - overseeded with *Bromus inermis* Leyss. 100%, harvested by mowing; $v_4$ - overseeded with *Bromus inermis* Leyss. 75 % and *Onobrychis vicifolia* Scop. 25 %, harvested by mowing; $v_5$ - overseeded with Bromus inermis Leyss. 50 % and *Onobrychis vicifolia* Scop. 50 %, harvested by mowing.

The dry matter content (DM) was determined by drying at the oven temperature of 103 ºC for 3 hours; standard - SR ISO 6496/2001.

Root samples included soil separable material with dimensions greater than 1 mm and the undiscovered organic part of the soil surface, including parcels, knotted knots and fractions of stems not recovered by mowing. The soil monoliths were size 0.3 m × 0.3 m × 0.2 m = 0.018 $m^3$ and were harvested on 28.08.2024.

The total nitrogen content in the plant and root samples was determined using the Vario MCRO Cube elemental analyzer - PT 162SR; ISO 10694/1998.

The apparent density was determined by taking porobes in natural settlement and weighing them after drying.

The nitrogen content in the soil was determined by the Kjeldahl method; STAS 7184/2-85. The nitrogen production in the soil was calculated for the depth of 0-20 cm, taking into account the apparent density.

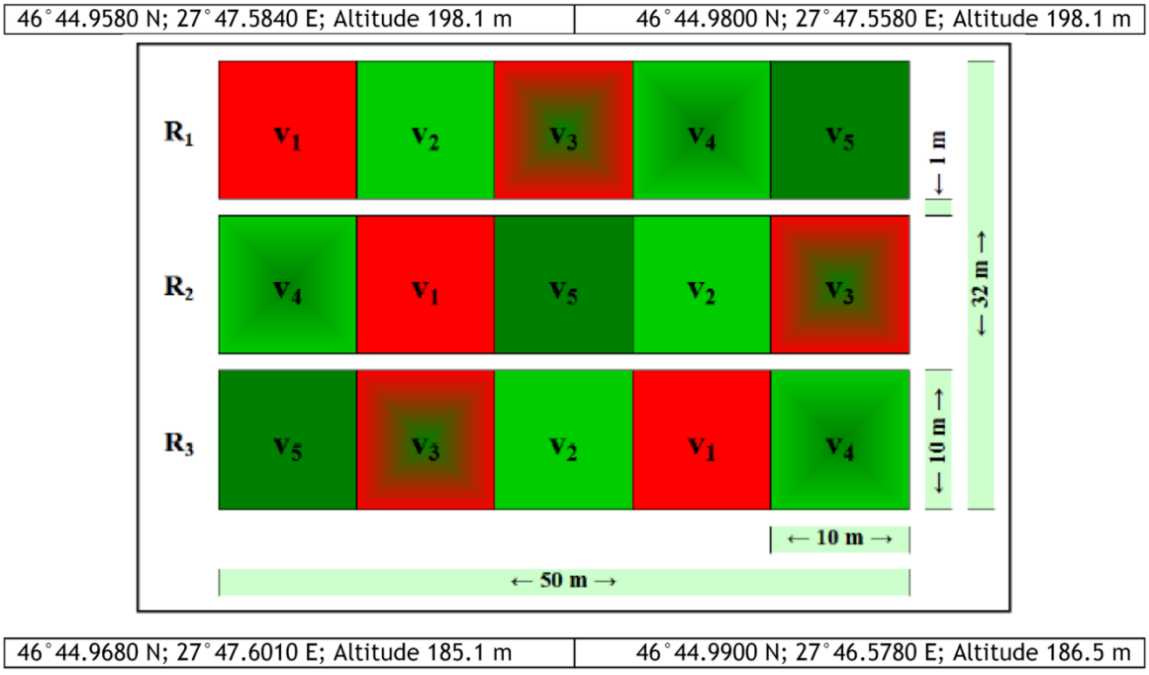


Figure 1. Experimental design

## RESULTS AND DISCUSSIONS

Plant production, in the form of dry matter, harvested on variants were 0.426 t·ha$^{-1}$ DM at the control variant $v_2$ - harvested by mowing, of 0.427 t·ha$^{-1}$ DM in case of $v_1$ - abandonment, the production obtained being almost identical to that of the control variant, of 0.525 t·ha$^{-1}$ DM in case of $V_3$ variant - overseeded with *Bromus inermis* Leyss. 100 %, harvested by mowing, the output obtained being higher than that of the control variant, with 22.7 % (significant difference), of 0.560 t·ha$^{-1}$ DM in the case of $V_4$ variant - overseeded with *Bromus inermis* Leyss. 75 % and *Onobrychis vicifolia* Scop. 25 %, harvested by mowing, the output obtained being higher than that of the control variant, with 31.0 %

(significant difference), of 0.565 t·ha$^{-1}$ DM in the $V_5$ variant - overseeded with *Bromus inermis* Leyss. 50 % and *Onobrychis vicifolia* Scop. 50 %, harvested by mowing, the production obtained being higher than that of the blank variant, by 32.2 % (significant difference) and have differed only by 0.040 t·ha$^{-1}$ DM (9.4 %) between the 3 varied over-seeding, the difference in dry matter production being insignificant (table 1).

The total nitrogen content in plants ranged from 0.94-0.98 %. Even though the percentage of total nitrogen in plants varied only by 0.04 % between variants, the production of dry matter determined the variations in total nitrogen production between the variants.

Total nitrogen production accumulated in dry matter production ranged from 0.0040-0.0042 t·ha$^{-1}$ N to vaiants $v_1$ - abandonment and $v_2$ - harvested by mowing (control variant), and, there is no significant difference and 0.0052-0.0053 t·ha$^{-1}$ N at over-seeded variants ($v_3$, $v_4$ and $v_5$), the differences compared to the control variant being statistically assured (distinct significant and very significant) (table 1).

The nitrogen content and nitrogen production exported through root production varied as follows: the nitrogen content in the roots ranged from 0.47-0.51 %; root production (t·ha$^{-1}$ DN) over the depth of 0-20 cm ranged from 3.555-3.588 t·ha$^{-1}$ DM; nitrogen production accumulated in root production ranged from 0.0169 t·ha$^{-1}$ N at variant $v_1$ -abandonment and 0.0172-0.0181 t·ha$^{-1}$ N, at the other variants, the differences from the blank variant being only 1.6-6.4 % (insignificant).

The nitrogen content and nitrogen production in the soil varied as follows: nitrogen production from the soil (t·ha$^{-1}$ N) over the depth of 0-20 cm ranged from 1.557-1.652 t·ha$^{-1}$ N; to the nitrogen production accumulated in the soil, the differences from the control variant were only 0.2-5.3 % (being distinctly significant in the $V_4$ and $V_5$ variants) (table 1).

On average, the total nitrogen reserve was 1.628 t·ha$^{-1}$ N, of which only 1.37 % is found in plants and roots, the remaining 1.606 t·ha$^{-1}$ N (98.63 %) being stored in the soil, in various forms accessible or not accessible to plants (figure 1).

Table 1. Centralisation of the results on total nitrogen production in the *Dichanthium ischaemum* (L.) Roberty meadow

| **Experimental variant** | **Plant production** | | **Roots production** | | **Nitrogen production in soil** | **Total nitrogen production** |
|---|---|---|---|---|---|---|
| | **t·ha$^{-1}$ DM** | **t·ha$^{-1}$ N** | **t·ha$^{-1}$ DM** | **t·ha$^{-1}$ N** | **t·ha$^{-1}$ N** | **t·ha$^{-1}$ N** |
| $v_1$ - abandonment | 0.426 | 0.0042 | 3.588 | 0.0169 | 1.557 | 1.5781 |
| $v_2$ - harvested by mowing (control variant) | 0.427$^{C}$ | 0.0040$^{C}$ | 3.555$^{C}$ | 0.0181$^{C}$ | 1.577$^{C}$ | 1.5991$^{C}$ |
| $v_3$ - overseeded with *B.i.* 100%, harvested by mowing | 0.525* | 0.0052** | 3.578 | 0.0172 | 1.593 | 1.6154 |
| $v_4$ - overseeded with *B.i.* 75 % and *O.v.* 25 %, harvested by mowing | 0.560* | 0.0053*** | 3.569 | 0.0178 | 1.649 | 1.6721** |
| $v_5$ - overseeded with *B.i.* 50 % and *O.v.* 50 %, harvested by mowing | 0.565* | 0.0053*** | 3.566 | 0.0175 | 1.652 | 1.6748** |
| LSD 0.5 | *0.101* | *0.0006* | *0.027* | *0.0003* | *0.104* | *0.0370* |
| LSD 0.1 | *0.148* | *0.0008* | *0.039* | *0.0004* | *0.152* | *0.0538* |
| LSD 0.001 | *0.221* | *0.0013* | *0.058* | *0.0006* | *0.228* | *0.0807* |

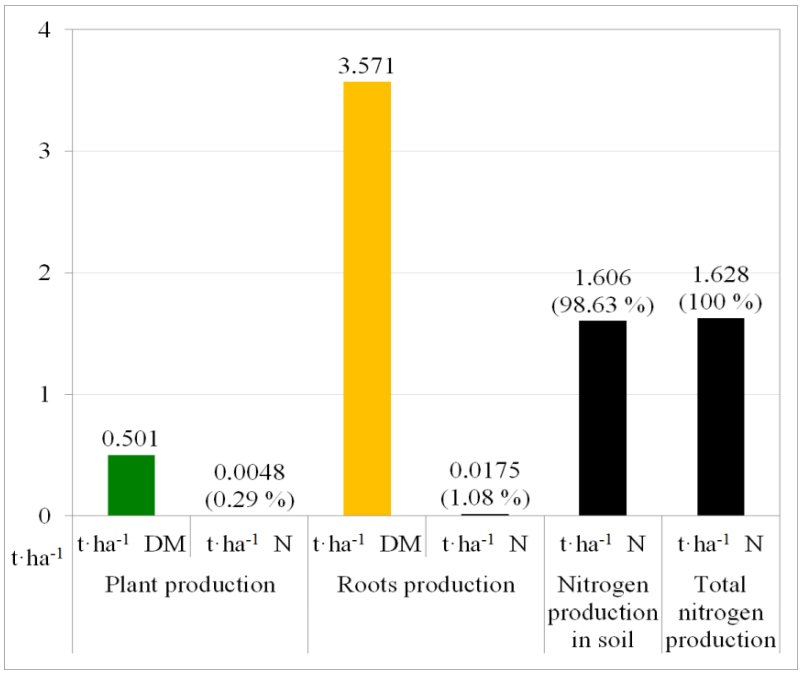


Figure 1. Average total nitrogen production in the *Dichanthium ischaemum* (L.) Roberty meadow.

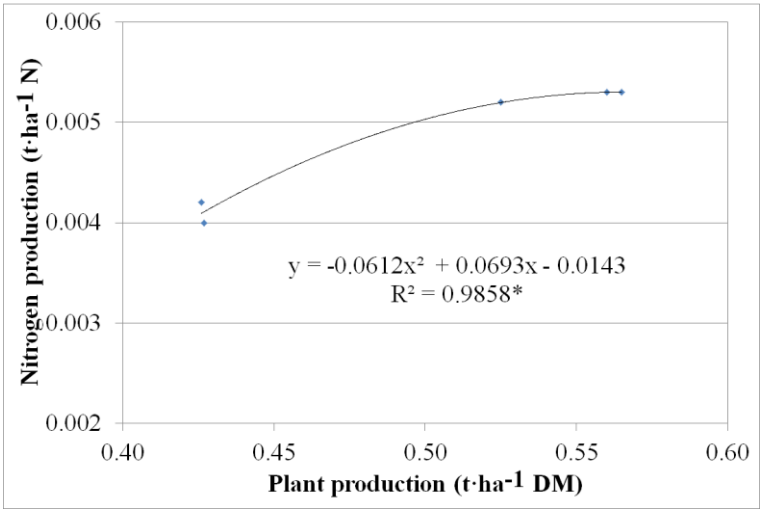


Figure 2. Correlations between plant production and nitrogen production.

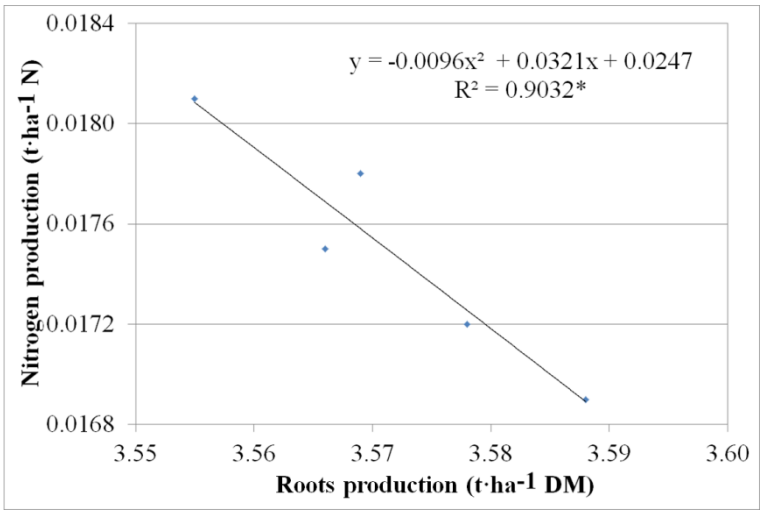


Figure 3. Correlations between root production and nitrogen production.

Figure 2 and figure 3 show the correlations between plant production, root production and the amount of nitrogen accumulated. It can be noted that the average square deviations of regressions are statistically ensured (the $r^2$ value is very significant for the correlation between plant production and the amount of nitrogen accumulated in it and significant for the correlation between root production and the amount of nitrogen accumulated in it), which shows that between plant production, root production and the amount of nitrogen accumulated in it there is correlation.

In addition to climate conditions and management measures applied influence the carbon sequestered in the soil. Thus, measures such as completing the vegetable carpet with valuable species and fertilizing the grassland have a positive influence on the amount of nitrogen accumulated in the plants, but also in the soil.

## CONCLUSIONS

The effect of over-sowing has manifested itself not only on the nitrogen content of grassland vegetation, but also on the amount of total nitrogen accumulated.

On average, in the *Dichanthium ischaemum* (L.) Roberty meadow, the total nitrogen reserve was 1.628 $t \cdot ha^{-1}$ N, of which only 1.37 % is found in plants and roots, the remaining 1.606 $t \cdot ha^{-1}$ N (98.63 %) being stored in the soil, in various forms accessible or not accessible to plants.

Between plant production, root production and the amount of nitrogen accumulated there was correlation.

## ACKNOWLEDGEMENTS

ADER 2023-2026: Proiect ADER 15.3.4 - Creșterea cantității de carbon sechestrat la nivelul solului, pe pajiștile permanente degradate situate pe terenuri în pantă supuse eroziunii, prin lucrări de supraînsămânțare sau reînsămânțare

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