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# THE ISSUE OF INFLUENCE RECREATIONAL LOADS ON CONTENT OF BASIC MINERAL NUTRIENTS IN SOD-LAYERED SOILS

A. Ryzhov, competitor, *
F. Brovko, Doctor of Agricultural Sciences,
O. Brovko, Candidate of Biological Sciences.

*It is shown that the upper y 0,5-meter layer of sod-layered soils under the influence of recreational load is reduced contents of: humus - by 57-71 %, high hydrolyzed nitrogen, phosphorus and mobile forms of metabolic forms of potassium - by 15-66 %.*

Soil, recreation, humus, nitrogen, phosphorus, potassium

The use of forests for recreational purposes leads to compaction of the top 15-cm soil layer [10], adversely affects their biological and enzymatic activity [8] and causes a decrease in y soil humus content, total nitrogen, gross and mobile forms of nitrogen and phosphorus [6] that leads to violations of the mineral nutrition of y woody plants [7]. Since, mentioned literature, the influence of anthropogenic seal only chemical properties of sod-podzolic soils, and so we conducted this study.

**The aim of researches** - to establish the quantitative impact of anthropogenic seal the contents of the main mineral nutrients y sod-layered soils.

**Materials and methods of researches**. The object of the study served as sod-layered soils that formed under the canopy of mature pure oak stand, completeness of 60 %, understory of elderberry that grows in clumps area. Plantation is located on south of the park "Alexandria" that is in city Bilaia Tserkva and undergoes continuous human impacts on residents. The prolonged recreation impacts in the plantation formed a network of trails and playgrounds equipped for sports and recreation in which there is no grass vegetation. As a control, served as a focus of ground with no visible signs of degradation of ground grass, as well as research - part of the soil that is lost due to trampling the grass cover. In soil samples, selected of 10-cm layers to a depth of 0.5 m was defined in 5 repetition content - humus [3], mobile forms of phosphorus and potassium forms of exchange by Kirsanov’s method in modification of NSC ISSAR [4] and high hydrolyzed nitrogen by Turina and Kirsanovs [1]. Average values of the

* Supervisor Professor F.M. Brovko

content of the investigated chemical elements in soil were determined by programs designed for personal computers [2], and evaluation of the importance of the data carried out at the 5 % level of accuracy of Student's test [5].

**Results.** Trampling sod-layered soil due to anthropogenic stress significantly affects the water-physical properties of the upper 50-cm column. Under the influence of an increase in compaction density ( to 10-54 %) and reduction of duty cycle (by 8-52 %) of soil, which leads to reduction of productive moisture (49 %) in investigated soil layer [9] and at the same time affect its chemical properties. In particular, according to our study a negative impact on the content of basic mineral nutrients.

In sod-layered soils that have undergone compression and served as controls (Table 1), the maximum humus content (3,0 %) was observed in upper 10-cm thickness of the humus-accumulate horizon. The same soil horizon, subject to compaction, containing 1,1% humus, which is 63,3 % less than in mature canopy oak stands. Overall, the most significant decrease of humus content (criterion $t_f$ - 2,97-3,43) observed y upper 20-cm layer, which is undergoing the largest seal. This layer of soil humus under the influence of compaction, decreased compared to control at 63,3-71,4 %. A significant, albeit smaller difference (0,4-0,5 % y absolute and 55,6-62,5 % y relative units) humus content, observed y 20-50-cm soil layer studied.

**1. Impact of anthropogenic seal humus content in 0,5-meter thick sod-layered soil**

| Depth of taking samples, sm | Humus content in earth, % | | It is relative to “control” | |
|---|---|---|---|---|
| | non- consolidated “control” | consolidated | % | t |
| 0–10 | 3,0±0,60 | 1,1±0,22 | 36,7 | 2,97 |
| 10–20 | 1,4±0,28 | 0,4±0,08 | 28,6 | 3,43 |
| 20–30 | 0,9±0,18 | 0,4±0,08 | 44,4 | 2,54 |
| 30–40 | 0,9±0,19 | 0,4±0,08 | 44,4 | 2,54 |
| 40–50 | 0,9±0,16 | 0,3±0,06 | 37,5 | 2,92 |

Note: Tabular meaning quintiles of criteria Students (t) at steady likelihood 0,05 – 2,45.

In cells of seal sod-layered soils we observed reduction of high-hydrolyzed nitrogen (Table 2) to 15,2-38,1 %. Such differences obtained for indicators of nitrogen at the 5 % level of probability are identified as irrelevant (tf = 0,77-2,02) and only 40-50-cm depth, we have observed significant differences (tf = 2,92) in high-hydrolyzed content oxide (62,5 %), which we believe is due to changes in flow and alluvial processes in the thickness of compacted soil.

**2. Effect of anthropogenic compaction on content of high-hydrolyzed nitrogen in 0,5-meter thick of sod-layered soil**

| Depth of taking samples, sm | Content of high-hydrolyzed nitrogen in soil, $mg \cdot kg^{-1}$ | | It is relative to "control" | |
|---|---|---|---|---|
| | non- consolidated "control" | consolidated | | non- consolidated "control" |
| 0–10 | 63,2±9,48 | 40,5±6,08 | 64,1 | 2,02 |
| 10–20 | 31,6±4,74 | 24,0±3,60 | 75,9 | 1,28 |
| 20–30 | 26,5±3,98 | 16,4±2,46 | 61,9 | 2,16 |
| 30–40 | 16,4±2,46 | 13,9±2,09 | 84,8 | 0,77 |
| 40–50 | 30,3±4,55 | 22,8±3,42 | 37,5 | 2,92 |

Note: Tabular meaning quintiles of criteria Students (t) at steady likelihood 0,05 – 2,45.

Data given y table 3 shows that the maximum content of mobile forms of phosphorus (88,0-88,7 $mg \cdot kg^{-1}$) was observed y upper 10-cm soil layer. It should be noted that the humus-accumulate horizon of soils which had not undergone consolidation over phosphorus 86.4 $mg \cdot kg^{-1}$ to a depth of 30 cm, and in a compacted soil phosphorus level was observed only y upper 10-cm layer. The essential difference is ($t_f$ = 4,09 and 4,12) in the content of mobile forms of phosphorus fixed y soil at a depth of 10-30 cm and in relative terms was 65 %.

**3. Effect of anthropogenic compaction on content of mobile forms of phosphorus in 0,5-meter thick of sod-layered soil**

| Depth of taking samples, sm | Content of mobile forms of phosphorus in soil, $mg \cdot kg^{-1}$ | | It is relative to "control" | |
|---|---|---|---|---|
| | non- consolidated "control" | consolidated | | non- consolidated "control" |

| | | | | |
|---|---|---|---|---|
| 0–10 | 88,7±13,26 | 88,0±13,20 | 99,2 | 0,04 |
| 10–20 | 86,6±12,96 | 30,2±4,53 | 35,0 | 4,09 |
| 20–30 | 86,4±12,96 | 29,8±4,47 | 34,5 | 4,12 |
| 30–40 | 35,8±2,46 | 29,2±4,38 | 81,6 | 0,95 |
| 40–50 | 31,8±4,77 | 24,8±3,72 | 78,0 | 1,16 |

Note: Tabular meaning quintiles of criteria Students (t) at steady likelihood 0,05 – 2,45.

## 4. **Effect of anthropogenic compaction on content of mobile forms of potassium content in 0,5-meter thick of sod-layered soil**

| Depth of taking samples, sm | Content of metabolic forms of potassium in soil, mg·kg$^{-1}$ | | It is relative to "control" | |
|---|---|---|---|---|
| | non- consolidated "control" | consolidated | | non- consolidated "control" |
| 0–10 | 163,9±16,39 | 97,1±14,57 | 59,2 | 3,25 |
| 10–20 | 44,6±6,68 | 36,1±5,42 | 80,9 | 0,99 |
| 20–30 | 39,8±5,97 | 15,2±2,27 | 38,2 | 3,85 |
| 30–40 | 27,6±4,13 | 12,5±1,87 | 45,3 | 3,33 |
| 40–50 | 21,7±3,25 | 11,7±1,75 | 53,9 | 2,71 |

Note: Tabular meaning quintiles of criteria Students (t) at steady likelihood 0,05 – 2,45.

Maximum values metabolic forms of potassium content (Table 4) are also marked in the upper 10-cm soil layer studied. It should also be noted that in cells where the soil layer did not undergo compaction, potassium reached 163,9 mg·kg$^{-1}$, and in places there has been a decrease in sealing its contents by 40,8 %. In the event of compacting the contents of human metabolic forms of potassium in the 0.5- meter thick sod -layered soil significantly decreased ( tf = 2,71-3,85 ) and y relative units estimated at 38,2-59,2 % and only 10-20-cm layer was observed unimportant difference ( tf = 0,99 ), which was 19,1 %.

**Conclusion.** So seal sod-layered soils is due to anthropogenic pressures, reduces y are content: humus - by 56-71 % high-hydrolyzed nitrogen - in 15-62 % of mobile forms of phosphorus - by 18-66 % and the exchange of forms potassium - by 19-62 %,

which causes changes in the species composition of plant communities and adversely affects the development of grassy soil.

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