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ECOLOGICAL ASPECTS OF ALFALFA PLANTINGS

For many decades, almost all branches of the national economy, under the guise of saving and rational use of labor, material and financial resources, ruthlessly exploited the nature. They used mineral resources, land, water and plant resources, wildlife and airspace in a predatory way. In the structure of farmland of the Mykolaiv region, arable land accounts for 84.4%, transfers – for 0.3%, perennial plantings – for 1.8%, hayfields – for 0.2%, and pastures – for 13.3%. Through the extensive agriculture, agricultural development and plowing of the territory of the region have reached 84.5% and 69.2%, respectively.

The consequence of the high economic development of the land fund, without proper measures for its protection and reproduction, is a violation of the environmentally acceptable ratio of arable land areas, natural forage lands, and forest stands, which negatively affects the stability of the agro-landscape, leads to progressive land degradation, and creates a threat to the environmental safety of the region.

Since 1993, a negative humus balance has developed on 75% of the area of agricultural land in the soils of Ukraine. As in other regions of Ukraine, the process of humus loss in the Mykolaiv region is progressing [1, 2].

In 1960, according to the Mykolaiv branch of the Institute "Ukrzemproekt", the humus content was 4.2%. Over the past 15–20 years, due to insufficient use of organic matter, crops of perennial grasses, and soil erosion, it decreased to 3.9%; in the Vitovsky region – even to 2.8%. Consequently, with such a tendency to reduce the humus content, the soils of the region can undergo catastrophic changes within a very short period of time in the history of soil formation. Therefore, all lands need protection from negative processes, pollution and deterioration of the ecological state. In part, this issue can be solved by expanding the area under perennial legumes, in particular alfalfa.

Alfalfa (*Medicago sativa* L.) is the most important forage crop all over the world and is cultivated in more than 70 countries for its great adaptability and multiple uses. The name of the plant means "father of all foods" in Arabic. Alfalfa can be used as grazing land for dairy cows, horses, sheep, goats, pigs, and chickens. It can also be used as hay, silage, green manure, and as a cover crop.

Alfalfa can be used not only for grazing, hay and silage production but also for soil improvement and soil conservation. The ecological significance of alfalfa is also reflected in the fact that it is cultivated to reduce soil erosion and improve soil fertility on croplands.

The alfalfa plant is very adaptable to different growing and weather conditions. It can exhibit a high tolerance to drought. This is due to its root system, which can reach a depth of 4.5–9 meters. The average length of the roots is 1.2–1.5 meters. The root system of alfalfa decreases the effects of soil compaction. Plant height ranges from 0.6 to 1.2 meters. Alfalfa grows well in well-drained soils, as moist soil promotes the development of various diseases.

Alfalfa is adequately supplied with nitrogen through its symbiotic relationship with nitrogen-fixing *Rhizobium* bacteria. Consequently, in most cases there is little need to apply nitrogen fertilizer.

In agricultural production, it is important to know the nitrogen balance in each unit of agricultural area in order to be able to predict the yield of crops and to prevent possible environmental pollution. Atmospheric nitrogen, which is symbiotically bound to legumes, also occupies a significant place in the balance of nitrogen compounds used by plants [3]. The productivity of atmospheric nitrogen fixation of individual legume swards has been studied by many authors [3, 4, 5], but the obtained results are very different (0–682 kg ha^{-1}) depending on the species, various environmental factors influencing the nitrogen uptake from the ambient atmosphere, and also the detection methods used.

Calculating according to the total nitrogen difference method, the productivity of alfalfa atmospheric nitrogen fixation in fertile sod-carbonate soils under Latvian agroclimatic conditions has been determined (Table).

Table

The amount of atmospheric nitrogen fixed by alfalfa and alfalfa-grass swards

Swards	Fixed atmospheric nitrogen, kg N ha^{-1}			
	three cuts		four cuts	
	3rd year of sward use	4th year of sward use	3rd year of sward use	4th year of sward use
Medicago varia	330	383	313	433
Medicago varia + grasses	333	317	275	390

Nitrogen fixation capacity of hybrid alfalfa was very high even in the third and fourth years of sward use, reaching as much as 433 kg ha^{-1}. In the following years of grass use, the productivity of atmospheric nitrogen fixation also exceeded 300 kg ha^{-1}, which was a significant addition to the total nitrogen balance. The obtained results correspond to the range of atmospheric nitrogen fixation productivity indices obtained by other authors [4]. According to experimental data, in Latvian agro-climatic conditions, alfalfa is able to bind a significant amount of atmospheric nitrogen in symbiosis with rhizobia. However, atmospheric nitrogen fixation can only take place if the soil contains the respective rhizobia and they form effective root nodules of alfalfa.

Currently, the state of alfalfa has worsened. The area under perennial grass crops is being reduced. According to the State Statistics Committee of Ukraine, the area of perennial grasses allocated for seed purposes more than halved from 2001 to 2006: from 123.1 to 55.2 thousand hectares. In 2020, this figure was only 8.4 thousand hectares, that is, it decreased by another 6.6 times [5]. Accordingly, the area of alfalfa seed fields has decreased, which on average makes up 25–32% of the total area of seed fields of the herbaceous. This negatively affects not only the general state of seed production of fodder crops but also the state of feed production and soil fertility, the indicators of which significantly deteriorate every year [6]. Nature protection can and should become an engine of scientific and technological progress, an incentive to develop new resources and energy saving technologies, waste-free production, and the manufacture of machines and mechanisms that protect the environment and produce environmentally friendly products.

One of the main substances necessary for a vital activity of a living organism is protein. In this regard, the task is to reproduce livestock more quickly and strengthen its feed base. In the diet of animals, it is necessary to increase the proportion of concentrated protein-rich feed.

The results of our research show that thanks to the cultivation of alfalfa, it is possible not only to meet the needs of animal husbandry for various types of feed (green mass, hay, haylage, grass flour, etc.) but also to improve fertility soil.

It was found that the best mowing time of alfalfa for seeds is intermediate (mowing at the beginning of the budding phase for green feed to provide farm animals with juicy high-protein feed and manage the herbage growing further to form a high seed yield). Growing alfalfa with intermediate mowing increases the seed yield by 20.9% compared to the first mowing, and the level of profitability increases from 182.9% to 313.7%, or by 130.8 percentage points (71.5 percent). Growing alfalfa for seeds with intermediate mowing is environmentally safer due to a decrease in the number of pests in the agrophytocenosis, and therefore also the need for insecticides decreases, compared to the first mowing.

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