

## BIOLOGICAL SCIENCES

### THE ROLE OF LEGUMES GRASS MIXTURE IN THE RESTORATION OF DEGRADED LAND

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Land degradation is one of the world's most pressing environmental problems, that affects everyone through food insecurity, higher food prices, climate change, environmental hazards, and the loss of biodiversity and ecosystem services. Globally, about 25 percent of the total land area has been degraded [1, p. 436–444].

Growing food on degraded land becomes progressively harder as soils rapidly reach exhaustion and water resources are depleted. Degradation also contributes to the loss of plant and animal species and can exacerbate the climate crisis by reducing the Earth's ability to absorb and store carbon [2, p. 90–96].

It is effective to use perennial legumes as a cheap source of symbiotic nitrogen. A well-developed soil microflora, which feeds on the root secretions of perennial leguminous grasses, in the process of its vital activity and annually in large amounts of dying, ensures the accumulation of the most important elements of soil fertility [3, p. 85–86].

In order to save energy and limit the use of mineral nitrogen, it is important to continue the use of leguminous grasses in grass stands up to 5-6 years [4, p. 32–35].

Perennial legumes are able to produce 500–700 kg/ha of humus every year, which is equivalent to applying 20–30 t/ha of manure [5, p. 40].

Perennial leguminous grasses are characterized by high potential productivity, the content of digestible protein can reach 200g in one feed unit. Research on the productivity and quality of fodder in the process of restoration of degenerate grass was conducted during 2012–2014, on lowland meadows in the field experiment of the Institute of Agriculture of the Carpathian region near the village of Obroshino of Pustomyiv district, Lviv region.

Direct sowing of perennial leguminous grasses in undisturbed sod of leveled lowland meadows was carried out in March 2011 with a Grait Plains 1006NT stubble seeder. The species and varietal composition of the sown herbs, as well as their sowing rates, are given in the scheme of the experiment:

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Factor A – herbs:

- 1 – meadow clover (14 kg/ha (70%)), Predkarpatska 6 variety;
- 2 – hybrid clover (9.8 kg/ha (70%)), variety Rozheva 27;
- 3 – lotus corniculatus (9.8 kg/ha (70%)), Ajax variety;
- 4 – galega orientalis (18 kg/ha (70%)), variety Caucasian prisoner;
- 5 – meadow clover + hybrid clover (7 kg/ha+4.9 kg/ha (35+35%));
- 6 – meadow clover + hybrid clover + lotus corniculatus (7 kg/ha+4.9 kg/ha+4.9 kg/ha (35+35+35%));
- 7 – meadow clover + hybrid clover + lotus corniculatus + galega orientalis (6.6 kg/ha+4.6 kg/ha+4.6 kg/ha+8.1 kg/ha (33+33+33+32%)).

Factor B – fertilizer:

- 1 – P<sub>60</sub>K<sub>90</sub> (control)
- 2 – N<sub>60</sub>P<sub>60</sub>K<sub>90</sub>
- 3 – N<sub>60</sub>P<sub>60</sub>K<sub>90</sub> + Vuksal Combi B.

For foliar fertilization, the preparation Vuksal Kombi B (N–30%, K<sub>2</sub>O–22.0%) was used, which is an organo-mineral fertilizer, a highly concentrated suspension with a unique formulation and principle of action, due to the content of chelated (EDTA) trace elements (magnesium, boron, iron, manganese, molybdenum, zinc).

In the first year of research (2012), the highest rate of dry matter was 12.2 t/ha, obtained on a three-component grass mixture of meadow clover, hybrid clover, and lotus corniculatus under complete mineral fertilization using the Vuksal Kombi B preparation.

The highest rate of dry matter in 2013 – 17.1 t/ha – was provided by a four-component grass mixture, where the seeds of the following types of leguminous grasses were sown: meadow clover, hybrid clover, lotus corniculatus and galega orientalis and spraying with Vuksal Combi B was used against the background of full mineral fertilizers.

The highest yield of dry matter – 18.0 t/ha was obtained in 2014 when a four-component grass mixture was sown in the turf with full mineral fertilizer and Vuksal Kombi B preparation. On average, over three years of research (2012–2014), this grass mixture showed the highest indicators of the yield of dry matter – 15.4 t/ha for complete mineral fertilization with the use of Vuksal Combi B.

The efficiency of the use of feed nutrients by animals primarily depends on providing it with digestible protein. When evaluating the sown grasses, it was found that the most valuable was a three-component grass mixture, where meadow clover, hybrid clover and lotus corniculatus were sown with full mineral fertilization and the use of the Vuksal Kombi B preparation. These types of leguminous perennial grasses provided the highest yield of fodder units – 11.35 t/ha with the yield of digestible protein at the level of 2.0 t/ha.

**Fodder productivity of the restored grass stand depending  
on the sown grasses and fertilizer, average for 2012–2014, t/ha**

Perennial legumes (factor A)	Fertilization (factor B)	Entrance		Increase to P <sub>60</sub> K <sub>90</sub>	
		feed units	digestible protein	feed units	digestible protein
meadow clover	P <sub>60</sub> K <sub>90</sub>	8,35	1,2		
	N <sub>60</sub> P <sub>60</sub> K <sub>90</sub>	8,64	1,2	0,29	0
	N <sub>60</sub> P <sub>60</sub> K <sub>90</sub> + Vuksal Kombi B	10,14	1,6	1,79	0,4
hybrid clover	P <sub>60</sub> K <sub>90</sub>	8,21	1,2		
	N <sub>60</sub> P <sub>60</sub> K <sub>90</sub>	8,85	1,3	0,64	0,1
	N <sub>60</sub> P <sub>60</sub> K <sub>90</sub> + Vuksal Kombi B	10,46	1,4	2,25	0,2
lotus corniculatus	P <sub>60</sub> K <sub>90</sub>	8,79	1,0		
	N <sub>60</sub> P <sub>60</sub> K <sub>90</sub>	9,46	1,4	0,67	0,4
	N <sub>60</sub> P <sub>60</sub> K <sub>90</sub> + Vuksal Kombi B	10,46	1,6	1,67	0,6
galega orientalis	P <sub>60</sub> K <sub>90</sub>	9,45	1,1		
	N <sub>60</sub> P <sub>60</sub> K <sub>90</sub>	10,13	1,4	0,68	0,3
	N <sub>60</sub> P <sub>60</sub> K <sub>90</sub> + Vuksal Kombi B	10,65	1,6	1,2	0,5
meadow clover + hybrid clover	P <sub>60</sub> K <sub>90</sub>	9,45	1,0		
	N <sub>60</sub> P <sub>60</sub> K <sub>90</sub>	10,36	1,5	0,91	0,5
	N <sub>60</sub> P <sub>60</sub> K <sub>90</sub> + Vuksal Kombi B	10,79	1,8	1,34	0,8
meadow clover + hybrid clover + lotus corniculatus	P <sub>60</sub> K <sub>90</sub>	9,06	0,9		
	N <sub>60</sub> P <sub>60</sub> K <sub>90</sub>	9,91	1,6	0,85	0,7
	N <sub>60</sub> P <sub>60</sub> K <sub>90</sub> + Vuksal Kombi B	11,35	2,0	2,29	1,1
meadow clover + hybrid clover + lotus corniculatus + galega orientalis	P <sub>60</sub> K <sub>90</sub>	9,03	1,8		
	N <sub>60</sub> P <sub>60</sub> K <sub>90</sub>	9,54	2,1	0,51	0,3
	N <sub>60</sub> P <sub>60</sub> K <sub>90</sub> + Vuksal Kombi B	10,84	2,2	1,81	0,4
HIP <sub>05</sub>	Factor A	0,9	0,8		
	Factor B	1,0	0,2		

This grass mixture with complete mineral fertilizer and Vuksal Kombi B drug contributed to the increase in the share of leguminous species in the restored meadow agroecosystem, and this led to an increase in the content of both raw and digestible protein in the feed.

Among the single-species sown grasses, the highest yield of fodder units (10.65 t/ha) was provided by the galega orientalis with complete mineral fertilization with the use of Vuksal Combi B. This is explained by the high quality indicators of the galega orientalis fodder.

In the conditions of the Western Forest-Steppe, the highest productivity – 15.4 t/ha of dry matter, the yield of digestible protein 2.2 t/ha and fodder units – 10.8 t/ha was obtained by sowing a multi-component grass mixture of meadow clover, hybrid clover, and sedge in the turf Ukrainian and Eastern goats with complete mineral fertilizer  $N_{60}P_{60}K_{90}$  and the combined application of Vuksal Combi B.

A reliable way to increase the production of high-protein fodder is to improve the structure of the sown areas of fodder crops. Special attention should be paid to perennial leguminous grasses, which in the coming years will increase the fertility of arable land and will be the main stabilizing factor in the sustainable development of fodder production and an integral component of biologization and greening of the agroecosystem.

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