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Dynamics of the Species Composition of Phytocenoses of Floodplain Mountain Meadows of the Carpathians Subject to Superficial Improvement

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Abstract. The conducted research of various authors has developed a number of measures for surface improvement of meadowland in various soil and climatic conditions. However, studies on the influence of such surface improvement measures as the use of organic and mineral fertilizers and sowing of perennial grasses and legumes in the sod on the dynamics of the species composition of Floodplain Mountain meadows of the Carpathians have not yet been conducted, which confirms the relevance of this study. The article presents the results of three-year studies conducted during 2017-2019 in the peasant farm of V.F. Martyshchuk (the Verkhovinsky District of the Ivano-Frankivsk region) to study the features of transformation of the species composition of natural phytocenoses of floodplain Meadows of the Black Cheremosh river of the mountain and forest belt of the Carpathians under the influence of their surface improvement with the use of organic and mineral fertilizers and sowing of a cereal mixture for haymaking use and *Tribolium repens* L. for multipurpose use. It was found that floodplain Meadow phytocenoses were mainly cereals and mixed grasses with a share of wild cereals of 57-58% (up to 15 of them % *Festuca rubra* L. s. str. and 5-6% of low-value ones in feed terms *Calamagrostis arundinaceae* (L.) Roth and *Deschampsia caespitosa* (L.) Beauv.), mixed grasses – 35-38% and unseeded *Fabaceae* 5-7%. When applying a set of measures for surface improvement of cereals and mixed grasses, low productive (within 1.95-2.15 t/ha of dry weight) floodplain mountain meadowlands, their species composition improved. For making $P_{30}K_{60}$ the content of wild plants increased by 2-5% *Fabaceae*, and $N_{60}P_{30}K_{60}$ – by 9-10% unseeded *Poaceae*. For haymaking use, *Poaceae* with *Phleum pratense* L. and *Festuca pratensis* Huds. against the background of making $N_{60}P_{30}K_{60}$ for sowing a mixture in the sod in the spring, their share increased to 74%, and for multi-year use and sowing *Trifolium repens* L. against the background of making $P_{30}K_{60}$ the quantity of *Fabaceae* increased to 44% or by 32%. The highest floral saturation (43 species from 19 families and 93-98% from perennials) was observed in variants without fertilization and with the introduction of $P_{30}K_{60}$ for multi-year use, which is 4-14 species more compared to haymaking use, or with the introduction of $N_{60}P_{30}K_{60}$ and or with sowing a mixture of cereals on the background of $N_{60}P_{30}K_{60}$ for haymaking use, or sowing *Trifolium repens* L. against the background of $P_{30}K_{60}$ for multipurpose use

Keywords: legumes, cereals, species composition, meadow phytocenosis, mixed grasses, floral saturation

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INTRODUCTION

One of the most important ways to improve meadowland is to improve its surface. Among the measures of superficial improvement of meadow grass stand, which can dramatically affect its species composition when caring for it, there is fertilization and sowing of herbs. Fertilizers can be used effectively on all types of meadowland. Nevertheless, first, they are highly effective on sufficiently moistened land (floodplain and low-lying Meadows, normal land and irrigated areas of grasslands), where valuable meadow grasses from the mesophyte group predominate [1-2]. Regular use of fertilizers in optimal doses and ratios that correspond to the nature of the herbage and soil characteristics increases the share of valuable forage species in herbage and creates reliable conditions for maintaining high productivity of meadowland for many years [3-5].

Along with mineral fertilizers, organic fertilizers are used in meadows (manure, including liquid, silt from reservoirs, sapropels, bird droppings, peat, wastewater, green mass of green manure, etc.), primarily on poor low-humus soils, as well as for the purpose of their disposal in Mountain Meadows where there is no arable land [2; 6]. The response of meadow plants to mineral fertilizers is higher than that of field crops. However, the effectiveness of fertilizing meadow grass is largely determined by the ratio of nutrients. On *Poaceae* in herbage, a complete mineral fertilizer, then in descending order nitrogen-potash, nitrogen-phosphorus, nitrogen, potassium-phosphorus, potassium and phosphorus [2], provides the greatest return.

Nitrogen fertilizers are more effective in meadows that are better provided with moisture (lowland and floodplain) with a predominance in herbage *Poaceae* herbs. The highest reaction to the application of phosphorous and potash fertilizers is characterized by *Fabaceae* herbs that, with regular fertilization, last longer in herbage [7]. Nitrogen fertilizers on legume and cereal herbage, in contrast to *Poaceae*, little effective [8]. When applying nitrogen fertilizers, as you know, the growth of *Poaceae* at the same time, conditions of potassium and phosphate starvation are created for *Fabaceae* and there is a displacement of them from the herbage. If there is insufficient potassium supply, valuable grass species fall out and species that can absorb it from hard-to-reach forms spread [9].

In recent years, the interest of sowing herbs has significantly increased on meadowlands of industrial workers and scientists due to the emergence of new technical opportunities and an energy and environmental crisis in the national economy of Ukraine [2]. It was found that seeding *Poaceae* in undisturbed Meadow turf, it does not give positive results in conditions of insufficient supply of nitrogen to the soil. Seedlings that are provided with nitrogen due to its fixation by nodule bacteria take root better. Greater positive effect of seeding *Fabaceae* it is manifested when the soil is sufficiently provided with mobile forms of phosphorus and potassium [10]. For successful sowing, it is necessary to weaken the old coenosis and strengthen the ability of seedlings of sown species to grow rapidly. Better results from this measure are observed in wet growing conditions and in wetter years, in particular in low-lying Meadows than in dry ones [11].

Sowing a legume-cereal mixture in a degenerate Meadow stand quickly improves the species composition of agrocoenoses, reducing the proportion of low-value mixed grasses in feed terms and increasing the productivity of meadowland and feed quality [12; 13]. A similar effect on the structure of reducing coenoses is produced by sowing a cereal mixture, but mineral nitrogen fertilizers provide the increased and stable productivity of these coenoses over the years. Improves the species composition and accelerates the process of stabilization of Meadow coenoses and sowing seeds of wild grass species, which are collected in meadows adapted to certain conditions with natural, but productivity remains low [14].

In the practice of onion farming, the most promising method of creating legume-cereal herbage is sowing perennials *Fabaceae* herbs in loosened strips by combined aggregates [15]. It was found that for seed germination and survival of seedlings, appropriate conditions are necessary, which take root better in places with partially disturbed sod, as well as when draining seeds using phosphorous fertilizers and inoculants. The best results are obtained when sowing *Fabaceae* in a grass stand that has no strong competitors, as well as without the use of nitrogen fertilizers.

The analysis of literature sources on the development and improvement of measures for surface improvement of meadowlands shows that the features of transformation of the species composition of phytocenoses of floodplain mountain meadows of the Carpathians with their surface improvement have not yet been studied. This has become the subject of our research, which is covered in this article.

Research purpose it consists in establishing the features of transformation of the species composition of phytocenoses of floodplain Meadows of the mountain and forest belt of the Carpathians with their superficial improvement.

MATERIALS AND METHODS

Experimental studies on the peculiarities of transformation of the species composition of phytocenoses of Floodplain Meadows of the mountain and forest belt of the Carpathians with their surface improvement were carried out during 2017-2019 in the peasant economy of V.F. Martyshchuk (P. Krasnik Verkhovinsky district, Ivano-Frankivsk region) in the floodplain of the Black Cheremosh river. The soil cover of the experimental site consists of sod-brown-earth shallow underdeveloped carbonate light loamy on alluvium calcites, middle-stony

on the modern alluvium, which is covered with pebbles from a depth of 0.5-1.0 m. The 0-20-cm layer of this soil contains humus – 2.6%, alkaline hydrolyzed nitrogen – 8.4 mg/kg, mobile phosphorus – 4.3 mg/kg, exchange potassium – 7.8 mg/kg with PH Sol. – 5.0 and ecological and agrochemical score-16.

The study was conducted according to generally accepted methods in feed production and onion farming [16]. The size of sown plots is 10 m^2, accounting – 8 m^2. The experiment is repeated four times. The experiment scheme included the following options and factors (table. 1): improvement *factor:* 1) no improvement, 2) $P_{30}K_{60}$, 3) $N_{60}P_{30}K_{60}$, 4) 15 t/ha of manure, $P_{30}K_{60}$ + seeding *Trifolium repens* L. 6 kg/ha for multipurpose use and 5) $N_{60}P_{30}K_{60}$ + seeding the mixture of *Poaceae* (*Phleum pratense* L., 6 kg / ha + *Festuca pratensis* Huds., 10 kg/ha). Factor *usage mode*: 1) haymaking with 2 slopes and 2) multi-slope (imitation of pasture use).

Mineral fertilizers, in doses according to the experiment scheme, in particular, nitrogen in the form of ammonium nitrate, phosphorous – granular superphosphate and potash – kalimagnesia, as well as litter manure, in doses according to the experiment scheme, were applied annually in one period in the spring superficially after snowmelt. Sowing of a mixture of cereals and creeping Clover according to the experiment scheme was carried out once in the spring superficially when laying the experiment in 2017. Mowing of grasses for haymaking use in the first mowing was carried out in the flowering phase of the dominant components of the grass stand, and for multi-mowing (imitation of pasture) and after grass for haymaking use – the height of the grass stand is 15-20 cm.

The species composition of the meadow phytocenosis on the experimental site was studied under the influence of measures for its surface improvement by geobotanical description of grass stands before considering the harvest according to DSTU 4687:2007 [17]. The definition of Meadow plant species and their families was carried out in accordance with the modern nomenclature of taxa [18].

RESULTS AND DISCUSSION

Studies conducted by various authors have established that surface improvement, in particular the introduction of organic and mineral fertilizers and sowing of cereals and legumes of perennial grasses in the sod, has a positive effect on the species composition of Meadow phytocenoses, which in turn has a positive effect on the productivity and chemical composition and nutritional value of feed [2; 19; 20]. In particular, with the introduction of nitrogen fertilizers, growth and development improves and the number of long-term fertilizers increases *Poaceae* herbs and the number of perennials decreases *Fabaceae* herbs and mixed grasses in Meadow phytocenoses. At the same time, their floral saturation decreases. The introduction of phosphorous and potash fertilizers, especially in years favorable for precipitation, leads to an increase in the meadow phytocenosis of perennial plants. *Fabaceae* and reducing the number of *Poaceae*.

Sowing of cultivated species adapted to certain ecological conditions of the growing place, perennial *Fabaceae* without applying nitrogen fertilizers or *Poaceae* by applying these fertilizers, it increases the share of sown species in Meadow phytocenoses. Sowing seeds of wild species on degraded Meadow herbage adapted to certain ecological conditions improves the species composition and accelerates the process of its stabilization [2].

The results of our research presented in the article on the influence of surface improvement measures for floodplain meadowlands with natural herbage of the Black Cheremosh River in the Carpathian Mountain and forest belt on their botanical feed composition are described below. The original herbage before laying the experiment was cereal-mixed with the content of wild plants *Poaceae* 53-54%, mixed grasses – 39-42% and unseeded *Fabaceae* 4-8%, which is clearly visible in Figure 1 in the version without fertilizers.

For both haymaking and multi-mowing use in the fertilizer-free version on average for 2017-2019 studies compared to the first year, the ratio between *Poaceae* and mixed grasses did not change much, although there was a tendency to increase *Poaceae* and reduction of mixed grasses (Table 1, Fig. 1). For $P_{30}K_{60}$, there was an increase in the content of wild perennial *Fabaceae* plants for haymaking use by 2%, and for multicut – by 5%.

For $N_{60}P_{30}K_{60}$ compared to $P_{30}K_{60}$ during haymaking use, an increase was observed in unseeded crops of *Poaceae* by 9% while the content was reduced of *Fabaceae* by 5% and of mixed grasses by 6%. In this case, the multi-year use of cereals increased by 10%, and legumes and various grasses decreased by 7 and 8%, respectively.

When applying manure in comparison with the option without fertilizers, the changes between these botanical groups were similar to the changes that were observed under the action of applying $N_{60}P_{30}K_{60}$ compared to making a $P_{30}K_{60}$, but less pronounced (Table 1). When applying manure in comparison with the option without fertilizers for haymaking use, an increase was observed in the share of unseeded crops of *Poaceae* by 7% when the content was reduced of *Fabaceae* by 2% and of mixed grasses by 5%. For multipurpose use, *Poaceae* increased by 5% in this case, and *Fabaceae* and mixed grasses decreased by 1 and 4%, respectively.

Analysis of the results of sowing a mixture of *Poaceae* herbs and *Phleum pratense* L. and *Festuca pratensis* Huds. in the sod in spring against the background of making $N_{60}P_{30}K_{60}$ for haymaking use showed that the greatest changes occurred with the Botanical composition of the herbage in this case, according to the average data. Total share *Poaceae* compared to making $N_{60}P_{30}K_{60}$ it increased from 67 to 74% or by 7%, and compared

to the option without fertilizers – by 17%, and mixed grasses decreased – by 6 and 13%, respectively. As part of the *Poaceae* Botanical group, the total share of sown grasses increased to 43%, including *Phleum pratense* L. – up to 19%, and *Festuca pratensis* Huds. – up to 24%. At the same time, the number of unseeded *Poaceae* crops decreased by 26% compared to the option with the introduction of $N_{60}P_{30}K_{60}$ and by 22% compared to the option without fertilization.

For multi-year use for sowing in the sod in spring against the background of $P_{30}K_{60}$ *Trifolium repens* L. application according to the data averaged over three years, its share increased by 30%, and the total number of *Fabaceae* increased from 12 to 44% or by 32%, and by 37% compared to the option without fertilization. Simultaneously, the share of *Poaceae* decreased by 16 and 20%, respectively, and that one of mixed grasses by 11 and 6%, respectively.

Analysis of the results of studies by year showed that in this case, the patterns of changes that occurred with the ratio of botanical groups of grass stands, both for haymaking and multi-mowing use, were mostly similar to the results obtained on average over three years (Fig. 1). For haymaking use in the direction from the 1st to the 3rd year, there was an increase in the total share of grass stands *Poaceae* and a reduction in the number of mixed grasses by 3-9%. Against the background of making $N_{60}P_{30}K_{60}$ and for sowing the mixture *Poaceae* these changes were more significant. Among the sown herbs in the variant with sowing a mixture of cereals for three years there was an increase in the content *Phleum pratense* L. and reducing the share *Festuca pratensis* Huds. by 8-13%.

For multi-manual use, the largest share of *Poaceae* in most options, except for the option with seeding *Trifolium repens* L., was in the second year of use. At the same time, this year, in these variants, the lowest share of *Fabaceae* in the herbage (at the level of 3-5%) was also due to adverse weather conditions, resulted from the lack of moisture. Meanwhile, as in the option with seeding *Trifolium repens* L. in the sod, its share was stable during all three years of research in the herbage at the level of 37-40%.

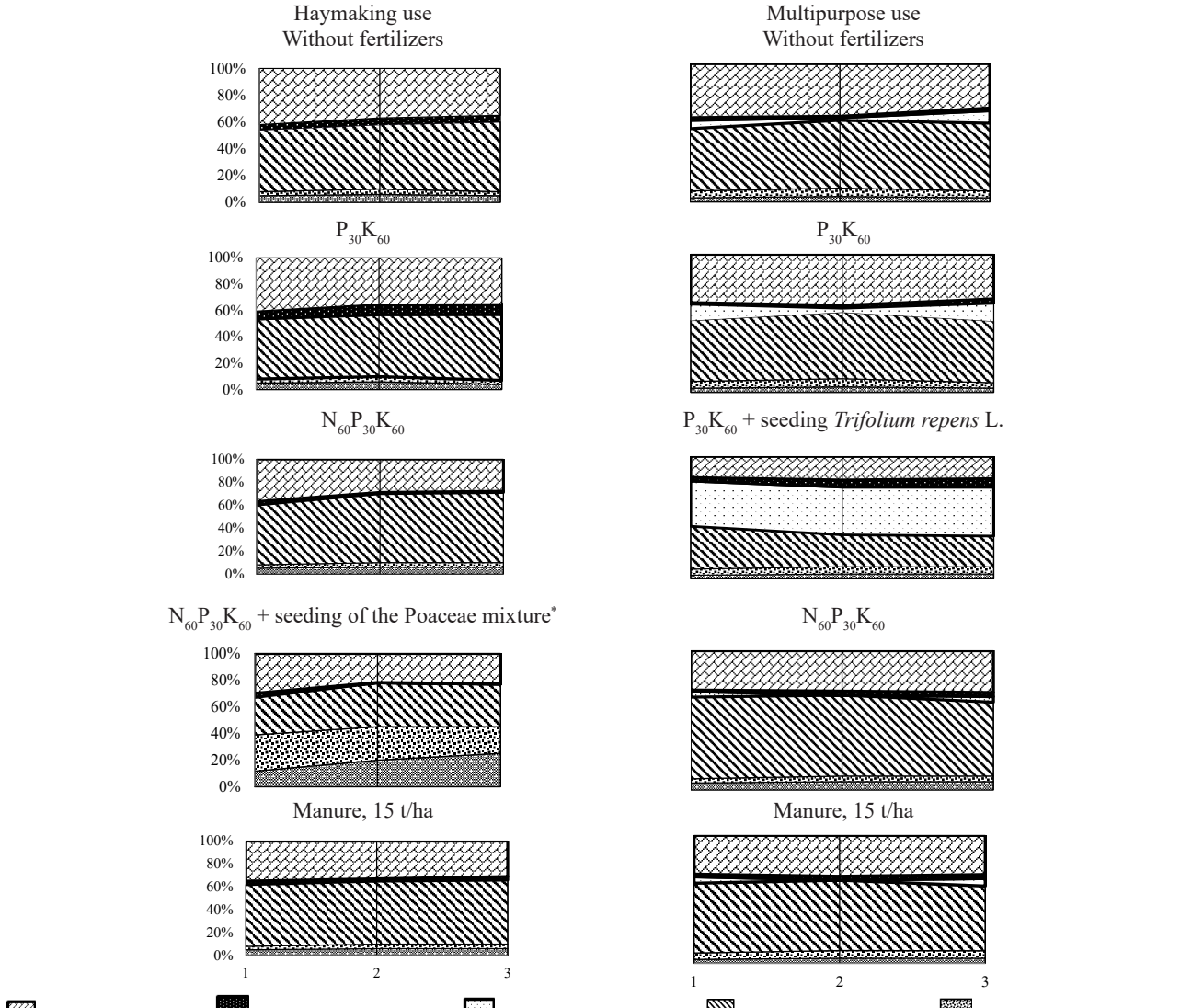

Figure 1. *Botanical composition of the grass stand of floodplain mountain meadows depending on surface improvement measures, 2017-2019, %*

Notes*: 1, 2, 3 – years of use. *Components of the mixture: 1) Phleum pratense L., 6 kg/ha +2) Festuca pratensis Huds., 10 kg/ha*

***Table 1**. Botanical composition of the grass stand of floodplain Meadows depending on surface improvement measures (average for 2017-2019)*

Options for improvement measures	Total *Poaceae*	Including		Unseeded	Total *Fabaceae*	Including *Trifolium repens* L.	Miscellaneous herbs
		By components*					
		First	Second				
Haymaking use							
Without fertilizers	57	5	3	49	5	–	38
$P_{30}K_{60}$	56	5	3	48	7	–	37
$N_{60}P_{30}K_{60}$	67	6	4	57	2	–	31
$N_{60}P_{30}K_{60}$ + seeding of the *Poaceae* mixture*	74	19	24	31	1	–	25
Manure, 15 t/ha	64	6	4	54	3	–	33
HIP_{05}, t/ha							
Multipurpose use							
Without fertilizers	58	3	5	50	7	6	35
$P_{30}K_{60}$	54	3	5	46	12	9	37
$P_{30}K_{60}$ + seeding *Trifolium repens* L.	38	4	6	28	44	39	18
$N_{60}P_{30}K_{60}$	66	6	4	56	5	3	29
Manure, 15 t/ha	63	4	6	53	6	4	31
HIP_{05}, t/ha	3	1	1	3	2	2	2

*Components of the mixture: 1) *Phleum pratense* L., 6 kg/ha +2) *Festuca pratensis* Huds., 10 kg/ha

The results of studies on the study of the floral saturation of the meadow natural grass stand of the floodplain in the third year of use, depending on the measures of surface improvement for haymaking and multi-mowing use are shown in Table 2. Their analysis showed that among the improvement measures in the composition of the meadow phytocenosis of the floodplain, the largest number of species (43) was recorded for multi-peak use in variants without fertilization and against the background of $P_{30}K_{60}$, which is 6 more species than for haymaking use.

***Table 2**. Share of components of meadow grass stand of the floodplain depending on surface improvement measures, % (3rd 2019 year of use)*

Types	Haymaking use				Multipurpose use			
	Without fertilizers	$P_{30}K_{60}$	$N_{60}P_{30}K_{60}$	$N_{60}P_{30}K_{60}$ + seeding of the *Poaceae* mixture*	Without fertilizers	$P_{30}K_{60}$	$P_{30}K_{60}$ + seeding *Trifolium repens* L.	$N_{60}P_{30}K_{60}$
Poaceae								
Cynosurus cristatus L.	5	5	4	2	3	2	–	4
Festuca pratensis Huds.	3	3	4	20	5	4	6	4
Festuca ovina L.	3	3	3	–	8	6	5	8
Festuca rubra L. s. str.	13	13	15	10	15	14	11	18
Calamagrostis arundinaceae (L.) Roth	4	4	6	3	+	+	+	–
Holcus mollis L.	8	6	7	3	9	7	5	9
Agrostis gigantea Roth	3	3	8	7	+	+	+	–
Agrostis canina L.	–	–	–	–	+	1	+	3
Agrostis tenuis Sibth.	1	1	–	–	+	+	–	–
Elytrigia repens (L.) Nevski	5	5	7	4	5	5	–	5
Phleum pratense L.	5	4	6	25	3	3	4	6

Table 2, Continued

Types	Haymaking use				Multipurpose use			
	Without fertilizers	$P_{30}K_{60}$	$N_{60}P_{30}K_{60}$	$N_{60}P_{30}K_{60}$ + seeding of the *Poaceae* mixture*	Without fertilizers	$P_{30}K_{60}$	$P_{30}K_{60}$ + seeding *Trifolium repens* L.	$N_{60}P_{30}K_{60}$
Poa palustris L.	7	7	10	3	2	2	–	4
Poa annua L.	+	+	–	–	3	3	2	–
Briza media L.	–	–	–	–	+	+	–	–
Deschampsia caespitosa (L.) Beauv.	4	4	1	+	5	4	2	2
Total types, %	60	57	71	74	57	52	35	63
Total types, pcs.	13	13	11	10	15	15	10	10
Fabaceae								
Trifolium montanum L.	4	5	1	–	1	2	5	2
Trifolium pratense L.	1	3	–	–	1	1	2	1
Trifolium repens L.	–	–	–	–	9	13	40	4
Total types, %	5	8	1	–	11	16	47	7
Total types, pcs.	2	2	1	–	3	3	3	3
Mixed grasses**								
Arnica montana L.	3	3	3	+	3	3	+	3
Anemone nemorosa L.	+	+	+	+	+	+	+	+
Blechnum spicant (L.) Roth	+	+	–	–	+	+	–	–
Heracleum spondylium L.	+	+	+	+	+	+	+	+
Capsella bursa-pastoris (L.) Medik.	4	4	2	3	4	4	3	3
Rhinanthus alpinus Baumg.	5	5	3	3	5	5	3	4
Rhinanthus minor L.	+	+	–	–	+	+	–	–
Campanula carpatica Jacq.	+	+	+	–	+	+	–	+
Ranunculus acris L.	+	+	+	+	+	+	+	+
Stellaria media (L.) Vill.	+	+	–	–	+	+	–	–
Carum carvi L.	+	+	+	+	+	+	+	+
Leucanthemum vulgare Lam.	4	4	4	4	4	4	4	4
Taraxacum officinale Webb. ex Wigg	5	5	5	4	5	5	2	5
Hieracium viscidulum Tausch	–	–	+	+	+	+	+	+
Cirsium arvense (L.) Scop.	–	–	+	+	+	+	+	+
Clinopodium vulgare L.	+	+	–	–	–	–	–	–
Potentila anserina L.	3	3	3	3	3	3	3	3
Potentila aurea L.	1	1	1	1	1	1	1	1
Potentila argentea L.	5	5	5	4	5	5	2	5
Galium aparine L.	–	–	–	–	+	+	–	–
Plantago lanceolata L.	2	2	2	+	2	2	+	2
Juncus castaneus Smith	+	+	+	+	+	+	+	+
Viola biflora L.	–	–	–	–	+	+	–	–
Equisetum sylvaticum L.	+	+	+	–	+	+	–	–
Rumex carpaticus Zapal.	+	+	+	1	+	+	+	+
Total types, %	35	35	28	23	32	32	18	30
Total types, pcs.	22	22	18	16	25	25	16	19
Cyperacea								
Carex digitate L.	–	–	–	–	+	+	–	+
Carex montana L.	–	–	–	–	+	+	–	+
Total types, pcs.	37	37	30	26	43	43	29	32

***Notes**: * – mix components: 1) Phleum pratense L., 6 kg/ha +2) Festuca pratensis Huds., 10 kg/ha; ** – the amount of mixed grasses is given together with Cyperacea*

It should be noted that for making $N_{60}P_{30}K_{60}$ in comparison with the background $P_{30}K_{60}$ the floral saturation of the studied coenosis decreased from 43 to 29 or by 14 species for multi-year use and from 37 to 30 or by 7 species for haymaking use. The lowest floral saturation was in the variants with sowing perennial grasses in the sod. For sowing the mixture of *Poaceae* herbs on the background of $N_{60}P_{30}K_{60}$ for haymaking use, the total

number of species decreased from 30 to 26 or by 4 species, and for sowing *Trifolium repens* L. for multi-year use on the background of $P_{30}K_{60}$ – from 43 to 29 or for 14 types.

The floral saturation of the phytocenosis in all variants of surface improvement was higher for multi-year use than for haymaking.

Most of the species (25) were from the Botanical group of mixed grasses together with *Cyperacea* with the highest share of 32%, also recorded on the same backgrounds and usage mode. *Arnica montana* L., *Capsella bursa-pastoris* (L.) Medik., *Rhinanthus alpinus* Baumg., *Leucanthemum vulgare* Lam., *Taraxacum officinale* Webb. ex Wigg, *Potentila anserina* L., *Potentila aurea* L., and *Potentila argentea* L., *Rumex carpaticus* Zapal were among the mixed grasses, the share of which was the largest, namely in the range of 1-5%. The remaining species listed in Table 2 were found singly. The modes of Use and fertilization did not naturally affect the share of species from the mixed grass group.

In second place on the same fertilizer options in terms of the number of species (15) was the Botanical group *Poaceae* with a share of 52-57% against the background of $P_{30}K_{60}$ and multi-level usage mode. *Festuca rubra* L. s. str. (14-15%), *Holcus mollis* L. and *Festuca ovina* L. (6-9% each), *Deschampsia caespitosa* (L.) Beauv., *Elytrigia repens* (L.) Nevski, *Festuca pratensis* Huds., *Poa palustris* L. and *Poa annua* L., *Phleum pratense* L., *Cynosurus cristatus* L. (4-5% each) occupied the largest share among *Poaceae* for these options. *Calamagrostis arundinaceae* (L.) Roth, *Agrostis gigantea* Roth. were present for haymaking use in the herbage with a share in the range of 3-8%, while for multi-year use they were found mainly singly. On the contrary, *Poa annua* L. more was in the grass stand for multi-armed use. The total number increased from 10 to 45% for sowing the mixture of *Poaceae* herbs with *Festuca pratensis* Huds. and *Phleum pratense* L. on the background of $N_{60}P_{30}K_{60}$.

The lowest number of species (3) was from the *Fabaceae* group with the highest share (47%) in the variant with seeding *Trifolium repens* L. against the background of making $P_{30}K_{60}$ for multipurpose use. Against the background of making $P_{30}K_{60}$ without seeding *Trifolium repens* L., the share of its wild population was 13%. Due to seeding *Trifolium repens* L., its share increased by 34% in the 3rd year of use. The share of *Trifolium montanum* L. was more under the haymaking regime than under the multi-towed one.

When analyzing the distribution of components by the life span of the meadow grass stand of the floodplain, it was revealed that regardless of the studied surface improvement options and use modes, among all species, most (24-37) belonged to perennials, with a share of 93-98% of the total crop weight (Table 3). Regarding surface improvement measures in both modes of use, the largest number of perennials with the largest percentage of the total crop mass was in the version without fertilizers and against the background of $P_{30}K_{60}$, and least of all for sowing seeds *Poaceae* or *Fabaceae* grass in the sod. With additional application of nitrogen in a dose of N_{60} against the background of $P_{30}K_{60}$ the number of perennials decreased, as well as the total number of species. The number of annuals and biennials was insignificant with fluctuations of 1-5 and 1 species, respectively, with a share of 2-7% and 0-3% of the total crop mass.

***Table 3**. Distribution of meadow grassland components by life expectancy depending on surface improvement measures, 3rd 2019 year of use*

Options for improvement measures	Number of types, pcs.				% Of the total crop weight		
	⊙	Θ	ϒ	Together	⊙	Θ	ϒ
Haymaking use							
Without fertilizers	4	1	32	37	4	1	95
$P_{30}K_{60}$	4	1	32	37	4	3	93
$N_{60}P_{30}K_{60}$	1	1	28	30	2	-	98
$N_{60}P_{30}K_{60}$ + seeding of the *Poaceae* mixture	1	1	24	26	3	-	97
HIP_{05}, t/ha							
Multipurpose use							
Without fertilizers	5	1	37	43	7	-	93
$P_{30}K_{60}$	5	1	37	43	7	-	93
$P_{30}K_{60}$ + seeding *Trifolium repens* L.	2	1	26	29	5	-	95
$N_{60}P_{30}K_{60}$	1	1	30	32	3	-	97
HIP_{05}, t/ha							

***Notes**: * ⊙ – annuals; Θ – biennials; ϒ – perennials*

The distribution of components by meadow grass stand families of the floodplain, depending on surface improvement measures, is shown in Table 4. Analysis of the results showed that 45 species of meadow plants from 21 families were recorded in the meadow grass stand of the floodplain with different improvement options and different use modes. The following families represented the species that took part in the formation of the meadow grass stand crop: *Asteraceae*, *Araliaceae*, *Fabaceae*, *Caryophyllaceae*, *Polygonaceae*, *Ranunculaceae*, *Poaceae*, *Apiaceae*, *Nelumbonaceae*, *Plantaginaceae*, *Scrophulariaceae*, *Rosaceae*, *Juncaceae*, *Equisetaceae*, *Brassicaceae* etc. Most of the species, namely 15, belonged to the *Poaceae* family. the *Asteraceae* family was the second with 5 types of herbs, the *Fabaceae* and *Rosaceae* families were on the third with 3 types of each, and the *Scrophulariaceae* and *Cyperaceae* families were the fourth with 2 types of each. The remaining families were represented by one species each.

***Table 4**. Distribution of components by families of meadow grass stand of the floodplain depending on surface improvement measures, pcs. (3rd year of Use 2019)*

Families	Haymaking use				Multipurpose use				Total types
	Without fertilizers	$P_{30}K_{60}$	$N_{60}P_{30}K_{60}$	$N_{60}P_{30}K_{60}$ + seeding of the *Poaceae* mixture*	Without fertilizers	$P_{30}K_{60}$	$P_{30}K_{60}$ + seeding *Trifolium repens* L.	$N_{60}P_{30}K_{60}$	
Asteraceae	3	3	5	5	5	5	5	5	5
Araliaceae	1	1	–	–	1	1	–	1	1
Blechnaceae	1	1	–	–	1	1	–	–	1
Fabaceae	2	2	1	–	3	3	3	3	3
Caryophyllaceae	1	1	1	–	–	–	–	–	1
Polygonaceae	1	1	1	1	1	1	1	1	1
Lamiaceae	1	1	–	–	–	–	–	–	1
Campanulaceae	1	1	-	-	1	1	–	1	1
Ranunculaceae	1	1	1	1	1	1	1	1	1
Poaceae	13	13	11	10	15	15	10	10	15
Apiaceae	1	1	1	1	1	1	1	1	1
Nelumbonaceae	1	1	1	1	1	1	1	1	1
Rubiaceae	1	1	–	–	1	1	–	1	1
Cyperaceae	–	–	–	–	2	2	–	–	2
Plantaginaceae	1	1	1	1	1	1	1	1	1
Scrophulariaceae	2	2	1	1	2	2	1	1	2
Rosaceae	3	3	3	3	3	3	3	3	3
Juncaceae	1	1	1	1	1	1	1	1	1
Violaceae	–	–	–	–	1	1	–	–	1
Equisetaceae	1	1	1	–	1	1	–	–	1
Brassicaceae (Cruciferae)	1	1	1	1	1	1	1	1	1
Total families	19	19	14	11	19	19	12	15	21
Total types	37	37	30	26	43	43	29	32	45

In the *Poaceae* family, most of the types were for multi-year use on options without fertilizers and against the background of $P_{30}K_{60}$. Among the surface improvement options, the largest number of families (19) was observed for multi-year use on options without fertilizers and against the background of $P_{30}K_{60}$, and the smallest (11-12) – for sowing the mixture of *Poaceae* herbs on the background of $N_{60}P_{30}K_{60}$ for haymaking use

and sowing *Trifolium repens* L. for multi-year use on the background of $P_{30}K_{60}$.

CONCLUSIONS

Floodplain meadow phytocenoses are mainly cereals and mixed grasses with a share of wild cereals of 57-58% (up to 15 of them % *Festuca rubra* L. s. str. and 5-6% of low-value ones in feed terms *Calamagrostis arundinaceae* (L.) Roth and *Deschampsia caespitosa* (L.) Beauv.), mixed grasses – 35-38% and unseeded *Fabaceae* 5-7%. When applying a set of measures for surface improvement of cereals and mixed grasses, low productive (within 1.95-2.15 t/ha of dry weight) floodplain mountain meadowlands, their species composition improved. For making $P_{30}K_{60}$ the content of wild plants increased by 2-5% *Fabaceae*, A $N_{60}P_{30}K_{60}$ – for 9-10% of unseeded cereals. For haymaking use and sowing a mixture of *Poaceae* with *Phleum pratense* L. and *Festuca pratensis* Huds. against the background of making $N_{60}P_{30}K_{60}$ in the sod in spring, their share increased to 74%, and to 44% or by 32% for multi-year use and sowing *Trifolium repens* L. against the background of making $P_{30}K_{60}$ quantity *Fabaceae* increased.

The highest floral saturation (43 species from 19 families and 93-98% from perennials) was observed in variants without fertilization and with the introduction of $P_{30}K_{60}$ for multi-year use, which is 4-14 species more compared to haymaking use, or with the introduction of $N_{60}P_{30}K_{60}$ and/or with sowing the mixture of *Poaceae* herbs on the background of $N_{60}P_{30}K_{60}$ for haymaking use, or sowing *Trifolium repens* L. against the background of $P_{30}K_{60}$ for multipurpose use.

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Динаміка видового складу фітоценозів заплавних гірських луків Карпат за поверхневого їх поліпшення

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Анотація. Проведеними дослідженнями різних авторів розроблено ряд заходів поверхневого поліпшення лучних угідь у різних ґрунтово-кліматичних умовах. Однак досліджень стосовно вивчення впливу таких заходів поверхневого поліпшення як застосування органічних і мінеральних добрив та підсівання злакових і бобових багаторічних трав у дернину на динаміку видового складу заплавних гірських луків Карпат ще не проводилось, що підтверджує актуальність даного дослідження. У статті наведено результати трирічних досліджень, проведених впродовж 2017–2019 рр. у селянському господарстві Мартищука В.Ф. (Верховинський район Івано-Франківської області) з вивчення особливостей трансформації видового складу природних фітоценозів заплавних луків р. Чорний Черемош гірсько-лісового поясу Карпат під дією поверхневого їх поліпшення із застосуванням органічних і мінеральних добрив та підсівання злакової суміші за сінокісного використання і *Trifolium repens* L. – за багатоукісного використання. Встановлено, що заплавні лучні фітоценози є переважно злаково-різнотравними з часткою дикорослих злаків 57–58 % (з них до 15 % *Festuca rubra* L. s. str. і по 5–6 % малоцінних у кормовому відношенні *Calamagrostis arundinaceae* (L.) Roth та *Deschampsia caespitosa* (L.) Beauv.), різнотрав'я – 35–38 % та несіяних *Fabaceae* 5–7 %. За застосування комплексу заходів поверхневого поліпшення злаково-різнотравних, низькопродуктивних (в межах 1,95–2,15 т/га сухої маси) заплавних гірських лучних угідь покращувався їх видовий склад. За внесення $P_{30}K_{60}$ на 2–5 % збільшувався вміст дикорослих *Fabaceae*, а $N_{60}P_{30}K_{60}$ – на 9–10 % несіяних *Poaceae*. За сінокісного використання за підсівання навесні в дернину суміші *Poaceae* з *Phleum pratense* L. і *Festuca pratensis* Huds. на фоні внесення $N_{60}P_{30}K_{60}$ частка їх збільшилася до 74 %, а за багатоукісного використання й за підсівання *Trifolium repens* L. на фоні внесення $P_{30}K_{60}$ кількість *Fabaceae* збільшилася до 44 % або на 32 %. Найбільша флористична насиченість (43 види з 19 родини та на 93–98 % з багаторічників) спостерігалася у варіантах без внесення добрив та за внесення $P_{30}K_{60}$ за багатоукісного використання, що на 4–14 видів більше у порівнянні з сінокісним використанням, або з внесенням $N_{60}P_{30}K_{60}$ та або з підсіванням суміші злакових трав на фоні $N_{60}P_{30}K_{60}$ за сінокісного використання, або підсівання *Trifolium repens* L. на фоні $P_{30}K_{60}$ за багатоукісного використання

Ключові слова: бобові, злаки, видовий склад, лучний фітоценоз, різнотрав'я, флористична насиченість