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(що на 30-44 % більше, ніж в одновидковому посіві) із вмістом у кормі 28,3-30,7 кормових одиниць і 3,85-5,02 кг перетравного протеїну (у посушливій рік – 36,0; 21,4 і 3,0, відповідно). Із бобово-аланових травосумішок найвищою прожаркістю відмічена еспарцето-тростяцезла – 30,4-37,0 т/га (25,4 т/га – в посушливих умовах). **Висновки.** Встановлено, що еспарцет піщаний на дерновому ґрунті доцільно вирощувати в бідних сумішках з люцерною сьомогібридною та з тростяцею збірною, що забезпечують стабільну продуктивність та якість корму.

**Ключові слова:** дерновий ґрунт, еспарцет піщаний, травосумішки, екологічна стабільність, продуктивність, якість корму.

The farming lands of the Zhytomyr Polissia occupy about 1 million hectare. The soil cover is characterized by big diversity according to the level of fertility and the degree of gleization [1]. About 40% of farming lands are in waterlogged phase. The unsatisfactory work of the drain systems restricts the cultivation of grain and arable crops. For this reason, such lands are recommended to be withdrawn from the intensive cultivation and to be transformed into forage lands.

The creation of high-performance long-viable herbage with high soil protective effect on the lands brought out of arable areas is one of the important issues of the agricultural science and practice.

Long-term herbs, which are recommended for the distribution in the Polissia area, are very various in respect of biological features as well as the requirements to cultivation conditions. Each of them occupies its own niche in the optimized agrolandscape. We improved the cultivation technologies of such long-term leguminose grasses as a meadow clover, lucerne, birdsfoot deer vetch, both in pure sowing and in legume-grass mixtures on the drained mineral soils of differing moistening degrees [2-4]. We believe that, except the above-mentioned herbs, much more attention

## THE PECULIARITIES OF FORMATING HERBAGE MIXTURES PRODUCTIVITY BY MEANS OF HUNGARIAN SAINFOIN ON SODDY SOIL

**Вступ.** Крім традиційних багаторічних бобових трав, що вирощуються на осушуваних мінеральних ґрунтах, заслуговує на увагу еспарцет піщаний. Тому метою наших досліджень є визначення продуктивності та якості агрофітоценозів на основі еспарцету на дерновому ґрунті. **Умови та методика досліджень.** Дослідження проводилися на дерновому ґрунті з вмістом гумусу – 3,17 %, рН – 6,4, рухомих форм фосфору та калію, відповідно, – 140 і 96 мг/кг ґрунту. Вивчалися еспарцет у чистому посіві та бобові і бобово-аланові травосумішки на його основі. **Результати досліджень.** Найвища продуктивність та якість зеленого корму була встановлена в двоконпонентних сумішках еспарцету піщаного з люцерною сьомогібридною та з тростяцею збірною. Еспарцето-люцерновий ценоз забезпечив найвищу продуктивність – на рівні 45,2-51,0 т/га зеленої маси

should be paid to such a long-term legumes culture as Hungarian sainfoin [5].

**The research design.** The research was carried out while temporary experiment in Polissya Institute of Agriculture on drained soddygley deep light loamy soil under the unilateral control of soil water and air regime with the following weighted average: the content of humus – 3,17%, рН<sub>soil</sub> – 6,4, hydrolytic acidity – 1,70 mg-equiv, mobile forms of phosphorus and potassium, respectively, 14,0 and 9,6 mg per 100 g of the soil.

The research studied 10 options of legumes and legume-grass mixtures based on Hungarian sainfoin (see tab.1 and 2). The mineral fertilizers are applied on the general background – P40K60.

**The findings of the investigation.** One of the necessary conditions promoting the active increase of vegetative mass of long-term herbs is their optimum provision with soil moisture during the vegetation period. Our research constantly observed the dynamics of the soil moisture provision in the main phases of herbs development as well as during their critical periods. Considering that the soddy soil is characterized by a high moisture capacity, it does not undergo intensive moisture evaporations even during an air drought.

Within four years of herbs use, spring moisture reserves in a meter layer made from 160 to 280 mm that was enough for the normal growth and development of herbage. During the summer period, the amount of moisture decreased to 140 mm but it was not critical for the cultures. The most season was the summer period of 2015 when the moisture content decreased to 70 mm, thus influencing the decline in the productivity of the second and the third haymakings.

The results of the research evidence that the structure of herbage mixtures has changed over the years of their use (the tab.1). For example,

the wild grasses share in the Hungarian sainfoin monoculture doubled – to 31% on the fourth year of its use. The mixture of Hungarian sainfoin with clover differed in high content of wild grass – upto 38%. Beginning with the second year of use, clover was gradually exclude out of herbage by weed coenosis.

Its share in leguminose components with lucerne (the latter by fourth year held supremacy) its share in binary mixtures made 58%, in three-component – 43%, in four-component legume-grass mixture – 28%.

In other options of leguminose mixtures the content of wild grass did not exceed 5-8%. The

### 1. The dynamics of botanical structure formation of herbage mixtures first hay crop

№ var.	Plants	Share of plant species, %			
		2012	2013	2014	2015
1	Hungarian sainfoin	83	93	66	69
	wild grass	17	7	34	31
2	Hungarian sainfoin	28	74	73	60
	meadow clover	63	13	2	2
	wild grass	9	13	28	38
3	Hungarian sainfoin	26	26	38	37
	lucerne	65	70	56	58
	wild grass	9	4	5	5
4	Hungarian sainfoin	51	83	51	57
	birdsfoot deer vetch	39	8	17	23
	wild grass	10	9	32	20
5	Hungarian sainfoin	50	41	33	35
	lucerne	21	41	45	43
	birdsfoot deer vetch	20	16	14	17
	wild grass	9	2	9	5
6	Hungarian sainfoin	65	79	46	35
	bunchgrass	23	12	49	58
	wild grass	12	9	5	7
7	Hungarian sainfoin	59	84	64	69
	meadow catmint	28	10	28	24
	wild grass	13	6	8	7
8	Hungarian sainfoin	52	55	45	48
	cocksfoot	33	42	51	47
	wild grass	15	3	4	5
9	Hungarian sainfoin	34	24	21	22
	lucerne	17	29	28	28
	bulbous oat grass	17	13	27	20
	cocksfoot	21	26	16	21
10	wild grass	11	8	8	8
	Hungarian sainfoin	38	51	53	52
	birdsfoot deer vetch	15	12	7	10
	meadow catmint	16	20	17	18
	meadow fescue	17	10	17	13
wild grass	14	7	7	7	

exception was Hungarian sainfoin + birdsfoot deer vetch: the high contamination (20%) is explained by a low share of birdsfoot deer vetch in a census – 23%. All the years of the herbage utilization point out the oppression of birdsfoot deer vetch by Hungarian sainfoin, that proves their incompatibility.

Within the binary legume-grass mixture Hungarian sainfoin + Bunchgrass, the latter gradually excludes legumes culture and makes 58%. Meadow catmint as a late culture, on the contrary, is replaced by Hungarian sainfoin, which made 69% in structure of a herbage mixture.

The option of Hungarian sainfoin + cocksfoot stood out in the respect of the greatest ecological stability. These cultures coincide according to the phases of their development as well as the ripeness onset. The ratio of legume and grass culture during the years of utilization practically did not change.

The productivity of these herbage within four years of utilizations depended on their species-specific structure (tab.2). The

productivity of Hungarian sainfoin green material in pure sowing fluctuated within 27,6-35,5 t/hectare, or in terms of dry weight – 6,8-8,1 t/hectare. Hungarian sainfoin mixtures with other legume herbs (var.3-5) were 13,7-36,6% more productive.

The first year of utilization gave the highest productivity of green material – 48,5 t/hectare was received in two-component mixes of Hungarian sainfoin with meadow clover and with birdsfoot deer vetch, during the fourth year this indicator decreased to 24,1 and 30,9 t/hectare, respectively (in the first and second census).

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## 2. Perennial herbs yielding capacity, t/hectare

№ var.	The composition of herbage mixtures	Yielding capacity, t/hectare							
		2012		2013		2014		2015	
		g.m.*	d.m.*	g.m.	d.m.	g.m.	d.m.	g.m.	d.m.
1	Hungarian sainfoin in single-crop sowing	33.6	6.8	35.5	8.1	33.4	7.4	27.6	6.8
2	Hungarian sainfoin + meadow clover	48.5	9.1	27.1	6.6	29.5	6.8	24.1	5.6
3	Hungarian sainfoin + lucerne	46.8	9.7	51.0	11.7	45.2	10.5	36.0	9.1
4	Hungarian sainfoin + birdsfoot deer vetch	48.5	8.8	40.2	9.5	39.7	8.4	30.9	7.7
5	Hungarian sainfoin + lucerne + birdsfoot deer vetch	40.9	9.1	41.6	9.5	41.2	9.3	31.4	7.9
6	Hungarian sainfoin + bunchgrass	31.3	7.6	29.5	6.6	30.8	7.1	24.6	6.4
7	Hungarian sainfoin + meadow catmint	31.8	6.8	27.8	6.6	26.5	5.6	21.1	5.0
8	Hungarian sainfoin + cocksfoot	34.7	7.8	37.0	9.1	30.4	7.3	25.4	6.7
9	Hungarian sainfoin + lucerne + bulbous oatgrass + cocksfoot	31.8	6.9	28.7	6.3	26.5	6.4	22.8	5.5
10	Hungarian sainfoin + birdsfoot deer vetch + meadow catmint + meadow fescue	30.0	5.9	24.5	5.8	23.0	5.1	19.1	5.0
	НІР <sub>05</sub>	2.5	0.2	3.2	0.3	1.69	0.36	1.98	0.17

material in pure sowing fluctuated within 27,6-35,5 t/hectare, or in terms of dry weight – 6,8-8,1 t/hectare. Hungarian sainfoin mixtures with other legume herbs (var.3-5) were 13,7-36,6% more productive.

The first year of utilization gave the highest productivity of green material – 48,5 t/hectare was received in two-component mixes of Hungarian sainfoin with meadow clover and with birdsfoot deer vetch, during the fourth year this indicator decreased to 24,1 and 30,9 t/hectare, respectively (in the first and second census).

From the second year of utilization, the binary mixture of Hungarian sainfoin with lucerne is the most productive, the outcome of green material made 51,0 t/hectare, and

in the fourth, the most droughty year – 36,0 t/hectare; according to the outcome of dry material – 11,7 and 9,1 t/hectare, respectively. An advantage over others legume cenoses make 14,6-27,5%.

The yielding capacity of legume-grass herbage (var.6-10) was 11-47% lower in comparison with legumes. The highest rate of yielding capacity is observed in the mixture of Hungarian sainfoin with cocksfoot which made from 34,7 t/hectare of green material in the first and to 25,4 t/hectare – in the fourth years of utilization. It should be noted that these two cultures supplement each other in biological development in an optimum manner: the beginning of blossoming of Hungarian sainfoin coincides with the earing of cocksfoot.

### 3. Nutritive quality of a perennial herbs forage

Variant №	The content in 100 g of green material							
	year	fodder unit, kg	Digestible protein, kg	Provision with digestible protein, g	year	fodder unit, kg	Digestible protein, kg	Provision with digestible protein, g
1	2012	22.4	3.90	174	2014	22.7	3.03	133
2		27.2	5.12	188		19.6	2.65	135
3		28.8	4.39	152		28.3	3.85	136
4		24.8	3.77	152		23.7	3.27	138
5		24.7	4.30	174		23.3	3.11	133
6		21.6	3.63	147		18.8	2.44	129
7		19.5	2.53	130		17.3	2.13	123
8		22.4	3.43	153		19.0	2.54	134
9		18.4	2.53	137		17.8	2.41	135
10		17.7	2.38	134		16.8	2.22	132
1	2013	26.4	3.73	141	2015	20.9	2.6	124
2		18.9	2.57	136		19.7	2.7	137
3		30.5	5.02	165		21.4	3.0	140
4		29.1	4.10	141		20.4	2.8	137
5		30.2	4.41	146		21.0	2.9	138
6		21.7	2.82	130		22.9	2.7	118
7		20.6	2.65	129		22.4	2.8	125
8		24.3	3.15	130		22.0	2.8	127
9		18.1	2.48	137		21.1	2.5	118
10		17.9	2.25	126		21.5	2.6	121

The least productive are the four-component legume-grass mixtures, in particular, Hungarian sainfoin + birdsfoot deer vetch + meadow catmint + meadow fescue with an outcome of 19,1-30,5 t/hectare of green or 5,0-5,9 t/hectare of dry material. Such combination of herbs are hardly compatible. Birdsfoot deer vetch is to some degree suppressed by a cock's head, and meadow catmint is late in the development, that is, the phase of tasselling begins after the onset of Hungarian sainfoin blossoming.

We defined the nutritional value of herbage mixtures following on from the results of the full zootechnical analysis of a forage and using digestibility coefficients of these indicators [6]. The biocenoses quality at identical mineral nutrition depended on their species-specific structure. The occurrence of legume components in the mixtures provided high feeding quality of these herbage.

During the first year of utilization the high rates were typical of the Hungarian sainfoin + clover mixture, containing 27,2 kg of fodder units and 5,12 kg of protein in a green forage. Respectively, fodder unit provision with digestible protein, being one of the indicators of an adequate forage, was the highest and made 188 g (the tab.3). The lower content of fodder units was observed in the green

material of a single-component Hungarian sainfoin – 22,4 kg, though their provision with digestible protein is rather high – 174 g. Among legume-grass cenoses, the highest protein content is established in a Hungarian sainfoin + Bunchgrass forage – 3,63 kg.

According to the results of the zootechnical analysis, the quality indicators considerably decrease over the years of herbage utilization due to their "aging" and the change in their botanical structure.

In particular, at the fourth year, we used the herbs in binary mixture Hungarian sainfoin with clover for the reason that the latter excluded from the herbage along with the increase of wild grass share; the content of fodder units sharply decreased – to 19,7 kg with the protein being twice reduced – to 2,7 kg.

The mixture of Hungarian sainfoin with lucerne remains both the most productive and qualitative with regard to feeding. It is characterized by the highest content of fodder units and a digestible protein – 21,4 and 3,0 kg respectively, and the provision of a fodder unit with a digestible protein – 140 g. Among legume-grass cenoses, the Hungarian sainfoin with cocksfoot forage is of the highest quality – 22,0, 2,8 and 127, respectively.

## CONCLUSION

*It is expedient to cultivate hungariansainfoin on soddy soil in binary mixtures with a lucerne and cocksfoot, which provide the highest yield capacity and the quality of a forage since the second year of utilization.*

*Agrocenoses of Hungarian sainfoin with lucerne provided the productivity of green material at the level of 45,2-51,0 t/hectare,*

*under drought conditions – 36,0 t/hectare; Hungarian sainfoin with cocksfoot – 30,4-37,0 and 25,4 t/hectare, respectively. During the years of utilisation the fodder quality of the first mixture made up 21,4-30,5 fodder units and 3,00-5,02 kg of a digestible protein, the second mixture showed the value of 19,0-24,3 and 2,54-3,43 respectively.*

## BIBLIOGRAPHY

1. Dibrov B.I. Grunty Zhytomyrskoy oblasti. / B.I. Dibrov / – K.: Urozhay, 1969. – 58 s.
2. Melnyckuk A.O. Produktivnistiladventsiurohato ho v chystykh posivakh v travosumishkakh na os ushuvanomy dermovo-hleyovomu grunty Polissia / A.O. Melnyckuk, O.I. Savchuk, O.O. Vlasenko // Kormyikormovyrobnytstvo: Mizhv. temat. nauk. zbirnyk. – Vinnytsia, 2009. – № 64. – S. 156-162.
3. Savchuk O.I. Vyroshchuvanni koniushynyluchnoyi u Polissi / O.I. Savchuk // Zemlerobstvo: Mizhv. temat. nauk. zbirnyk. – K., 2008. – Vyp. 80. – S. 62-67.
4. Savchuk O.I. Efektyvnist vyroshchuvanni liutsernyzal ezho vid rivni audobrennii anariznykhtypakh gruntyv / O.I. Savchuk, A.M. Bovsunivskyy, O.O. Vlasenko // Kormyikormovyrobnytstvo: Mizhv. temat. nauk. zbirnyk. – Vinnytsia, 2008. – № 61. – S. 55-60.
5. Lemishchenko S.S. Espartsetpishchanny / S.S. Lemishchenko – K., 1951. – 44 s.
6. Praktikum z hodivlisilskohospodarskykh kultur / Ibatulin I.I., Panasenko Yu.O., Kononenko V.K. ta in. – K., 2000. – 371 s.