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NUTRIENTS YIELD OF LEGUMINAL PERENNIAL GRASSES GREEN MASS DEPENDING ON THE VEGETATION FEATURES

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Abstract

In the year of coverless sowing of six species of perennial legumes, the largest yield of green mass of dry matter, metabolic energy, feed units and digestible protein is provided by white clover (*Melilotus albus* L.), as the fastest growing crop among leguminous perennial grasses. In the second year of the growing season, the highest yield of dry matter is provided by sowing of sainfoin (*Onobrychis arenaria* Kit.), and of metabolic energy and feed units - sainfoin (*Onobrychis arenaria* Kit.) and white clover (*Melilotus albus* L.). The highest yield of digestible protein was green fodder of white clover (Melilotus albus L.). In the third year of the vegetation of leguminous perennial grasses, the highest dry matter yield was green mass of sand sainfoin (*Onobrychis arenaria* Kit.) and alfalfa (*Medicago sativa* L.), metabolic energy and fodder units - sainfoin (*Onobrychis arenaria* kit.), alfalfa (Medicago sativa L.). In the fourth year of the growing season, the largest yields of dry matter, metabolic energy and feed units were green fodder of sand sainfoin (*Onobrychis arenaria* Kit.), and digestible protein - sand sainfoin (*Onobrychis arenaria* Kit.) and alfalfa (*Medicago sativa* L.).

Keywords: legumes, perennial grasses, nutrients, yield, growth, development, vegetation.

Formulation of the problem

Feed production uses a limited set of forage crops, including leguminous perennial grasses, which leads to disruptions in the green conveyor. The need to increase the efficiency of the use of plant productivity potential requires the involvement in economic use of uncommon in industrial conditions species of legumes perennial grasses with the simultaneous development of technology for their cultivation [1].

Among the traditional perennial legumes - alfalfa (*Medicago sativa* L.), clover (*Trifolium pratense* L.) and sand sainfoin (*Onobrychis arenaria* Kit.), In recent years have become widespread eastern goatweed (*Galega orientalis* Lam.), and in the southern regions - white clover (*Melilotus albus* L.) and even bird's-foot trefoil (*Lotus corniculatus* L.). In modern fodder production, non-traditional fodder plants are increasingly used, which are characterized by lower feed costs, high adaptability, and also help to solve the problem of fertility and soil protection [2].

However, research information on the advantages of new crops or their disadvantages, compared to long-known and widespread in agricultural production of perennial legumes is insufficient, incomplete and does not allow to draw a reliable conclusion about the choice of one or another type of perennial legumes for green fodder. in the Forest-Steppe of the Right Bank of Ukraine.

Analysis of recent research and publications

Research conducted by Matkevich V.T. (2006) in Ukraine showed that the eastern goatweed (*Galega orientalis* Lam.) provides the highest dry matter yield - 86.84 kg / ha, while alfalfa (*Medicago sativa* L.), meadow clover (*Trifolium pratense* L.), sand sainfoin (*Onobrychis arenaria* Kit.) and white clover (*Melilotus albus* L.) are inferior, respectively, by 25.0; 27.9; 23.3 and 26.8 c / ha, and bird's-foot trefoil (*Lotus corniculatus* L.) - 41.8 c / ha [3–5].

According to other data, alfalfa (*Medicago sativa* L.) accumulates up to 9 t / ha of dry matter and 180 kg / ha of biological nitrogen. *Lotus corniculatus* (L.) has less drought resistance than alfalfa (*Medicago sativa* L.). Its root system is highly branched and penetrates to a depth of 1.5 m and is well adapted to acidic and poor soils. *Lotus corniculatus* L. provides a yield of 7.5 t / ha of dry matter and accumulates 70 kg / ha of biological nitrogen. Oriental goatweed (*Galega orientalis* Lam.) is also drought-resistant, but grows well with neutral acidity and fertile soils with high water holding capacity. The dry matter yield of eastern goatweed (*Galega orientalis* Lam.) reaches 9–10 t / ha [6].

Alfalfa (*Medicago sativa* L.) at moderate rates of mineral fertilizer provides a yield of 112–145 c / ha of dry matter and accumulates in the soil about 100 c / ha of plant residues with a content of 278–296 kg / ha of nitrogen [7].

Meadow clover (*Trifolium pratense* L.) on the background of phosphorus-potassium fertilizers for 2 years of use provides 22.1 t / ha of dry matter, which contains 541 kg of nitrogen, of which 403 kg - symbiotic. In the year of sowing, meadow clover (*Trifolium pratense* L.) provides a yield of 2.5–3 t / ha of dry matter with a content of 80–110 kg / ha of nitrogen [8].

Oriental goat weed (*Galega orientalis* Lam.) with a dry matter yield of 6 t / ha leaves in the soil 16 t / ha of organic residues, which contain 315 kg of nitrogen, of which 46% remains in the soil, and the rest is removed with the harvest in the Ivanovo region Russia on the background of $P_{90}K_{120}$ [9, 10].

Selection of previously unsolved parts of the overall problem

As it has been presented the receipt of very contradictory information on the yield of nutrients of different types of legumes, perennials, which are widespread and insignificant in the forest-steppe of Ukraine, it is necessary to establish the peculiarities of vegetation, as well as the yield of nutrients to cultivation in the conditions of Ukraine.

The purpose of the article

The purpose of the study was to determine the yield of green mass of six species of perennial legumes: alfalfa (*Medicago sativa* L.), meadow clover (*Trifolium pratense* L.), sand sainfoin (*Onobrychis arenaria* Kit.), white clover (*Melilotus albus* L.), bird's-foot trefoil (*Lotus corniculatus* L.) and eastern goatweed (*Galega orientalis* Lam.) depending on the peculiarities of vegetation.

The nutrient indicators of green mass that were studied were the yield of dry matter, metabolic energy, feed units and digestible protein per hectare during each year of research. The peculiarities of growth and development of leguminous perennial grasses were considered to be the duration of days before the onset of each phase of plant development and the accumulation of crops in these phases the sum of active temperatures.

Field research was conducted during 2013–2017 at the Research Farm of the SRF "Agronomichne" of Vinnytsia National Agrarian University. The field of the experimental plot has a wide undulating relief, the flat lands are dominated by slopes. The surface of watershed plateaus is leveled, its slope does not exceed 2–3 °, so the surface runoff of atmospheric and meltwater is slow and soil erosion is almost absent. The soil is moistened due to precipitation, the groundwater level is at a depth of 10-15 m.

The soil at the experimental site is gray podzolic medium loam. The agrochemical composition of the soil of the experimental site is characterized by the following indicators: humus content - 2.0%, hydrolyzed nitrogen (according to Cornfield) - 133 mg / kg of soil - low, mobile forms of phosphorus (according to Chirikov) - 390 mg / kg of soil - very high, mobile forms of potassium (according to Chirikov) - 64 mg / kg of soil - medium, calcium - 130 mg / kg of soil - sufficient, hydrolytic acidity - 2.53 mg.-eq./100 g of soil - increased, the reaction of the soil solution pH. 5.0 - medium acid. Providing the site with trace elements: copper is - 5.4 mg / kg of soil, zinc - 6.0 mg / kg of soil, heavy metal content: lead - 1.4 mg / kg of soil, cadmium - not detected

Sowing of perennial legumes was carried out in 2013 in an uncovered manner in the early spring with the introduction of herbicides. To reduce the acidity of the soil, liming of the experimental site was performed. The formed crop of green mass of grasses was mowed in the phase of the beginning of flowering of plants. Leguminous perennial grasses have been grown for four years. Annual mowing was performed up to three times during the growing season.

The experiments were repeated four times. The estimated area of the field experiment is 50 m^2, the total area of the plot is 70 m^2. Variants in the experiment are placed systematically in 6 blocks.

The following records and observations were performed: phenological observations - approximately on the basis of visual observations of the onset of plant development phases with counting the number of days from germination or restoration of plant vegetation to mowing [11]; accounting for the yield of green mass of perennial legumes - in a continuous way by mowing and weighing all the green mass from the accounting area [11]; determination of biochemical indicators of green fodder quality - on the basis of the generally accepted method of general zootechnical analysis of fodder in the certified and accredited laboratory of the Institute of fodder and agriculture of Podillya NAAS; determination of feed nutrition was performed on the content of protein, fat, fiber, REM, taking into account the coefficients of their digestibility [12, 13]; determination of gross energy - by the content of raw nutrients using the appropriate energy coefficients [14, 15].

Presenting main material

From the second year of life, perennial legumes enter the stage of their full development. During this period and until death, all grasses develop similarly, so phenological observations of plants are considered in the aggregate of all years of life of leguminous perennial grasses.

The beginning of regrowth of perennial legumes in the 2nd and subsequent years of the growing season occurred on average in all research years on March 8-15 and only in the eastern goatweed (*Galega orientalis* Lam.) - on March 27. Plants of sand sainfoin (*Onobrychis arenaria* Kit.) began to grow the fastest on March 8. This is due to the fact that this crop is able to restore spring vegetation at the lowest among all leguminous perennial grasses average daily temperature - 3.8 ºC (Tables 1, 2).

One day later, meadow clover (*Trifolium pratense* L.) begins to grow at an average daily temperature of 4.1 ºC. 4 days later from sandy sainfoin (*Onobrychis arenaria* Kit.) grows white clover (*Melilotus albus* L.) at an average daily temperature of 5.0 ºC and 7 days later - alfalfa (*Medicago sativa* L.) and bird's-foot trefoil (*Lotus corniculatus* L), which begin the spring vegetation for the second and subsequent years of vegetation at an average daily temperature of 6.0 ºC.

The aboveground regrowth of the eastern goatweed (*Galega orientalis* Lam.) began 19 days later than the sand sainfoin (*Onobrychis arenaria* Kit.) and 12 days later than the alfalfa (*Medicago sativa* L.) and the bird's-foot trefoil (*Lotus corniculatus* L.) average daily temperature of 9.2 ºC. The beginning of regrowth of perennial legumes was characterized by the appearance of single shoots on plants.

Table 1

Phases of vegetation of leguminous perennial grasses, average for the second-fourth years of vegetation (SRF "Agronomichne", average. 2014-2017)

Leguminous perennial grasses	Days depending on the phase of vegetation										
	Start date of growth	Tillering	Branching	Budding	Start of flowering	Start date of re-growth 2 nd cut	Budding	Start of flowering	Start date of regrowth 3d c	Budding	Start of flowering
Alfalfa (*Medicago sativa L.*)	15.03.	34	42	75	90	5	26	34	10	30	46
Meadow clover (*Trifolium pratense* L.)	9.03.	40	54	80	88	7	23	31	5	44	51
Sand sainfoin (*Onobrychis arenaria* Kit.)	8.03.	41	49	70	75	21	35	40	8	45	52
White clover (*Melilotus albus* L.)	12.03.	37	42	87	93	-	-	-	-	-	-
Bird's-foot trefoil (*Lotus corniculatus* L.)	15.03.	34	53	66	71	8	33	45	4	19	24
Eastern goatweed (*Galega orientalis* Lam.)	27.03.	21*	28	53	58	8	50	59	17	-	-

* *Note:* eastern goatweed: tillering phase corresponds to the growth and emergence of underground shoots.

Frosts on the soil surface minus 6.0 ºC, which were observed in early April of the second year of life of leguminous perennial grasses caused the freezing of plant leaves. In particular, 30% of the leaf surface of the eastern goatweed (*Galega orientalis* Lam.), 10% of the plant surface of *Lotus corniculatus* L. and *Onobrychis arenaria* Kit., 5% of the surface of meadow clover plants (*Trifolium pratense* L.) were damaged.). The seedlings of alfalfa (*Medicago sativa* L.) and white clover (*Melilotus albus* L.) were not damaged by frost at all.

In 34–41 days after the beginning of regrowth, the formation of a bush from shoots (stalking) is observed in leguminous perennial grasses. This phase occurred most rapidly in alfalfa (*Medicago sativa* L.) and bird's-foot trefoil (*Lotus corniculatus* L.), and latest in sand sainfoin (*Onobrychis arenaria* Kit.). According to the calendar term, this phase occurred in most leguminous perennial grasses at the same time - on April 18–19 at an average daily temperature of 9.3–10.0 ºC and the sum of active temperatures of 257–293 ºC.

Table 2

Accumulation of active temperatures by crops of leguminous perennial grasses depending on phases of vegetation, average for the second-fourth years of vegetation (SRF) "Agronomichne", average 2013-2017)

Leguminous perennial grasses	Average daily temperature at the start of growth	Temperature ºC depending on the vegetation phase									
		Tilling	Branching	Budding	Start of flowering	Start date of regrowth 2 nd cut	Budding	Start of flowering	Start date of regrowth 3d cut	Budding	Start of flowering
Alfalfa (*Medicago sativa L.*)	6,0	257	327	798	994	82	548	758	235	779	1050
Meadow clover (*Trifolium pratense* L.)	4,1	287	482	885	1030	114	492	663	106	1052	1142
Sand sainfoin (*Onobrychis arenaria* Kit.)	3,8	293	415	686	783	379	758	838	208	991	1091
White clover (*Melilotus albus* L.)	5,0	275	343	1119	1201	-	-	-	-	-	-
Bird's-foot trefoil (*Lotus corniculatus* L.)	6,0	257	513	708	805	154	652	943	96	543	623
Eastern goatweed (*Galega orientalis* Lam.)	9,2	149*	243	613	710	145	1069	1299	359	-	-

* *Note:* eastern goatweed: tillering phase corresponds to the growth and emergence of underground shoots.

The eastern goat weed (*Galega orientalis* Lam.) Developed somewhat differently at this time. Unlike other leguminous perennial grasses that form a bush, in the eastern goatweed (*Galega orientalis* Lam.) There is the growth of individual shoots from the buds of recovery on the underground part of the stem, which characterized the onset of the spring regrowth phase, and from the buds of horizontal root shoots, shoots from which come to the surface of the soil, thus occupying the free space of the soil, not occupied by plants (rows). Thus, one mother plant of the eastern goatweed (*Galega orientalis* Lam.) does not form a bush, but a set of individual (single) shoots, separated from each other.

The branching phase is characterized by the appearance of lateral branches on the central shoot. In most species of leguminous perennial grasses, this phase occurred 42–53 days after the onset of spring regrowth and only in the eastern goatweed (*Galega orientalis* Lam.) - 28 days, which is 14 days faster than in alfalfa (*Medicago sativa* L.) and white clover (*Melilotus albus* L.), and for 25–26 days - than in bird's-foot trefoil (*Lotus corniculatus* L.) and meadow clover (*Trifolium pratense* L.).

According to the calendar terms, the fastest branching phase occurred in the white clover (*Melilotus albus* L.) - on April 23 and the eastern goatweed (*Galega orientalis* Lam.) - on April 24, and the latest - in the bird's-foot trefoil (*Lotus corniculatus* L.) - May 7. As to the plants of meadow clover (*Trifolium pratense* L.) branching is conditional, because they do not have a central shoot, and the leaves rise on the branches from the root collar.

At the beginning of May, frosts of 2.0 ºC were observed. Leguminous perennial grasses at this time were in the branching phase. Among all the species, only 15% of the plants of the eastern goatweed (*Galega orientalis* Lam.) were frozen with damage to 15% of the leaf surface.

The budding phase occurred 53–87 days after the beginning of regrowth of perennial legumes. The fastest - in the eastern goatweed (*Galega orientalis* Lam.), and the latest - in the white clover (*Melilotus albus* L.).

According to the calendar terms, the earliest of this phase reached sand sainfoin (*Onobrychis arenaria* Kit.) - on May 17, eastern goatweed (*Galega orientalis* Lam.) - on May 19, bird's-foot trefoil (*Lotus corniculatus* L.) - on May 20, and latest - white clover (*Melilotus albus* L.) - June 7.

The phase of the beginning of flowering, when legumes of perennial grasses were mown, first occurred in the plants of the eastern goatweed (*Galega orientalis* Lam.) - 58 days after the beginning of regrowth, with the accumulation of the sum of active temperatures of 710 ºC, in bird's-foot trefoil (*Lotus corniculatus* L.) and sainfoin. sand (*Onobrychis arenaria* Kit.) - after 71 and 75 days, respectively, with the sum of temperatures of 805 and 783 ºC, clover (*Trifolium pratense* L.) and alfalfa (*Medicago sativa* L.) - after 88 and 90 days, respectively, with accumulation of the sum of active temperatures of 1030 and 994 ºC, and at the latest - in plants of white clover (*Melilotus albus* L.) - 93 days after the beginning of regrowth with the sum of temperatures of 1201 ºC.

According to the calendar terms, the fastest stages of the beginning of flowering were sowing of sand sainfoin (*Onobrychis arenaria* Kit.), eastern goatweed (*Galega orientalis* Lam.) and bird's-foot trefoil (*Lotus corniculatus* L.) - on May 22, 24 and 25, respectively. . Then meadow clover (*Trifolium pratense* L.) - on June 4 and latest alfalfa (*Medicago sativa* L.) and white clover (*Melilotus albus* L.) - on June 13.

The beginning of regrowth of perennial legumes in the second cut was observed 5-8 days after mowing and only sand sainfoin (*Onobrychis arenaria* Kit.) - after 21 days, which is due to the formation of extremely large mass in the first cut and severe depletion of its plants. Crops of sainfoin (*Onobrychis arenaria* Kit.) were characterized by a very uneven and time-stretched regrowth, which did not allow to accurately establish the beginning of the phase.

The plants of alfalfa (*Medicago sativa* L.) began to grow the fastest, and the plants of white clover (*Melilotus albus* L.) did not grow again after mowing the first cut.

Phases of the beginning of flowering in the 2nd cut leguminous perennial grasses reached in 31–59 days after the beginning of regrowth of the 2nd cut, the fastest - meadow clover (*Trifolium pratense* L.), alfalfa (*Medicago sativa* L.) and sand sainfoin (*Onobrychis arenaria* Kit.) - after 31, 34 and 35 days, respectively, and the latest - eastern goatweed (*Galega orientalis* Lam.) and bird's-foot trefoil (*Lotus corniculatus* L.) - after 59 and 45 days, respectively. Crops of alfalfa (*Medicago sativa* L.) and meadow clover (*Trifolium pratense* L.) formed a second cut, using 236–367 ºC less than for the formation of the first cut. Other species of perennial legumes spent 55–600 ºC more than the first cut, especially the eastern goatweed (*Galega orientalis* Lam.).

According to the calendar terms, the crops of meadow clover (Trifolium pratense L.) were formed the fastest on July 12, followed by *Lotus corniculatus* (July 17), sand sainfoin (*Onobrychis arenaria* Kit.) and alfalfa. sowing (*Medicago sativa* L.) - July 22, and the latest - eastern goatweed (*Galega orientalis* Lam.) - July 30.

The regrowth of perennial legumes after mowing the 2nd mowing took place in 4–17 days: the fastest plants were *Lotus corniculatus* (L.) and meadow clover (*Trifolium pratense* L.), and the latest was the eastern gooseberry (*Galega orientalis* Lam.).

All types of grasses, except for the eastern goatweed (*Galega orientalis* Lam.), formed a full-fledged third cut. The time required for the formation of legumes perennial grasses of the third cut was 24-52 days, the least - in plants of bird's-foot trefoil (Lotus corniculatus L.), and the most - clover (*Trifolium pratense* L.) and sainfoin (*Onobrychis arenaria* Kit.) . To form the third cut, alfalfa (*Medicago sativa* L.), meadow clover (*Trifolium pratense* L.) and sainfoin (*Onobrychis arenaria* Kit.) spent the most active temperatures compared to the first and second cuts, and bird's-foot trefoil (*Lotus corniculatus* L .) - the smallest.

According to the calendar terms, the fastest stage of flowering in the 3rd cut was reached by *Lotus corniculatus* L. - on August 17, then meadow clover (*Trifolium pratense* L.) - on September 6, sand sainfoin (*Onobrychis arenaria* Kit.) and alfalfa (*Medicago sativa* L.) on September 15 and 16, respectively.

The most fully used sum of active temperatures of the vegetation period was sown with Lotus corniculatus L., meadow clover (*Trifolium pratense* L.) and alfalfa (*Medicago sativa* L.) - 2839–2802 ºC, sand sainfoin (*Onobrychis arenaria* Kit). 120 ºC less, and the eastern goatweed (*Galega orientalis* Lam.) - 467 ºC less.

Summarizing the results of research to study the peculiarities of growth and development of perennial legumes for the second and subsequent years of the growing season, it should be noted:

- almost all leguminous perennial grasses begin to grow in the second and subsequent years of the growing season during the week, only the eastern goatweed (*Galega orientalis* Lam.) - 12-19 days later. At the lowest average daily temperature, sand sainfoin (*Onobrychis arenaria* Kit.) And meadow clover (*Trifolium pratense* L.) begin to grow - 3.8–4.1ºC;

- the onset of the tillering phase - the beginning of intensive growth of perennial legumes, is determined not so much by the accumulation of the sum of active temperatures, as the achievement of the average daily ambient temperature of 9.0-10.0 ºC;

- starting from the branching phase, there is an acceleration of plant development in the eastern goatweed (*Galega orientalis* Lam.), compared with other legumes perennial grasses for 14-26 days from the beginning of spring regrowth, but taking into account the late onset of regrowth of the eastern goatweed (*Galega orientalis* Lam.), this phase in calendar terms came almost simultaneously with other types of perennial legumes;

- from the budding phase there is a delay in the development of plants of white clover (*Melilotus albus* L.), pores

Comparing the phases of growth and development of perennial legumes in the year of sowing and subsequent years of vegetation, it is established:

- coincidence of the duration of the periods from the emergence of seedlings to branching - in the year of sowing and from the beginning of spring restoration of vegetation to tillering - the second year of vegetation, in all leguminous perennial grasses;

- in the year of sowing, the sum of active temperatures required for the beginning of flowering of leguminous perennial grasses was on average 200 ºC higher than in the second year of vegetation in the first cut and 50–250 ºC - in the second cut.

The highest yield of dry matter from the green mass of leguminous perennial grasses in the year of sowing was provided by white clover (*Melilotus albus* L.) - 10.3 t / ha, sand sainfoin (Onobrychis arenaria Kit.) by 18.5% less - 8.4 t / ha. Alfalfa (*Medicago sativa* L.) and meadow clover (*Trifolium pratense* L.) provided the same dry matter yield - 6.8-6.9 t / ha, and eastern goatweed (*Galega orientalis* Lam.) - the smallest - 2.7 t / ha (Table 3).

Table 3

The yield of nutrients from the green mass of perennial legumes
(SRF "Agronomichne", 2013-2017)

Leguminous perennial grasses	Vegetation years	Dry matter, t / ha	Metabolic energy, GJ/ha	Fodder units, t/ha	Digestible protein, t/ha
Alfalfa (*Medicago sativa* L.)	1	6,9	64,17	6,1	1,23
	2	9,2	85,57	8,2	1,66
	3	7,8	72,54	7,0	1,40
	4	5,8	53,94	5,2	1,04
Meadow clover (*Trifolium pratense* L.)	1	6,8	68,07	6,5	0,86
	2	8,9	89,09	8,5	1,13
Sand sainfoin (*Onobrychis arenaria* Kit.)	1	8,4	78,12	7,5	1,34
	2	11,5	106,95	10,2	1,82
	3	8,0	74,40	7,1	1,27
	4	6,6	61,38	5,9	1,05
White clover (*Melilotus albus* L.)	1	10,3	115,15	11,0	2,24
	2	9,4	105,09	10,1	2,06
Bird's-foot trefoil (*Lotus corniculatus* L.)	1	5,8	53,65	5,1	1,08
	2	7,8	72,15	6,9	1,46
	3	6,5	60,13	5,8	1,23
	4	2,9	26,83	2,6	0,55
Eastern goatweed (*Galega orientalis* Lam.)	1	2,7	28,13	2,7	0,34
	2	8,5	88,57	8,5	1,09
	3	6,9	71,90	6,9	0,88
	4	3,7	38,56	3,7	0,47

In the second year of the growing season, the dry matter yield from the green mass of perennial legumes increased. It was the highest in sand sainfoin (*Onobrychis arenaria* Kit.) - 11.5 t / ha, 19.1% lower in white clover (*Melilotus albus* L.) and alfalfa (*Medicago sativa* L.) and the lowest - 7.8 t / ha by bird's-foot trefoil (*Lotus corniculatus* L.), which is 32.2% less than in sand sainfoin (*Onobrychis arenaria* Kit.).

In terms of the content of metabolic energy and feed units in the green mass in the year of sowing, white clover (*Melilotus albus* L.) also prevailed - 115.15 GJ / ha and 11.0 t / ha, respectively. These indicators in sandy sainfoin (*Onobrychis arenaria* Kit.) were 32.2% lower, and in eastern goatweed (*Galega orientalis* Lam.) - 75.6% lower.

In the second year of the growing season, the supply of metabolic energy and fodder units of green mass of perennial legumes is equalized. The maximum values are provided by sand sainfoin (*Onobrychis arenaria* Kit.) and white clover (*Melilotus albus* L.) with values of 106.95–105.09 GJ / ha of metabolic energy and 10.2–10.1 t / ha of fodder units. The yield of metabolic energy from the green mass of meadow clover (*Trifolium pratense* L.) and eastern goatweed (*Galega orientalis* Lam.) Was 16.8% lower than from sand sainfoin (*Onobrychis arenaria* Kit.), and from bird's-foot trefoil (*Lotus corniculatus* L.) - 32.5% less and amounted to 72.15 GJ / ha of metabolic energy and 6.9 t / ha of feed units.

The yield of digestible protein from the green mass of leguminous perennial grasses in the year of sowing was highest in white clover (*Melilotus albus* L.) - 2.24 t / ha, which is 40.2-45.1% more than from sand sainfoin (Onobrychis arenaria Kit.) and alfalfa (*Medicago sativa* L.) and 84.8% more than from eastern goatweed (*Galega orientalis* Lam.).

In the second year of the growing season, the harvest of digestible protein also remained the highest in white clover (*Melilotus albus* L.) - 2.06 t / ha, which is 11.7% more than from sand sainfoin (*Onobrychis arenaria* Kit.), and 19, 4% more than the green mass of alfalfa (*Medicago sativa* L.). The lowest yield of digestible protein was in the green mass of eastern goatweed (*Galega orientalis* Lam.) and meadow clover (*Trifolium pratense* L.) - 1.09–1.13 t / ha, which is 47.1% less than white clover (*Melilotus albus*). L.).

Summarizing the results of research on the yield of nutrients in legumes, perennial grasses, it should be noted:

- green mass of white clover (*Melilotus albus* L.) was characterized by the highest collection of dry matter, metabolic energy, feed units and digestible protein in the year of sowing; metabolic energy and digestible protein, along with a decrease in dry matter yield compared to the green mass of sand sainfoin (*Onobrychis arenaria* Kit.) for the second year of the growing season;

- green mass of sand sainfoin (*Onobrychis arenaria* Kit.) was marked by the highest content of dry matter and metabolic energy for the second year of the growing season among all types of perennial legumes;

- green mass of bird's-foot trefoil (Lotus corniculatus L.) had the lowest dry matter content, yield of metabolic energy and feed units for the second year of vegetation;

- green mass of meadow clover (*Trifolium pratense* L.) was marked by the lowest content of digestible protein in the second year of the growing season among all types of leguminous perennial grasses;

- green mass of eastern goatweed (*Galega orientalis* Lam.) was characterized by the lowest yield of dry matter, the content of metabolic energy, feed units and digestible protein in the year of sowing and the growth of these indicators in the second year of vegetation;

- green mass of alfalfa (*Medicago sativa* L.) by all indicators occupied an intermediate position among all types of leguminous perennial grasses.

In the third year of vegetation of leguminous perennial grasses, the dry matter harvest was 6.5–8.0 t / ha. The most dry matter was provided by sand sainfoin (*Onobrychis arenaria* Kit.). 2.5% less dry matter was obtained from alfalfa (Medicago sativa L.), 13.8% less - from the eastern goatweed (*Galega orientalis* Lam.) and 18.8% less - from the bird's-foot trefoil (*Lotus corniculatus* L). Compared to the second year of the growing season, the dry matter harvest was 16.7–30.4% lower. The largest difference in the collection of dry matter, compared with the second year, was sand sainfoin (*Onobrychis arenaria* Kit.), and the smallest - bird's-foot trefoil (*Lotus corniculatus* L.).

The yield of metabolic energy and fodder units of the third year of vegetation of leguminous perennial grasses was 60.13–74.40 GJ / ha and 5.8–7.1 t / ha, respectively. Most fodder units and metabolic energy for the third year of the growing season were obtained from the green mass of sand sainfoin (*Onobrychis arenaria* Kit.), And the least - from the bird's-foot trefoil (*Lotus corniculatus* L.). Compared to the second year of vegetation of leguminous perennial grasses, the yield of metabolic energy and feed units was lower by 16.0–30.4%.

The harvest of digestible protein of the third year of the growing season from the green mass of leguminous perennial grasses was 0.88–1.40 t / ha. Most digestible protein is derived from alfalfa (*Medicago sativa* L.). 9.3% less digestible protein is obtained from the green mass of sainfoin

The yield of exchange energy and feed units was 26.83 –61.38 GJ / ha and 2.6–5.9 t / ha, respectively. The most metabolic energy and feed units are provided by sand sainfoin (*Onobrychis arenaria* Kit.), and the least by bird's-foot trefoil (*Lotus corniculatus* L.). The decrease in the yield of metabolic energy and feed units, compared with the third year of vegetation of leguminous perennial grasses, was 16.9-46.4%, the largest - from the eastern goatweed (*Galega orientalis* Lam.) and the bird's-foot trefoil (*Lotus corniculatus* L.) - from sand sainfoin (*Onobrychis arenaria* Kit.).

Digestible protein was obtained 0.47–1.04 t / ha. The most protein was provided by alfalfa (*Medicago sativa* L.) and sainfoin (*Onobrychis arenaria* Kit.), and the least - eastern goatweed (*Galega orientalis* Lam.). Compared to the third year of vegetation of leguminous perennial grasses, digestible protein was obtained by

17.3–55.3% less. The yield of digestible protein from *Lotus corniculatus* L. decreased the most, and from sand sainfoin (*Onobrychis arenaria* Kit.).

Summarizing the results of research on forage productivity of leguminous perennial grasses, it should be noted:

- sand sainfoin (*Onobrychis arenaria* Kit.) allows you to get the most dry matter, metabolic energy and feed units from the green mass of the third and fourth years of the growing season, and digestible protein - from the fourth year;

- green mass of bird's-foot trefoil (*Lotus corniculatus* L.) provides the lowest yield of dry matter, metabolic energy and feed units of the third and fourth years of the growing season;

- green mass of alfalfa (*Medicago sativa* L.) provides the largest collection of digestible protein for the third and fourth year of vegetation of perennial legumes;

- eastern goatweed (*Galega orientalis* Lam.) provides the lowest collection of digestible protein of the third and fourth years of the growing season;

- the highest yield of dry matter, metabolic energy, feed units and digestible protein for four years of vegetation of leguminous perennial grasses is provided by all grasses of the second year of vegetation, except white clover (*Melilotus albus* L.), which was more productive in the first year of vegetation;

- the lowest yield of dry matter, metabolic energy, feed units and digestible protein was observed in the fourth year of vegetation of perennial legumes;

- the highest yield of dry matter is provided by sainfoin (*Onobrychis arenaria* Kit.), and metabolic energy, feed units and digestible protein - white clover (*Melilotus albus* L.);

- the lowest yield of dry matter and digestible protein is provided by the green mass of eastern goatweed (*Galega orientalis* Lam.), and metabolic energy and feed units - bird's-foot trefoil (*Lotus corniculatus* L.).

Conclusions and suggestions

In the year of coverless sowing of six species of perennial legumes, the largest yield of green mass of dry matter, metabolic energy, feed units and digestible protein is provided by white clover (*Melilotus albus* L.), as the fastest growing crop among leguminous perennial grasses. In the second year of the growing season, the highest yield of dry matter is provided by sowing of sainfoin (*Onobrychis arenaria* Kit.), And of metabolic energy and feed units - sainfoin (*Onobrychis arenaria* Kit.) and white clover (*Melilotus albus* L.). The highest yield of digestible protein was green fodder of white clover (*Melilotus albus* L.).

In the third year of the vegetation of leguminous perennial grasses, the highest dry matter yield was green mass of sand sainfoin (*Onobrychis arenaria* Kit.) and alfalfa (*Medicago sativa* L.), metabolic energy and fodder units - sainfoin (Onobrychis arenaria kit.), Perennial. sowing (*Medicago sativa* L.). In the fourth year of the growing season, the largest yields of dry matter, metabolic energy and feed units were green fodder of sand sainfoin (*Onobrychis arenaria* Kit.), and digestible protein - sand sainfoin (*Onobrychis arenaria* Kit.) and alfalfa (*Medicago sativa* L.)

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