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AGRICULTURAL SCIENCES

INTENSITY OF LEGUMINAL PERENNIAL GRASSES GREEN MASS FORMATION DEPENDING ON WEATHER CONDITIONS OF VEGETATION

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Abstract

In the first year of the growing season, the largest average daily gains of green mass by the first cut are sand sainfoin (*Onobrychis arenaria* Kit.) and white clover (*Melilotus albus* L.), and by the second cut - in addition to these species - also *Lotus corniculatus* L. The most efficient use of natural resources for the formation of the vegetative mass of the second year of vegetation by the first cut is white clover (*Melilotus albus* L.) and eastern goatweed (G*alega orientalis* Lam.), in the second cut - meadow clover (*Trifolium pratense* L.) and alfalfa (*Medicago*) *sativa* L.), by the third cut - bird's-foot trefoil (*Lotus corniculatus* L.), in the third year of life - respectively sand sainfoin (*Onobrychis arenaria* Kit.) and eastern goatweed (*Galega orientalis* Lam.); alfalfa (*Medicago sativa* L.); bird's-foot trefoil (*Lotus corniculatus* L.), in the fourth year - sand sainfoin (*Onobrychis arenaria* Kit.); alfalfa (*Medicago sativa* L.) and sainfoin (*Onobrychis arenaria* Kit.).

Keywords: legumes, perennial grasses, vegetative mass, intensity, vegetation, weather conditions.

Formulation of the problem

Perennial legumes are primarily a balanced and complete feed for the livestock sector of agricultural production, so when choosing types of perennial legumes for different soil and climatic conditions of cultivation, take into account their yield, suitability for a particular type of feed, sustainability in the agroecosystem, and their ecological role in relation to the complex impact on the soil and subsequent crops in crop rotation [1].

Of particular importance are perennial legumes in field lands and natural forage lands, which are not only an important source of feed, but also a major factor in the biologization of agriculture. With limited resource provision of agriculture, when the balance of soil organic matter is unfavorable, the importance of biologization of agriculture increases, as the annual costs of humus mineralization are very significant [2].

Leguminous perennial grasses are extremely important in solving the problem of resource conservation and stabilization of crop yields, because their cultivation consumes 2-3 times less energy compared to cereals and row crops [3].

Optimizing the structure of sown areas of leguminous perennial grasses and increasing the productivity of forage crops will reduce the humus deficit by 20-25%, and the supply of biological nitrogen will increase by 2 times. Forage production is one of the main stabilizing factors, which can ensure not only productivity but also the sustainability of agricultural landscapes. However, due to global warming, it is important to optimize the species structure of perennial legumes [4].

Analysis of recent research and publications

In the structure of field fodder crops the largest share should be occupied by leguminous perennial grasses, the sown areas of which must be restored to the norms recommended for the Forest-Steppe zone of 45-50%. Among perennial legumes, a special place is given to alfalfa – the most productive and least energy-intensive high-protein crop. In the Forest-Steppe, it should occupy 50-60% of all crops of leguminous perennial grasses. On acid soils, meadow clover is preferable. For dry lands you need to use sand sainfoin [5-7].

One of the decisive factors in the choice of grasses in the conditions of climate change is their adaptability to periodic during the growing season lack of moisture. This is facilitated by the deep development of the root system of herbs, which is primarily characteristic of alfalfa. It is able to quickly restore growth while improving moisture supply. In addition, the placement of alfalfa on poor and acidic soils limits root growth and reduces drought resistance. Bird's-foot trefoil has less resistance to drought than alfalfa. Its root system is well branched and penetrates to a depth of 1.5 m and is well adapted to acidic and poor soils. Oriental goatweed is also drought-resistant, but grows well with neutral acidity and fertile soils with high water holding capacity [8-10].

Alfalfa has been grown in the Forest-Steppe since ancient times, is better adapted to soil and climatic factors and changes in growing conditions, is characterized by plasticity, durability, polygamy, high fodder value and provides the highest yield of leaf mass and nutrient yield with the highest energy efficiency. Therefore, today it remains the main legume of the Forest-Steppe. However, the use of sainfoin, bird's-foot trefoil,

white clover and eastern goatweed should be complementary with the maximum use of their biological characteristics in specific soil and climatic conditions. In particular, sand sainfoin has a constant seed productivity, early achievement of mowing maturity in the first cut and high biological resistance to adverse growing conditions. White clover has the ability to form high yields of green mass on sandy, infertile and saline soils, high drought resistance and winter hardiness. Bird's-foot trefoil has productive longevity and the ability to grow on low-yielding and acidic soils. In the eastern goatweed - it is productive longevity, high biological plasticity. The benefits of these herbs will allow you to get a higher yield than alfalfa [11-13].

Selection of previously unsolved parts of the overall problem

As to the mentioned above, it is necessary to establish the intensity of growth of green mass of leguminous perennial grasses taking into account weather factors, which will allow to choose for the production conditions of the Forest-Steppe Right Bank of Ukraine those types of leguminous perennial grasses that can form a high yield of green mass in a short period of time. minimum amount of natural resources, including moisture and heat.

The purpose of the article

The aim of the research was to establish the intensity of green mass formation by 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.). The intensity of green mass formation means the amount of harvest formed by plants in one day per unit area.

Field research was conducted during 2013-2017 at the Research Farm (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 – 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.

One of the important factors influencing the intensity of plant formation of vegetative mass is the weather conditions in the years of study. During the 2013 calendar year, 652 mm of precipitation, which is 18 mm more than the average long-term value (634 mm), with an average annual temperature of 9.0 ºC, which is 2.0 ºC higher than the norm (7.0 ºC). The growing season began in the first decade of April and ended in the second decade of November. During the growing season, 429 mm of precipitation fell. The hydrothermal coefficient (HTC) for the calendar year was 1.38 with a long-term value of the hydrothermal coefficient of 1.52 (Table 1).

Table 1.

Weather conditions in the years of research
(according to the Vinnytsia Regional Hydrometeorological Center)

Indexes	Long-term indicator	Years of research				
		2013	2014	2015	2016	2017
Average annual temperature, ° C	7,0	9,0	8,6	9,3	9,0	9,1
Average temperature during the growing season, ° C	12,4	16,0	13,6	15,8	16,7	14,6
The amount of precipitation per year, mm	634	652	550	368	469	503
The amount of precipitation during the growing season, mm	451	429	379	263	217	315
HTC for the year	1,52	1,38	1,50	0,69	0,54	0,86

In 2014, the amount of precipitation was 550 mm, which was 86.8% of the long-term average. The average annual temperature was 8.6 ºC, which is 1.6 ºC higher than the long-term average. The growing season began in the second decade of March and lasted until the end of the first decade of November. During the growing season the amount of precipitation was 442 mm. HTC was 1.50.

In 2015, 368 mm of precipitation fell, which was only 58% of the average long-term data. The average annual temperature was 9.3 ºC, which is 2.3 ºC higher than the average long-term temperature. The growing season for the growth and development of perennial legumes began in the third decade of March and lasted until the second decade of November. During the growing season 235 mm of precipitation fell. HTC was 0.69, which indicates very unfavorable conditions for vegetation and crop formation.

In 2016, the average annual temperature was 9.0 ºC, which is 2 ºC above the norm. The amount of precipitation during the year was 469 mm, which is 26% less than normal. The growing season began in early April and lasted until the end of September. The hydrothermal coefficient was 0.54, which corresponds to extremely arid vegetation conditions of plants.

2017 was characterized by an average annual temperature of 9.1 ºC, which is 2.1 ºC above normal. The amount of precipitation for the year was 503 mm, which corresponds to 80% of the long-term norm. HTC

was 0.86, which corresponds to unfavorable growing conditions.

Thus, based on the analysis, it was found that the most favorable growing conditions, taking into account the temperature and humidity levels, were in 2014, which corresponds to the second year of growing perennial legumes. The most unfavorable growing conditions were typical for 2016, when the grasses grew for the fourth year.

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

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

The following records and observations were performed: phenological observations - roughly on the basis of visual observations of the onset of phases of plant development with counting the number of days from germination or restoration of plant vegetation to mowing [14]; 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 [14]; foliage of the vegetative mass - by weighing plants and their leaves [15]; clogging of the green mass - a method of analysis and subsequent weighing of sheaf samples [16].

Presenting the main material

In the formation of the vegetative mass of leguminous perennial grasses, the rate of its growth is of paramount importance. After all, crops can generate significant yields throughout the growing season, using a significant amount of natural and climatic resources. This requires the establishment of average daily gains in green mass of perennial legumes.

The largest average daily increases in vegetative mass in the first year of vegetation of perennial grasses in the first cut were observed in white clover (*Melilotus albus* L.) – 483.8 kg / ha per day and in sand sainfoin (*Onobrychis arenaria* Kit.) – 483.9 kg / ha per day. High average daily growth in sand sainfoin (Onobrychis arenaria Kit.) was observed due to the formation of a significant vegetative mass – 30.0 t / ha in a short time – 52 days after germination, and white clover (*Melilotus albus* L.) – only due to high yield – 38.7 t / ha. 1.3 times lower average daily gains were observed in plants of alfalfa (*Medicago sativa* L.), 1.58 times – in bird's-foot trefoil (*Lotus corniculatus* L.) and 1.62 times – in meadow clover (*Trifolium pratense* L.). Due to almost no growth in the year of sowing of eastern goatweed (*Galega orientalis* Lam.). Its average daily gain was only 92.9 kg / ha per day (Table 2).

In the second cut of the first year of vegetation, the highest average daily gains of green mass were observed in bird's-foot trefoil (*Lotus corniculatus* L.), white clover (*Melilotus albus* L.) and sand sainfoin (*Onobrychis arenaria* Kit.), which amounted to 293.5-296.9 kg / ha per day. *Lotus corniculatus* (L.) achieved this indicator due to the short interval of formation of the second cut – 13 days after the beginning of regrowth, white clover (*Melilotus albus* L.) – due to high yield - 20.7 t / ha, and sand sainfoin (*Onobrychis arenaria* Kit.) – due to a combination of yield and early maturity. The average daily gains in alfalfa (*Medicago sativa* L.) were 1.24 times less than in bird's-foot trefoil (*Lotus corniculatus* L.), and in meadow clover (*Trifolium pratense* L.) – 1.62 times less.

Table 2

Average daily growth of green mass of perennial legumes grasses in the year of sowing (SRF "Agronomichne")

Perennial legumes grasses	Gains, kg / ha per day, depending on the cut		
	1	2	3
Alfalfa (*Medicago sativa* L.)	371,4	239,2	-
Meadow clover (*Trifolium pratense* L.)	298,8	183,8	-
Sand sainfoin (*Onobrychis arenaria* Kit.)	483,9	293.5	-
White clover (*Melilotus albus* L.)	483,8	295,7	-
Bird's-foot trefoil (*Lotus corniculatus* L.)	306,7	296,9	177,6
Eastern goatweed (*Galega orientalis* Lam.)	92,9	-	-

The average daily gain of vegetative mass of perennial legumes in the second cut decreased by 35.6-39.0%, compared with the first cut in alfalfa (*Medicago sativa* L.), clover (T*rifolium pratense* L.), sand sainfoin (*Onobrychis arenaria* Kit .) and white clover (*Melilotus albus* L.), and in the bird's-foot trefoil (*Lotus corniculatus* L.) remained virtually unchanged. Only in the third cut the average daily increments of *Lotus corniculatus* L. decreased by 40% compared to the first and second cuts.

Summarizing the results of research to study the intensity of the yield formation of green mass of perennial legumes in the year of sowing, it should be noted:

- according to the ratio "yield of green mass – speed of its formation" in the first cut white clover (*Melilotus albus* L.) and sand sainfoin (*Onobrychis arenaria* Kit.) prevail;

- eastern goat has the lowest average daily gains (*Galega orientalis* Lam.);

- in the second cut the largest average daily gains were observed in sand sainfoin (*Onobrychis arenaria* Kit.), white clover (*Melilotus albus* L.) and bird's-foot trefoil (*Lotus corniculatus* L.);

- high average daily growth of white clover (*Melilotus albus* L.) is achieved due to the formation of a large vegetative mass, bird's-foot trefoil (*Lotus corniculatus* L.) – due to early ripening, and sand sainfoin (*Onobrychis arenaria* Kit.) – due to a combination of both indicators;

- in most leguminous perennial grasses, the average daily gain in the second cut is reduced by 35–40%, and in the bird's-foot trefoil (*Lotus corniculatus* L.) – in the third cut.

In the first cut of the first year of vegetation, the highest foliage is observed in the plants of the eastern goatweed (*Galega orientalis* Lam.) – 57.9% and white clover (*Melilotus albus* L.) – 51.3%. This is explained by the fact that these types of leguminous perennial grasses in the year of sowing form only vegetative shoots, and the phases of budding and flowering do not reach (Table 3).

Table 3

Foliage and littering of green mass of perennial legumes in the year of sowing (SRF "Agronomichne")

Perennial legumes grasses	%, depending on the cut						Average, %	
	1		2		3			
	foliage	littering	foliage	littering	foliage	littering	foliage	littering
Alfalfa (*Medicago sativa* L.)	36,3	11,2	43,4	3,9	-	-	39,9	7,6
Meadow clover (*Trifolium pratense* L.)	36,8	21,0	48,7	2,3	-	-	42,8	11,7
Sand sainfoin (*Onobrychis arenaria* Kit.)	33,0	13,8	32,9	6,1	-	-	33,0	10,0
White clover (*Melilotus albus* L.)	51,3	4,8	53,0	5,7	-	-	52,2	5,3
Bird's-foot trefoil (*Lotus corniculatus* L.)	44,0	8,5	45,5	20,2	50,0	26,7	46,5	18,5
Eastern goatweed (*Galega orientalis* Lam.)	57,9	8,9	-	-	-	-	57,9	8,9

The foliage of the green mass of lotus corniculatus (*Lotus corniculatus* L.) was 44.0%, and other types of perennial legumes – 33.0-36.8%.

In the second cut, the foliage of meadow clover (*Trifolium pratense* L.) increases by 11.9% to 48.7% and alfalfa (*Medicago sativa* L.) by 7.1% to 43.4%. The foliage of sainfoin (O*nobrychis arenaria* Kit.), white clover (*Melilotus albus* L.) and bird's-foot trefoil (*Lotus corniculatus* L.), almost did not change compared to the first cut. The highest foliage was observed in white cranberry (*Melilotus albus* L.) – 53.0%, which, compared to other types of leguminous perennial grasses, does not form peduncles.

The infestation of green mass of perennial legumes with weeds in the first cut is the lowest in white clover (*Melilotus albus* L.) – 4.8%, due to the large vegetative mass and its intensive growth, which significantly suppresses weeds. The largest litter of green mass of meadow clover (*Trifolium pratense* L.) – 21.0% – is due to its slow growth.

Contamination of the second cut of leguminous perennial grasses, except for lovage (Lotus corniculatus L.) decreased by 2.3-9.1 times, which is facilitated by faster growth of vegetative mass and dry weather. The share of weeds in their vegetative mass in the second cut was 2.3-5.7%. Only in the green mass of *Lotus corniculatus* L. the litter increases to 20.2% due to low grass cover in the second and subsequent cuts, which is not competitive with weeds.

Summarizing the results of studies on the foliage and litter of green mass of perennial legumes in the year of sowing, it should be noted:

- perennial grasses that do not form generative stems have the highest foliage in the first cut
- white clover (*Melilotus albus* L.) and eastern goatweed (*Galega orientalis* Lam.), as well as bird's-foot trefoil (*Lotus corniculatus* L.); other types of leguminous perennial grasses have a foliage 1.5 times less than specified;
- in the second cut, due to a significant reduction of flower shoots, the foliage of alfalfa (*Medicago sativa* L.) and meadow clover (*Trifolium pratense* L.) increases by 7-12%;
- leguminous perennial grasses, which in the second cut form the same number of flower shoots with the first cut – sand sainfoin (*Onobrychis arenaria* Kit.) and bird's-foot trefoil (*Lotus corniculatus* L.) – have the same foliage in the second cut.

For the second and subsequent years of vegetation in the first cut, the foliage of perennial legumes in the early flowering phase was 38.0-45.3% and only sand sainfoin (*Onobrychis arenaria* Kit.) – 25.9%. This is due to the formation of an extremely large yield of sand sainfoin (*Onobrychis arenaria* Kit.) and, accordingly, the coarsening of the green mass. The highest was the foliage of plants of alfalfa (*Medicago sativa* L.) and eastern goatweed (*Galega orientalis* Lam.) (Table 4).

Table 4.

Foliage and litter of green mass of leguminous perennial grasses in the second or fourth years of the growing season (SRF "Agronomichne", average 2013-2017)

Perennial legumes grasses	%, depending on the cut						Average, %	
	1		2		3			
	foliage	littering	foliage	littering	foliage	littering	foliage	littering
Alfalfa (*Medicago sativa* L.)	45,3	9,2	48,2	2,9	49,0	2,5	47,5	4,9
Meadow clover (*Trifolium pratense* L.)	38,0	4,5	39,0	25,0	45,5	1,8	40,8	10,4
Sand sainfoin (*Onobrychis arenaria* Kit.)	25,9	2,7	38,5	31,7	50,0	9,7	38,1	14,7
White clover (*Melilotus albus* L.)	39,2	0,4	-	-	-	-	39,2	0,4
Bird's-foot trefoil (*Lotus corniculatus* L.)	38,7	6,1	45,5	4,0	56,3	5,9	46,8	5,3
Eastern goatweed (*Galega orientalis* Lam.)	41,5	1,0	59,0	2,0	-	-	46,8	1,5

In the second cut, the foliage of leguminous perennial grasses increased by 1-17% and amounted to 38.5-59.0%. It was the largest in the eastern goatweed (*Galega orientalis* Lam.), which in the second cut reaches the phase of single flowering and thus well leafy, and the smallest – in meadow clover (*Trifolium pratense* L.) and sand sainfoin (*Onobrychis arenaria* Kit.). In the third cut, the foliage of perennial legumes was 45.5-56.3%, which is 1-12% more than in the second cut. The highest was the foliage of plants of bird's-foot trefoil (*Lotus corniculatus* L.), and the lowest – in clover (*Trifolium pratense* L.).

The largest increase in foliage of the second cut, compared to the first – 13.4-17.5%, is characteristic of plants of sainfoin (*Onobrychis arenaria* Kit.) and eastern goatweed (*Galega orientalis* Lam.), and the smallest – 1.0-2.9 %, in plants of meadow clover (*Trifolium pratense* L.) and alfalfa (*Medicago sativa* L.), which form a uniform crop in both the first and second cut.

The largest increase in foliage of the third cut, compared to the second – 10.8-11.5%, was observed in plants of sainfoin (*Onobrychis arenaria* Kit.) and bird's-foot trefoil (*Lotus corniculatus* L.), and the smallest – 0.8% in alfalfa sowing (*Medicago* sativa L.).

Comparing the foliage of leguminous perennial grasses in the first cut in the year of sowing and the second and subsequent years of vegetation, it was found that higher foliage in the year of sowing was observed in plants of sand sainfoin (*Onobrychis arenaria* Kit.) – by 7%, white clover (*Melilotus albus* L.) – by 12.1%, the bird's-foot trefoil (*Lotus corniculatus* L.) – by 5.3% and the eastern goat (*Galega orientalis* Lam.) – by 16.4%. This is partly due to the development in the year of sowing of perennial legumes by winter type and the absence of the flowering phase (white clover (*Melilotus albus* L.), eastern goatweed (*Galega orientalis* Lam.)), as well as coarsening of the leaf and stem mass for the second and subsequent years vegetation due to the formation of a large crop (sand sainfoin (*Onobrychis arenaria* Kit.) and bird's-foot trefoil (*Lotus corniculatus* L.)). By alfalfa (*Medicago sativa* L.) plants, the foliage increased by 9.0% in the second and subsequent years of the growing season, and in meadow clover (*Trifolium pratense* L.) – by 1.2%.

By the second cut, the foliage in the second and subsequent years of vegetation increases in alfalfa (*Medicago sativa* L.) by 4.8%, sainfoin (*Onobrychis arenaria* Kit.) – by 5.6% and decreases in meadow clover (*Trifolium pratense* L.) by 9.7%, remains the same as in the year of sowing in plants of the bird's-foot trefoil (*Lotus corniculatus* L.).

The clogging of the green mass of leguminous perennial grasses in the first cut was 0.4-9.2%. It was the smallest in the green mass of white clover (*Melilotus albus* L.) due to extremely large biomass, and the largest – in alfalfa (*Medicago sativa* L.) and bird's-foot trefoil (*Lotus corniculatus* L.) – due to slow initial growth and predominance in their grassland weeds in wet weather. The most common weeds by *Lotus corniculatus* L. were *Euphorbia virgata* and *Capsella bursa-pastoris*.

By the second cut, there was insignificant littering of alfalfa (*Medicago sativa* L.) and eastern goatweed (*Galega orientalis* Lam.) – 2.0-2.9%, and significantly increased in sand sainfoin (*Onobrychis arenaria* Kit.) to 31.7% due to falling of grass, its depletion and uneven and non-uniform regrowth, as well as meadow clover (*Trifolium pratense* L.) – up to 25.0% due to regrowth in the second cut of shoots that were not mown in the first. The main mass of weeds consisted of grass clover (*Trifolium pratense* L.), milkweed (*Euphorbia virgata*), nettle (*Urtica dioica* L.), horse sorrel (*Rumex confertus Willd*.); in the green mass of bird's-foot trefoil (*Lotus corniculatus L*.) and sand sainfoin (*Onobrychis arenaria* Kit.) – Galinsoga small-flowered (*Galinsoga parviflora Cav*.), milkweed (*Euphorbia virgata*), dandelion (*Taraxacuma wica). retroflexus*).

Summarizing the results of studies on the foliage and litter of green mass of perennial legumes in the second and subsequent years of the growing season, it should be noted:

- the foliage of leguminous perennial grasses with each subsequent mowing increases and reaches the highest level in the third (last) mowing;

- plants of alfalfa (*Medicago sativa* L.) and meadow clover (*Trifolium pratense* L.) develop evenly during the formation of all cuts, so they have almost the same foliage in the first or third cuts;

- low foliage of green mass of sand sainfoin (*Onobrychis arenaria* Kit.) in the first cut is compensated by its significant growth in the second or third cuts;

- in the year of sowing, most leguminous perennial grasses have higher foliage than in the second and subsequent years of vegetation, except for alfalfa (*Medicago sativa* L.) and meadow clover (*Trifolium pratense* L.);

- littering of the green mass of leguminous perennial grasses in the first cut determined.

The average daily gain in the third cut was 84.3-391.7 kg / ha. They were highest in plants of *Lotus corniculatus* L., which is 37% more than in the second cut and similar to the level of the first cut. In other species of leguminous perennial grasses they were significantly lower than in the second cut: in alfalfa (*Medicago sativa* L.) – by 38.2%, but the same as in the first cut; in meadow clover (*Trifolium pratense* L.) – by 84.6%, sand sainfoin (*Onobrychis arenaria* Kit.) – by 65.2% lower.

Comparing the average daily yields of green mass in the first mowing in the year of sowing and in the second year of vegetation of perennial legumes, it was found that similar growth rates had sand sainfoin (*Onobrychis arenaria* Kit.), meadow clover (*Trifolium pratense* L.), clover (*Melilotus albus* L.). Larger growths than in the year of sowing had plants of eastern goatweed (*Galega orientalis* Lam.), and less – alfalfa (*Medicago sativa* L.).

By the second cut, the average daily growth of vegetative mass increases by 1.5-3.0 times in the second year of vegetation, compared with the first year of vegetation, and only in plants of *Lotus corniculatus* L. almost coincide with the first year.

In the third year of vegetation by the first cut the average daily growth of green mass of leguminous perennial grasses was 300.0-466.7 kg / ha. They were the

largest in the crops of Eastern goatweed (*Galega orientalis* Lam.), and the smallest – in alfalfa (*Medicago sativa* L.). In the third year of the growing season, the average daily growth decreased by 2.8-10.4%, compared to the second year of the growing season, except for alfalfa grass (*Medicago sativa* L.), where they increased by 15.9% (Table 5).

Table 5

Average daily growth of vegetative mass of leguminous perennial grasses for the second-fourth years of vegetation (SRF "Agronomichne", 2013-2017)

Perennial legumes grasses	Vegetation years	Gains, kg / ha per day, depending on the cut		
		1	2	3
Alfalfa (*Medicago sativa L.)*	2	252,2	450,0	278,3
	3	300,0	200,0	160,0
	4	255,6	225,0	-
Meadow clover (*Trifolium pratense L.*)	2	255,7	548,4	84,3
Sand sainfoin (*Onobrychis arenaria* Kit.)	2	462,7	425,0	148,1
	3	450,0	130,0	-
	4	325,0	200,0	-
White clover (*Melilotus albus L.*)	2	583,9	-	-
Bird's-foot trefoil (*Lotus corniculatus* L.)	2	400,0	246,7	391,7
	3	356,3	100,0	250,0
	4	150,0	120,0	-
Eastern goatweed (*Galega orientalis Lam.*)	2	520,7	188,1	-
	3	466,7	91,7	-
	4	250,0	50,0	-

In the second cut, the average daily gain was 91.7-200.0 kg / ha. They were the smallest on the herbaceous eastern goatweed (*Galega orientalis* Lam.), and the largest – alfalfa (*Medicago sativa* L.) compared with the first cut, the average daily increments decreased by 1.5-3.5 times, and compared to the second year of vegetation – by 2.1-3.3 times.

The average daily increments of the third cut were only *Lotus corniculatus* L. – 250.0 kg / ha and alfalfa (*Medicago sativa* L.) – 160.0 kg / ha. Compared to the second cut, the bird's-foot trefoil (*Lotus corniculatus L.*) had an average daily gain of 2.5 times larger, and alfalfa (*Medicago sativa* L.) – 1.3 times less. Compared to the second year of the growing season, the average daily gains of green mass of *Lotus corniculatus* L. were 1.6 times less, and alfalfa (*Medicago sativa* L.) – 1.7 times less.

In the fourth year of vegetation, the first cut continued to decrease the value of the average daily increase in green mass, in particular, it amounted to 150.0-325.0 kg / ha. The largest increments were characteristic of sand sainfoin (*Onobrychis arenaria* Kit.), And the smallest – for bird's-foot trefoil (*Lotus corniculatus* L.). Compared to the previous year of vegetation of leguminous perennial grasses, the average daily gains were 1.2-2.4 times less.

By the second cut, the value of average daily increments was 50.0-225.0 kg / ha. The largest increments were alfalfa (*Medicago sativa* L.), and the smallest – eastern goatweed (*Galega orientalis* Lam.). Compared to the first mowing, the increments decreased by 1.6-5.0 times, and compared to the third year of vegetation – increased by 1.1-1.5 times, except for the eastern goatweed (*Galega orientalis* Lam.), where they decreased by 1,8 times.

Summarizing the results of research on the average daily growth of green mass of perennial legumes in the second and subsequent years of the growing season, it should be noted:

- all studied grasses in the first cut provide the highest average daily gains of green mass of the second year of vegetation, except for alfalfa (*Medicago sativa* L.), which provides the highest average daily gains of the third year of vegetation;
- the lowest average daily gains of green mass in the first cut have grasses of the fourth year of vegetation;
- in the second cut all grasses have the highest average daily increments of the second year of vegetation, and the smallest – the fourth;
- the highest average daily gains in the third mowing of grasses are observed in the second year of vegetation of leguminous perennial grasses.

Conclusions and suggestions

In the first year of the growing season, the largest average daily increments of green mass in the first cut are sand sainfoin (*Onobrychis arenaria* Kit.) and white clover (*Melilotus albus* L.), and in the second cut - in addition to these species - also *Lotus corniculatus* L. The most efficient use of natural resources for the formation of the vegetative mass of the second year of vegetation in the first cut is white clover (*Melilotus albus* L.) and eastern goatweed (*Galega orientalis* Lam.), in the second cut - meadow clover (*Trifolium pratense* L.) and alfalfa (*Medicago sativa* L.), in the third cut - bird's-foot trefoil (*Lotus corniculatus* L.), in the third year of life – respectively sand sainfoin (*Onobrychis arenaria* Kit.) and eastern goatweed (*Galega orientalis* Lam.); alfalfa (*Medicago sativa* L.); bird's-foot trefoil (*Lotus corniculatus* L.), in the fourth year – sand sainfoin (*Onobrychis arenaria* Kit.); alfalfa (*Medicago sativa* L.) and sainfoin (*Onobrychis arenaria* Kit.).

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