Plant and Soil Science

Journal homepage: https://agriculturalscience.com.ua/en
Plant and Soil Science, 12(3), 28-37
Received xx.xx.2021 Revised xx.xx.2021 Accepted xx.xx.2021

UDC 636.085:633.361

DOI: 10.31548/agr2021.03.0028

I.V. Svystunova*

PhD in Agricultural Sciences, Associate Professor
National University of Life and Environmental Sciences of Ukraine
03041, 15 Heroiv Oborony Str., Kyiv, Ukraine

L.M. Burko

PhD in Agricultural Sciences, Senior Lecturer
National University of Life and Environmental Sciences of Ukraine
03041, 15 Heroiv Oborony Str., Kyiv, Ukraine

S.P. Poltoretskyi

Doctor of Agricultural Sciences, Professor
Uman National University of Horticulture
20300, 1 Instytutska Str., Uman, Ukraine

T.I. Prorochenko

PhD in Agricultural Sciences
National University of Life and Environmental Sciences of Ukraine
03041, 15 Heroiv Oborony Str., Kyiv, Ukraine

V.G. Pravednyi

Student
National University of Life and Environmental Sciences of Ukraine
03041, 15 Heroiv Oborony Str., Kyiv, Ukraine

The Effect of Fertilisation on the Nutritional Value of Alfalfa-Grass Mixtures in the Right-Bank Forest-Steppe

Abstract. One of the ways to reduce protein deficiency and produce complete feed is the cultivation of alfalfa-grass mixtures, which, due to the optimal ratio of protein and carbohydrate compounds, mineral salts and other valuable biologically active substances, most fully meet the physiological needs of animals. The purpose of the research was to determine the effect of mineral fertilisers on the nutritional value of alfalfa-cereal grass mixtures. Experimental studies were conducted during 2014-2016 on the experimental field of the Department of Feed Production, Land Reclamation and Meteorology, which is located in the SE NUBiP of Ukraine "Agronomic Research Station" on typical

Suggested Citation:
Svystunova, I.V., Burko, L.M., Poltoretskyi, S.P., Prorochenko, T.I., & Pravednyi, V.G. (2021). The Effect of Fertilisation on the Nutritional Value of Alfalfa-Grass Mixtures in the Right-Bank Forest-Steppe. *Plant and Soil Science*, 12(3), 28-37. doi: 10.31548/agr2021.03.0028.

*Corresponding author

low humus black soil. The results of the conducted research revealed that the inclusion of alfalfa in cereal grass stands increases the content of crude protein to a greater extent than the application of nitrogen at the rate of N_{60} on the same cereal grass stand on the same background of $P_{60}K_{90}$. There were no significant differences in crude protein accumulation between alfalfa-grass stands with different cereal components on the same backgrounds. The introduction of alfalfa into grass stands promotes the growth of protein and crude fat in the feed and reduces the content of nitrogen-free extractives. The chemical composition of grass feed is most affected by nitrogen fertilisers on grass stands. With the introduction of N_{60} on the background of $P_{60}K_{90}$ the dry weight of the feed increases by 2.8% of the crude protein content and 26 g of the provision of a feed unit with digestible protein. The digestibility of the dry mass of alfalfa and legume-cereal grass stands relative to pure cereals increases by 2-5%. The composition of cereal components in legume-cereal mixtures and the fertiliser system do not significantly affect the digestibility of feed. On all studied grass stands the highest quality of forage is provided by the introduction of $N_{60}P_{60}K_{90}$+ Fumar

Keywords: alfalfa-grass mixtures, feed nutrition crude protein, crude fat, metabolisable energy

RELEVANCE

One of the urgent problems of the livestock industry in Ukraine is the lack of vegetable protein in the diet of animals. According to the zootechnical norm, each feed unit should be provided with 105-115 g of digestible protein, but in fact, it contains 30-35% less, which leads to a decrease in livestock productivity and feed overspending by more than 1.5 times (Kurgak V. H., Tovstoshkur V. M., 2010; Makarenko P.S., 2003; Petrychenko V.F. *et al.*) One of the solutions to this problem is to increase the efficiency of the use of natural fodder lands – a valuable source of cheap grass fodder, well balanced in protein, minerals and vitamins, but also a significant factor in improving the ecological situation in agricultural landscapes, as they protect soils from erosion and water sources from siltation.

In Ukraine, the area of such lands is about 7.8 million hectares, including 1 million hectares in the right-bank Forest-Steppe. However, their productivity today does not exceed 1.0-1.2 t/ha of feed units, which is several times less than their potential capabilities. Technological methods of formation of highly productive sown grass stand on natural fodder lands recommended by many scientists are too energy- and resource-consuming under modern conditions (Kovtun K. P. *et al.*, 2018; Kurgak V. G. *et al.*, 2002; Kurgak V. G., Titova V. M., 2002; Panakhid H. Ya. *et al.*, 2020; Patyka V. P. *et al.*, 2015).

ANALYSIS OF RECENT RESEARCH AND PUBLICATIONS

Along with the need to increase the yield of sown grasslands, it is important to obtain high-quality feed for animals The nutritional value of perennial forage grasses is significantly affected by soil conditions, species and varietal composition of grass stands, the mode of its use, fertilisation and other agrotechnical methods (Kurhak V.G., Voloshyn V. M, 2017; V. Olifirovich V.A., Veklenko U.A., 2021; Petrychenko V.F. *et al.*, 2020; Weiß K., Kalzendorf C., 2016).

An effective means of improving the quality of feed, especially in terms of protein content, is the introduction of legumes into perennial forage agrophytocenoses (Makarenko P.S., 2003). Their inclusion in the grass mixture in the

amount of 50% and more promotes intensive regrowth of plants, improves the protein content of the feed and its mineral composition, and also increases the yield of livestock products per unit of feed by 15-30% (Panakhid H.Ya. *et al.*, 2019).

With highly effective fertilisation, legume-grass stand in the conditions of the Forest-Steppe of Ukraine can provide a yield of 8.40 t/ha of dry matter, 0.97 t/ha of digestible protein and 87.5 GJ/ha of metabolisable energy. With the complex use (two mowing and further alienation of grass in the phase of pasture ripeness), the productivity of the mentioned indicators can be respectively 12.6 t/ha, 9.60, 1.12 t/ha and 136 GJ/ha of metabolic energy (Kovtun K.P., 2018).

Among perennial legumes, the leading role belongs to sowing alfalfa, which, due to the ability to actively use the moisture reserves of the autumn-winter period, even in spring drought, is able to form high yields (Kurhak V.G., Voloshyn V.M., 2017, Kovtun *et al*, 2020). Phytocenoses containing alfalfa sowing, compared to the same with the participation of meadow clover, are characterised by longer productive longevity (Kurhak V.H. Tovstoshkur V.M., 2010, Kurhak V.H. *et al*, 2020), so the share of alfalfa-grass mixtures in the structure of mown areas should reach 55-70% (Oenema O. *et al*, 2014). However, the theoretical aspects of the formation of high-productivity of mown grass stands of alfalfa sown in mixtures with various cereal components remain unclear.

Among the technological factors of increasing the productivity of sown legume-grass meadow phytocenoses, the most ambiguous is the use of mineral fertilisers, especially nitrogen fertilisers. It is determined that on poor soils, as a result of a high level of fixation of atmospheric nitrogen by legumes of symbiotic nitrogen from the atmosphere, crops form a high yield. On nitrogen-rich soils, leguminous plants largely lose their value as nitrogen fixers. In general, Meadow agrophytocenoses of various compositions respond positively to the application of mineral fertilisers (Olifirovych V.A., Veklenko Yu.A., 2021, Weiß K., Kalzendorf C., 2016).

In improving the efficiency of modern agricultural production, it is important to use growth regulators that affect protein synthesis, assimilation of nitrogen, phosphorus and potassium, positively affect the process of photosynthesis and reduce the content of nitrates in the feed.

Given their physiological characteristics, many authors (Kurhak V.G., Voloshyn V.M., 2017, Kovtun K.P. *et al.*, 2018, Olifirovych V.A., Veklenko Yu.A., 2021) propose a strategy for optimising the mineral nutrition of plants, focusing on the mandatory use of growth stimulators in modern technologies for growing crops, which will make it possible to reduce the rate of application of mineral fertilisers without reducing the level of yield and minimises the risks of environmental pollution of the environment and the resulting products. The use of growth stimulators makes it possible not only to obtain an additional 10-25% of the gross harvest of agricultural products but also reduces the content of nitrates and heavy metals in plants, as well as increases the nutritional value of grown feed (Lukyanets O.P., 2003; Panakhid H.Ya. *et al.*, 2019). Due to low production doses, growth stimulants belong to low-cost elements of agricultural technology (Kurhak V.G., Titova V.M., 2002). Their effectiveness is largely determined by the soil-climatic and agrotechnical conditions of growing crops.

The purpose of the research was to study the influence of technological measures of growing alfalfa-grass mixtures on the nutritional value of feed in the conditions of the right-bank forest-steppe.

MATERIALS AND METHODS

Experimental studies were conducted during 2014-2016 on the experimental field of the

Department of Feed Production, Land Reclamation and Meteorology, located in the SE NUBiP of Ukraine "Agronomic Research Station". The experimental scheme included the following factors: factor A – grass stand (types of grasses and seeding rate of their seeds, kg/ha): 1) alfalfa, 16; 2) alfalfa, 12 + Fescue Grass, 10 + Festuca pratensis, 8; 3) alfalfa, 10 + Fescue Grass, 10 + Dactylis glomerata, 8; 4) alfalfa, 10 + Bromus inermis, 14 + Lolium perenne, 10; 5) alfalfa, 10 + Bromus inermis, 14 + Fescue Grass, 8; 6) Bromus inermis, 14 + Fescue Grass, 8 (grass stand), control; factor B – fertiliser (nutrients and their doses): 1) no fertilisers, control; 2) $p_{60}K_{90}$; 3) $N_{60}P_{60}K_{90}$; 4) $N_{60}P_{60}K_{90}$ + Fumar growth stimulator. The area of the plot is 25 m², and the replication of the experiment is four times. The technology of growing perennial grasses, with the exception of the studied factors, is generally accepted for the Forest-Steppe of right-bank Ukraine. Phosphorus and potassium fertilisers in the norm of $P_{60}K_{90}$, according to the scheme of the experiment were applied annually in autumn. Nitrogen fertilisers at the norm of N60 were used in three doses: N_{20} in spring on permafrost soil and N_{20} – after the first and second mowing. Spraying of the grass stands with a Fumar growth stimulator was carried out at the beginning of the regrowth of grasses of each slope at a dose of 2 l/ha with water consumption of 200 l/ha during the period when cereal grasses were in the tillering phase, and alfalfa was in the shoot formation phase.

The soil of the experimental field is typical low-humus chernozem. The content of humus in the topsoil is 4.2-4.6%, mobile phosphorus (according to Machigin) – 40-55 mg/kg of soil, exchangeable potassium – 150-165 mg/kg of soil, easily hydrolysed nitrogen (according to Kornfield) – 140-160 mg/kg, pH of the salt extract – 6.7-7.0.

RESULTS AND DISCUSSION

According to the research results, it was found that the addition of alfalfa to cereals significantly improved the quality of feed (Table 1).

Table 1. Content of organic substances in feed and digestibility of alfalfa, alfalfa-grass and cereal grass depending on fertiliser, % in dry weight (average for 2014-2016)

Fertiliser	Crude protein	Protein	Crude fat	Crude fibre	rem	Digestibility, %
Alfalfa						
No fertilisers	17.5	11.8	2.5	25.1	46.7	60
$P_{60}K_{90}$	18.1	12.7	2.6	26.7	43.6	58
$N_{60}P_{60}K_{90}$	19.1	13.3	2.9	27.9	40.7	58
$N_{60}P_{60}K_{90}$ + Fumar	19.9	13.7	3.0	28.0	39.5	59
Alfalfa + Fescue Grass + Festuca pratensis						
No fertilisers	16.5	12.1	2.8	27.7	44.0	59
$P_{60}K_{90}$	17.0	12.8	3.0	28.3	42.4	58
$N_{60}P_{60}K_{90}$	17.4	13.4	3.4	28.9	41.7	58
$N_{60}P_{60}K_{90}$ + Fumar	18.4	13.6	3.5	29.0	39.6	58
Alfalfa + Fescue Grass + Dactylis glomerata						
No fertilisers	16.8	12.6	3.1	28.7	43.0	58

Table 1, Continued

Fertiliser	Crude protein	Protein	Crude fat	Crude fibre	rem	Digestibility, %
$P_{60}K_{90}$	16.9	13.0	3.3	29.0	41.3	58
$N_{60}P_{60}K_{90}$	18.4	13.7	3.5	29.5	38.8	57
$N_{60}P_{60}K_{90}$ + Fumar	18.6	13.9	3.6	29.7	38.2	57
Alfalfa + Bromus inermis + Lolium perenne						
No fertilisers	17.0	12.9	3.3	29.0	41.3	59
$P_{60}K_{90}$	17.4	13.3	3.5	29.3	40.2	58
$N_{60}P_{60}K_{90}$	18.8	13.7	3.7	29.9	41.7	58
$N_{60}P_{60}K_{90}$ + Fumar	19.1	14.1	3.7	29.4	37.8	59
Alfalfa + Bromus inermis + Fescue Grass						
No fertilisers	17.0	11.9	2.6	26.9	44.8	58
$P_{60}K_{90}$	17.3	12.4	2.9	27.7	43.1	57
$N_{60}P_{60}K_{90}$	18.7	13.0	3.0	28.6	40.5	58
$N_{60}P_{60}K_{90}$ + Fumar	19.0	13.4	3.2	28.8	39.7	58
Bromus inermis + Fescue Grass (grass stand)						
No fertilisers	11.1	9.5	3.6	29.6	47.2	55
$P_{60}K_{90}$	11.9	10.2	3.8	29.4	46.5	56
$N_{60}P_{60}K_{90}$	14.8	12.6	3.7	29.8	43.3	55
$N_{60}P_{60}K_{90}$ + Fumar	15.3	13.1	3.7	29.2	43.3	55
Zootechnical standard	14	–	3-5	25-30	–	50-70
LSD_{05}, %	0.6	0.6	0.2	0.6	0.7	2

Thus, on a nitrogen-free background (in variants without fertilisers and with the introduction of $P_{60}K_{90}$) the content of crude protein in the dry weight of feed increased from 11.1-11.9 to 16.5-17.4% or by 5.4-5.5%, and with the introduction of nitrogen (variants $N_{60}P_{60}K_{90}$ and $N_{60}P_{60}K_{90}$+ Fumar) – from 14.7-15.3 to 17.4-19.1% or by 1.7-2.7%. Thus, the increase in crude protein content on nitrogen-free backgrounds was more intense than on nitrogen backgrounds. There were no significant differences in crude protein accumulation between alfalfa-grass stands with different cereal components on the same backgrounds. In alfalfa grass on the same backgrounds of fertilisers, it was accumulated in dry weight by 0.5-1.5% more than in alfalfa-grass mixtures. The lowest amount of crude protein was observed in the grass stand – 11.1-11.9% in the variants without nitrogen and 14.7-15.3% for its introduction.

The introduction of alfalfa in the composition of the grass mixture simultaneously with the increase in crude protein content also led to an increase in protein content, crude fat, improved the digestibility of dry matter and reduced the amount of nitrogen-free extractive substances.

In the absence of nitrogen fertiliser in the grass stands of alfalfa and legume-grass mixtures, compared with the grass stand, the protein content in the dry weight of feed increased from 9.5-10.2 to 11.8-13.7% or by 2.3-3.5%, while with the introduction of nitrogen ($N_{60}P_{60}K_{90}$ and $N_{60}P_{60}K_{90}$+ Fumar) – from 12.6-13.1 to 13.0-14.1% or only by 0.4-1.1%. Thus, the increase in protein content, and crude protein, is more intense when growing plants on nitrogen-free backgrounds.

The digestibility of the dry weight of the forage of alfalfa and legume-cereal grass stands relative to pure cereal crops increased from 55-56 to 57-60% or by 2-5%. The composition of cereal components in legume-cereal mixtures and fertiliser systems did not significantly affect the digestibility of feed.

The content of nitrogen-free extractive substances under the influence of symbiotic and mineral nitrogen, in contrast to nitrogen-containing substances (crude protein and protein), decreased. Thus, in alfalfa and alfalfa-cereal grass stands, where symbiotic nitrogen has an impact, the content of rem in the dry weight of feed on backgrounds without nitrogen decreased from 46.5-47.2% to 40.2-46.7% or by 1.5-6.3%. When applying nitrogen fertilisers (variant $N_{60}P_{60}K_{90}$ compared to $P_{60}K_{90}$) on grass stands, the rem content decreased by 3.2%, while on stands with alfalfa – by 0.7-2.6%.

Among mineral fertilisers, the chemical composition of grass feed from grass stands is most affected by nitrogen fertilisers, the application of which in a dose of N_{60} on the background of $P_{60}K_{90}$, on average for all slopes, led to an increase in the dry weight of feed, first of all, the content of nitrogen-containing substances, in particular, crude protein – from 11.9 to 14.7%, or by 2.8%, and protein – from 10.2 to 12.6%.

In alfalfa and alfalfa-grass stands, the content of crude protein and protein from the introduction of nitrogen changed to a lesser extent – for the introduction of N_{60} on the background of $P_{60}K_{90}$ on average, for all mowing in the dry weight of feed, the content of crude protein increased from 16.9-18.1 to 17.4-19.1%, protein from 12.4-13.3 to 13.0-13.7%. Simultaneously with the increase in the content of crude protein (by 0.5-2.9%), a decrease in the content of nitrogen-free extractives was observed.

Consequently, the inclusion of alfalfa in grass stands provided an increase in the crude protein content to a greater extent than the introduction of nitrogen at a dose of N_{60} on the same cereal stand on the same background of $P_{60}K_{90}$.

On all studied grass stands the highest quality of forage was provided by the introduction of $N_{60}P_{60}K_{90}$+ Fumar. On alfalfa and alfalfa-grass stands, such a combination of technological measures provided the accumulation of 18.4-19.9% of crude protein in dry weight, which is 1.8-2.4% more compared to the variant without fertilisation. Under such conditions, the grass stand accumulated 15.3% crude protein, which is 4.2% more than without fertilisers.

The content of crude fat in dry weight was 2.5-3.8%, crude fibre – 25.1-29.9%. These parameters of feed quality did not significantly depend on the studied factors.

Comparison of the chemical composition of the obtained feed with the zootechnical standards of cattle feeding showed that their values mainly corresponded to the established standards, however, some discrepancies were also noted. Thus, the content of crude protein on the sown cereal stands on the background without fertilisers and with the introduction of $P_{60}K_{90}$ was less than average (11.1-11.9% compared to the standard of 14% in dry weight).

When using the obtained grass feed in animal feeding, it is important to evaluate it according to the indicators provided by the current standards of Ukraine for assessing the quality of feed. According to the data obtained, the content of

feed units in the dry weight of different types of grass stands was 73-82%, exchangeable energy – 8.6-9.5 MJ/kg, the provision of one feed unit with digestible protein – 107-174 g (Table 2).

Table 2. Nutritional value, energy intensity of dry mass and provision of fodder unit with digestible protein of meadow grasslands depending on fertilisation, (the average for 2014-2016)

Fertiliser	Content of feed units, %	Exchangeable energy content, MJ/kg	Provision of feed unit with digestible protein, g
Alfalfa			
No fertilisers	81	9.4	151
$P_{60}K_{90}$	82	9.5	154
$N_{60}P_{60}K_{90}$	82	9.5	164
$N_{60}P_{60}K_{90}$ + Fumar	82	9.5	170
Alfalfa + Fescue Grass + Festuca pratensis			
No fertilisers	76	9.0	152
$P_{60}K_{90}$	77	9.1	155
$N_{60}P_{60}K_{90}$	76	9.2	160
$N_{60}P_{60}K_{90}$ + Fumar	77	9.2	167
Alfalfa + Fescue Grass + Dactylis glomerata			
No fertilisers	76	9.0	155
$P_{60}K_{90}$	78	9.1	152
$N_{60}P_{60}K_{90}$	77	9.2	165
$N_{60}P_{60}K_{90}$ + Fumar	77	9.2	168
Alfalfa + Bromus inermis + Lolium perenne			
No fertilisers	76	8.9	158
$P_{60}K_{90}$	77	9.1	158
$N_{60}P_{60}K_{90}$	78	9.1	168
$N_{60}P_{60}K_{90}$ + Fumar	77	9.2	174
Alfalfa + Bromus inermis + Fescue Grass			
No fertilisers	76	9.0	156
$P_{60}K_{90}$	77	9.1	158
$N_{60}P_{60}K_{90}$	76	9.2	172
$N_{60}P_{60}K_{90}$ + Fumar	77	9.2	173
Bromus inermis + Fescue Grass (grass stand)			
No fertilisers	73	8.6	107
$P_{60}K_{90}$	74	8.7	112
$N_{60}P_{60}K_{90}$	75	8.8	138
$N_{60}P_{60}K_{90}$ + Fumar	75	8.8	143
Zootechnical standard	70-100	8-11	110-115

It was found that the introduction of alfalfa in the composition of alfalfa-cereal grass mixtures contributed to an increase in the content of feed units in the dry weight of grass from 73-75 to 76-78%, and the content of metabolisable energy – from 8.6-8.8 to 8.9-9.2 MJ/kg compared to pure cereal crops.

Comparing the obtained values of these indicators on alfalfa-cereal grass stands with single-species alfalfa sowing, it was determined that alfalfa sowing is characterised by slightly higher nutritional value and energy intensity. Its dry weight contained 4-6% more feed units and 0.3-0.5 MJ/kg more metabolisable energy. The parameters of nutrition and energy intensity changed little under the influence of fertiliser, only a tendency to increase the parameters of these indicators was noted.

The provision of a feed unit with digestible protein in the conducted studies was quite high and depending on the action of the studied factors was 107-174 g. This indicator was most affected by symbiotic and mineral nitrogen. With the inclusion of alfalfa in cereal grass stands, and in pure alfalfa crops in the absence of nitrogen mineral fertiliser, the provision of a feed unit with digestible protein increased from 107-112 g to 151-174 g or by 44-62 g, with the introduction of mineral nitrogen – from 138-143 g to 160-174 g or by 22-31 g. Among legume-grass mixtures, no significant difference was observed in the provision of digestible protein per feed unit.

The application of nitrogen fertilisers improved the supply of digestible protein to the feed unit more significantly on cereal grasses than on alfalfa and alfalfa-cereal grass stands. Nitrogen fertilizers at the rate of N_{60} on the background of $P_{60}K_{90}$ on the cereal grass increased the provision of a feed unit with digestible protein by 26 g, on alfalfa and alfalfa-cereal grass – by 5-14 g.

The highest nutritional value of feed for this indicator on all grass stands was seen with the introduction of $N_{60}P_{60}K_{90}$ + Fumar and amounted to 167-174 g on alfalfa and alfalfa-grass stands (exceeding 13-19 g before the control), 143 g on cereal stands (the increase to the control was 36 g).

CONCLUSIONS

Cultivation of alfalfa and alfalfa-grass stands without nitrogen fertilisers results in the production of grass fodder with a crude protein content in dry weight of 11.1-19.1%. The introduction of alfalfa into grass stands promotes the growth of protein and crude fat in the feed and reduces the content of nitrogen-free extractives.

The chemical composition of grass feed is most affected by nitrogen fertilisers on grass stands. With the introduction of N_{60} on the background of $P_{60}K_{90}$ in the dry mass of feed, the content of crude protein increases by 2.8% and the supply of digestible protein to the feed unit increases by 26 g.

REFERENCES

[1] Kovtun K.P., Veklenko Yu.A., Sydoruk H.P., Bezvuhliak, L.I., & Yashchuk V.A. (2018) Influence of sowing methods and spatial arrangement of components on the chemical composition of phytomass of two-component alfalfa-cereal mixtures in the conditions of the right-bank forest-steppe. Kormy i kormovyrobnytstvo, 85, 94-100.

[2] Kurhak V.H., & Tovstoshkur V.M. (2010). Influence of species composition and fertilization of perennial grasses on soil fertility indicators. Zbirnyk naukovykh prats Instytutu zemlerobstva, 3-4, 15-25.

[3] Kurhak V.H., & Voloshyn V.M. (2017). Improving the efficiency of perennial legumes in the meadows of Ukraine. Posibnyk ukrainskoho khliboroba "Biolohizatsiia zemlerobstva", 1, 288-291.
[4] Kurhak V.H., Lukianets O.P., & Titova V.M. (2002). Biochemical composition of forage of meadow grasses depending on fertilizer and mode of use. Zbirnyk naukovykh prats Instytutu zemlerobstva, 3, 25-33.
[5] Kurhak V.H., & Titova V.M. (2002). Efficacy of plant growth stimulants and nitrogen-fixing bacterial preparations on meadow grasses. Zbirnyk naukovykh prats Instytutu zemlerobstva, 1, 48-55.
[6] Lukianets O.P. (2003). Formation of meadow grasslands on arable lands. Visnyk ahrarnoi nauky, 12, 76-79.
[7] Makarenko P.S. (2003). The main elements of resource and energy saving in onion growing in modern conditions. Kormy i kormovyrobnytstvo, 51, 146-149.
[8] Olifirovych V.A., & Veklenko Yu.A. (2021). Improving the efficiency of growing alfalfa and cereal mixtures on eroded slopes. Kormy i kormovyrobnytstvo, 91, 93-102. doi: 10.31073/kormovyrobnytstvo202191-08
[9] Panakhyd H.Ya., Konyk H.S., & Kotiash U.O. (2019). Formation of newestablished legume-grass meadow swards depending on different types of fertilizers. Peredhirne ta hirske zemlerobstvo i tvarynnytstvo, 65, 114-124. doi: 10.32636/01308521.2019-(65)-10.
[10] Panakhyd H., Konyk H., & Stasiv O. (2020). Economic evaluation of models of technologies for the creation and use of legumes and cereals. Agricultural and Resource Economics, 6, 221-234. URL: http://are-journal.com.
[11] Patyka V.P., Hnatiuk T.T., Buletsa N.M., & Kyrylenko L.V. (2015). Biological nitrogen in the farming system. Zemlerobstvo, 2, 12-20.
[12] Petrychenko V.F., Korniichuk O.V., & Veklenko Yu.A. (2020). Scientific bases of intensification of fodder production on meadows and pastures of Ukraine. Kormy i kormovyrobnytstvo, 89, 10-22. doi: 10.31073/kormovyrobnytstvo202089-01.
[13] Yarmoliuk M.T. (2001) Agroecological main creation and use of cultural pastures in the western regions of Ukraine. Obroshyno, 248.
[14] Karbivska, U.M. (2020). Accumulation of root mass of legumes and its influence on the nutrient regime of sod-podzolic soil. Foothill and mountain agriculture and animal husbandry, 67(I), 84-97. doi: 10.32636/01308521.2020-(67)-1-6.
[15] Kovtun, K.P., Veklenko, Yu.A., & Yashchuk, V.A. (2020). Formation of phytocenosis and productivity of sainfoin-cereal grass mixtures depending on the methods of sowing and spatial distribution of species in the conditions of the right-bank Forest-Steppe. Feed and feed production, 89, 112-120. doi: 10.31073/kormovyrobnytstvo 202089-11.
[16] Kurhak, V.H., Panasyuk, S.M., Asanishvili, N.M., Slyusar, I.T., Slyusar, S.M., Shtakal, M.I., Ptashnik, M.M., Oksymets, O.L., Tsymbal, Ya.S., Kushchuk, M.O., Gavrysh, Ya.V., Kulyk, R.M., & Kudrya, S.O. (2020). Influence of perennial legumes on the productivity of meadow phytocenoses. Ukrainian Journal of Ecology, 10(6), 310-315. doi: 10.15421/2020_298.
[17] Oenema O., de Klein C., & Alfaroc M. (2014) Intensification of grassland and forage use: driving forces and constrains. *Crop and Pasture Science*, 65(6), 524-537. doi: 10.1071/CP14001.
[18] Weiβ, K., & Kalzendorf, C. (2016). Effectofwiltingandsilageadditives on silage quality of lucerne, red clover and legume-grass mixtures. The multiple roles of grassland in the European bioeconomy. Proceed. XXVI General Meeting of the European Grassland Federation. Trondheim, Norway. 4-8 September, 170-172.

І.В. Свистунова

Кандидат сільськогосподарських наук, доцент
Національний університет біоресурсів і природокористування України
03041, вул. Героїв Оборони, 15, м. Київ, Україна

Л.М. Бурко

кандидат сільськогосподарських наук, старший викладач
Національний університет біоресурсів і природокористування України
03041, вул. Героїв Оборони, 15, м. Київ, Україна

С.П. Полторецький

доктор сільськогосподарських наук, професор
Уманський національний університет садівництва
20300, вул. Інститутська, 1, м. Умань, Україна

Т.І. Пророченко

кандидат сільськогосподарських наук
Національний університет біоресурсів і природокористування України
03041, вул. Героїв Оборони, 15, м. Київ, Україна

В.Г. Праведний

студент
Національний університет біоресурсів і природокористування України
03041, вул. Героїв Оборони, 15, м. Київ, Україна

Вплив удобрення на поживну цінність люцерно-злакових травосумішок у Правобережному Лісостепу

Анотація. Одним із шляхів зменшення дефіциту протеїну та виробництва повноцінних кормів є вирощування люцерно-злакових травосумішок, які завдяки оптимальному співвідношенню білкових і вуглеводних сполук, мінеральних солей та інших цінних біологічно активних речовин найбільш повно задовольняють фізіологічні потреби тварин. Метою досліджень було визначення впливу мінеральних добрив на поживність люцерно-злакових травосумішок. Експериментальні дослідження проводили протягом 2014-2016 рр. на дослідному полі кафедри кормовиробництва, меліорації та метеорології, яке розташоване у ВП НУБіП України «Агрономічна дослідна станція» на чорноземі типовому малогумусному. Результати проведених досліджень показали, що включення люцерни в злакові травостої підвищує вміст сирого протеїну в більшій мірі, ніж внесення азоту в нормі N_{60} на тому ж злаковому травостої на тому ж фоні $P_{60}K_{90}$. Істотних відмінностей у накопиченні сирого протеїну між люцерно-злаковими травостоями з різним складом злакових компонентів на однакових фонах не виявлено. Введення люцерни в травостої сприяє зростанню вмісту протеїну і сирого жиру в кормі та зменшує вміст безазотистих екстрактивних речовин. На хімічний склад трав›яного корму найбільше впливають азотні добрива на травостоях. При внесенні N_{60} на фоні $P_{60}K_{90}$ у сухій масі корму збільшується на 2,8% вміст сирого протеїну і на 26 г забезпеченість кормової одиниці перетравним протеїном. Перетравність сухої маси люцерно-злакових і бобово-злакових травостоїв відносно чисто злакових підвищується на 2-5%. Склад злакових компонентів у бобово-злакових травосумішках та система удобрення суттєво не впливають на перетравність корму. На всіх досліджуваних травостоях найвищу якість корму забезпечує внесення $N_{60}P_{60}K_{90}$+ Фумар

Ключові слова: люцерно-злакові травосумішки, поживність корму, сирий протеїн, сирий жир, обмінна енергія