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Received: 2020-11-12 ; Accepted: 2020-12-03

CHEMICAL COMPOSITION OF GRASSFODDER OF DIFFERENT VARIETY OF SAINFOIN, DEPENDING ON TECHNOLOGICAL MEASURES OF GROWING

Summary

The results of three year researches in the conditions of the forest steppe of Right-bank Ukraine are presented. The chemical composition of grass forage of different types of sainfoin depending on technological measures of cultivation has been studied. It was established that the analysis of the obtained data on the content of organic matter in sainfoin grass showed that the yield of sown grass over the years of research was well provided with organic nutrients and the general level of its content in the feed mainly met the zootechnical standards of animal feeding and the requirements of state standards of Ukraine for the production of hay, haylage of I and II and artificially dried fodder of II and III classes. As for the mineral elements in the feed, with the introduction of phosphorus-potassium or complete mineral fertilizers, it increased or tended to increase, regardless of the type of sainfoin.
***Key words**: sainfoin (Onobrychis viciifolia* Scop.*), grassfodder, chemical composition, mineral elements*

SKŁAD CHEMICZNY ZIELONKI RÓŻNYCH ODMIAN ESPARCETY W ZALEŻNOŚCI OD TECHNOLOGICZNYCH ŚRODKÓW PRODUKCJI

Streszczenie

Przedstawiono wyniki trzyletnich badań w warunkach lasostepu Ukrainy Prawobrzeżnej. Badano skład chemiczny zielonki różnych odmian esparcety w zależności od metod uprawy. Stwierdzono, że uzyskany plon w latach badań był wysoki, a ogólny poziom zawartości składników pokarmowych w paszy odpowiadał zootechnicznym standardom żywienia zwierząt na Ukrainie. Zawartość składników mineralnych w zielonce, w zależności od zastosowanych nawozów fosforowo-potasowych lub pełnowartościowych nawozów mineralnych, zwiększała się lub miała tendencję wzrostową niezależnie od odmiany esparcety.
***Słowa kluczowe:** esparceta (Onobrychis viciifolia* Scop.*), zielonka, skład chemiczny, pierwiastki mineralne*

1. Introduction

Along with increasing the yield of fodder crops, fodder producers face an equally important task - obtaining high-quality fodder, which is one of the significant indicators and on which the productivity of animals depends. The chemical composition and nutritional valueis influenced by the varietal composition of the agrophytocenosis components, to some extent [1, 2]. Type and varietal differences in chemical composition show upmore or less depending on the specific conditions of plant cultivation, as different varieties react differently to changes in nutrition. Kyiak [3] indicates that the amount of hydrocarbons in the dry matter varied from 17% to 30% between the varieties of perennial grasses. In addition, the digestibility of organic matter changes, which on average ranges from 63 to 83%. Among the elements of mineral fertilizers,the chemical composition of the perennial grassesfeed is most affected by nitrogen. Nitrogen fertilizers, especially high doses, can significantly increase the protein content in the feed and its component protein [4, 5]. At the same time, the content of nitrogen-free extractives and their constituent part - hydrocarbons, including water-soluble ones, decreases in the feed. This is due to the fact that under the influence of nitrogen fertilizers, plants spend more sugar, which is operated to the amino acid synthesisand the conversion oflast ones into proteins [6, 7]. The objective of this study was to determine the effect of production means on the chemical composition of green forage of different sainfoin *(Onobrychis viciifolia* Scop.) varieties.

2. Materials and methods

2.1. Experimental field

Experimental studies were conducted during 2016-2018 at the research site "Agronomic Research Station" of NULES of Ukraine, which is located in the Pshenychne village, Vasylkiv district, Kyiv region. The study involved the following factors: A. Types of sainfoin: 1. Sowing (Amethyst Donetsk variety), 2. Transcaucasian (Adam variety), 3. Sandy (Emerald variety); B. Fertilizers, inoculation: 1. Without fertilizers and inoculation, 2. N45P60K90 + inoculation of seeds with rhizotorphin, 3. P60K90 + inoculation of seeds with rhizotorphin. Method of sowing - row, spring coverless. Rhizotorphine was used for inoculation. Repetition - four times, the sown area 80 m^{-2}, the accounting area 50 m^{-2}. The soil of the experimental field is typical low-humus chernozem, by granulometric composition – coarse, dusty, medium loamy. The content of humus (according to Tyurin [8]) in the arable layer is 4.4%, pH of salt extract 6.8-7.3, light hydrolyzed nitrogen (according to Cornfield) 106-114 $mg \cdot kg^{-1}$, mobile phosphorus (according to Machigin) 62-65 $mg \cdot kg^{-1}$ and exchangeable potassium (according to Chirikov) 89-106 $mg \cdot kg^{-1}$, absorption capacity 30.7-32.5 mg-eq (100 g of soil),

equilibrium soil density 1.16-1.25 g·cm^{-3}, humidity of steady withering 10,8%. These data allow to consider that the field research was conducted in typical soil and climatic conditions for the Northern part of the Right Bank Forest-Steppe.

2.2. Meteorological conditions

Weather and climatic conditions of the years of research, in general, were satisfactory for the growth and development of sainfoin, but differed from the average long-term indicators in terms of precipitation and average daily temperatures, according to iMetos weather station, located in"Agronomic Research Station" of NULES of Ukraine.

2.3. Statistical analysis

Results from one-year studies were subject to monomial analyses of variance, subsequently, a synthesis of experiments of many years was carried out using the statistical program. The significance of differences was estimated at the level of $\alpha = 0.05$.

3. Results and discussion

According to the results research it is established that the content of organic matter in the dry mass of sainfoin feed varies significantly depending on the type and variety of sainfoin, mineral fertilizers and inoculant treatment (rhizotorphin) seeds at sowing (Table 1). The content of crude protein in the dry mass of feed of all types of sainfoin corresponded to the optimal indicators which characterizes their nutritional value. The highest content of crude protein was in the sainfoin feed of Sandy type (Emerald variety) with the introduction of complete and phosphorus-potassium fertilizers with the rhizotorphin treatment of sainfoin seeds when sown, and reached 20.6%. The fiber content in sainfoin grass was marked in average within 21.2-21.9% of absolutely dry weight over three years (Table 1). Its lowest content was found in Amethyst variety grass of the Sowing type of sainfoin, the highest - in Emerald variety of Sandy type. However, this difference can be characterized only as a tendency to increase, because its indicators are within 1% [9, 10]. Regarding the content of crude fat in the dry mass of sainfoin in the flowering phase, it should be noted that its content significantly depended on the type and mineral fertilizer. The lowest fat content was found in the grass of Sowing sainfoin 3.48-3.62% on dry matter, the highest - in the green mass of Sandy type (Emerald variety) 4.16-4.22%. There was a clear increase of fat content in sainfoin feed depending on the application way of mineral fertilizers.

3.1. Mineral composition of feed

In the studies, the content of trace elements depended on the type of sainfoin and fertilizers (Table 2). The lowest ash content, on average,was observed in the feed of Sown Sainfoin 7.80-7.98%, while the highest 8.16% in the Adam variety of Transcaucasian type,during the three years of the study. Comparing the content of mineral elements in the feed with zootechnical requirements, it should be noted that its content in most cases corresponds to the established norm. Thus, phosphorus contained 0.52-0.66% in the feed. In addition, the smallest amount of phosphorus was in the Sowing feed of sainfoin (0.52-0.56%). At the same time, the phosphorus part in the dry mass increased from Sowing to Transcaucasian and further to Sandy type 8.15-8.16% per dry sample. With the application of mineral fertilizers, regardless of the type of sainfoin, the phosphorus content increased by 0.3-0.4% in the dry mass [9, 11]. In general, with the introduction of phosphorus-potassium or complete mineral fertilizers, the content of mineral elements in the feedincreased or tended to increase, regardless of the type of sainfoin. Sainfoin is an excellent forage legume, which was grown in Europe before the widespread use of commercial fertilizers [2, 12, 13, 14].

Table 1. The content of organic matter in the feed of sainfoin grasses depending on the type of sainfoin and fertilizer, the average for 2016-2018, % on the dry sample

Tab. 1. Zawartość substancji organicznych w paszy z esparcety w zależności od odmiany esparcety i rodzaju zastosowanego nawozu, średnia dla lat 2016-2018, % w suchej próbce

Type and variety of sainfoin	Fertilizer option	Crude substance					NFE
		ash	protein	albumen	cellulose	fat	
Sowing, Amethyst Donetsk variety	without fertilizers	7.80	19.2	15.3	21.3	3.48	48
	$N_{45}P_{60}K_{90}$ + inoculation	7.98	19.4	15.6	21.2	3.62	48
	$P_{60}K_{90}$ + inoculation	7.89	19.3	15.5	21.6	3.59	48
Transcaucasian, Adam variety	without fertilizers	8.06	20.1	16.5	21.6	4.07	46
	$N_{45}P_{60}K_{90}$ + inoculation	8.16	20.3	16.8	21.5	4.20	46
	$P_{60}K_{90}$ + inoculation	8.09	20.2	16.7	21.5	4.13	46
Sandy, Emerald variety	without fertilizers	8.05	20.5	16.8	21.7	4.16	46
	$N_{45}P_{60}K_{90}$ + inoculation	8.15	20.6	16.9	21.5	4.22	46
	$P_{60}K_{90}$ + inoculation	8.12	20.6	16.8	21.9	4.17	45
The smallest significant difference$_{05}$		0.32	0.6	0.6	0.5	0.4	0.7

Source: own study / Źródło: opracowanie własne

Table 2. Ash and mineral elements in the grass forage, depending on the type of sainfoin and fertilizer, the average for 2016-2018, % dry weight

Tab. 2. Popiół i składniki mineralne w paszy w zależności od odmiany esparcety i rodzaju zastosowanego nawozu, średnia dla lat 2016-2018, % suchej masy

Type and variety of sainfoin	Fertilizer option	Raw ash	Including				Ca : P	K / Ca+ Mg
			P	K	Mg	Ca		
Sowing, Amethyst Donetsk variety	without fertilizers	7.80	0.52	2.92	0.38	1.34	2.58	1.70
	$N_{45}P_{60}K_{90}$ + inoculation	7.98	0.56	2.96	0.39	1.35	2.41	1.70
	$P_{60}K_{90}$ + inoculation	7.89	0.56	2.99	0.39	1.35	2.41	1.72
Transcaucasian. Adam variety	without fertilizers	8.06	0.64	3.06	0.36	1.26	1.97	1.89
	$N_{45}P_{60}K_{90}$ + inoculation	8.16	0.65	3.11	0.37	1.33	2.05	1.83
	$P_{60}K_{90}$ + inoculation	8.09	0.66	3.19	0.37	1.32	2.00	1.89
Sandy. Emerald variety	without fertilizers	8.05	0.62	3.24	0.38	1.32	2.13	1.91
	$N_{45}P_{60}K_{90}$ + inoculation	8.15	0.65	3.33	0.39	1.33	2.05	1.94
	$P_{60}K_{90}$ + inoculation	8.12	0.64	3.30	0.39	1.33	2.05	1.92
The smallest significant difference$_{05}$		0.32	0.03	0.16	0.02	0.04	-	-

Source: own study / Źródło: opracowanie własne

4. Conclusions

It was established that the highest indicators of organic crude substances content in the feed during full flowering were in Sandy sainfoin grass, Emerald variety, while the content of nitrogen-free extractives were the lowest. There was a tendency of organic matter content to increase in the feedwith the introduction of mineral fertilizers, regardless of the type of sainfoin.

The content of mineral elements in the feed significantly depended on the type of sainfoin and the application of mineral fertilizers and inoculation. With the application of mineral fertilizers and inoculation, the content of all identified mineral elements increased regardless of the type of sainfoin.

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