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NUTRITION OF CORN IN MIXED CROPS WITH SOY FOR SILAGE DEPENDS ON THE TECHNOLOGICAL MODEL OF THEIR GROWING

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Abstract. *The results of research on the influence of cultivation technology on the formation of the nutritional value of the green mass of corn with soybeans on silage are presented. It has been established that the availability of digestible protein for the fodder unit is higher in the case of mixed crops. The introduction of mineral fertilizers, especially nitrogen fertilizers, inhibits soybean plants in mixed crops and leads to a decrease in their content in the mixture and a deterioration in the supply of digestible protein to the feed unit. The maximum provision of the feed unit with digestible protein was noted in the plot where corn and soybeans were sown in one row with the application of* $N_{120}P_{60}K_{90}$.

Key words: *corn, soy, nutrition, digestible protein, completeness of feed, feed unit.*

Introduction.

The efficiency of the livestock sector depends significantly on the provision of animals with a sufficient amount of nutritious and high-quality feed. One of the main types of canned fodder is silage, so finding ways to increase its nutritional value is an important task of agricultural science. The leading silage crop in Ukraine is corn, the green mass of which is known to be poorly balanced in digestible protein content. The deficit of this nutrient in the finished silage is 30-40 g/ feed unit. This problem can be solved by growing corn in mixed crops with high-protein crops, for example [1, 3, 4].

The principle of joint cultivation of plants was adopted by scientists from natural coenoses. The main purpose of such crops when growing them for fodder is to increase the productivity and nutrition of the fodder mass. However, it was noted that the increase in the productivity of mixed crops, compared to single-species crops of their components, is not always observed, but the quality of fodder is always higher under mixed cultivation of different types of fodder crops. At the same time, not only the content of protein in the forage increases, but also the content of amino acids in it, for example, lysine [2, 4, 6].

When forming mixed crops for feed, cereal and leguminous components are most often combined. Due to the high protein content in the leguminous component, the total protein content of the feed increases, the efficiency of photosynthesis in crops increases, the fertility of the soil is more fully used, which is also enriched with

biological nitrogen due to the cultivation of leguminous crops [1, 3, 5].

In mixed crops, the cultures included in their composition are characterized by different removal of nutrients. For example, cereal crops absorb a large amount of nitrogen and potassium and less phosphorus from the soil; leguminous crops absorb more potassium, phosphorus and sulfur. The ability of leguminous crops to obtain a significant amount of nitrogen with the help of nodule bacteria from the atmosphere reduces its removal from the soil. Under the symbiotic activity of legumes, the regime of nitrogen nutrition and the non-legume component improves [1, 2].

The purpose of the research is to study the nutritional characteristics of the green mass of corn with soybeans for silage depending on the technology of their cultivation.

Research materials and methods.

Field experiments were conducted in 2020-2021 in the fields of "Golden Bows" LLC of the Vinnytsia Region in the Right Bank part of Ukraine on gray forest soils.

The reaction of the soil solution at a depth of 0-30 cm is 5.2-5.3, hydrolytic acidity is 31.5 mg-equiv./kg of soil, the content of alkaline hydrolyzed nitrogen (according to Kornfield) is 65-80 mg/kg of soil, mobile phosphorus (according to Chirikov) – 75-100 mg/kg of soil, exchangeable potassium (according to Chirikov) – 83-100 mg/kg of soil.

The experiment was laid out according to the scheme: Factor A - sowing method (1. Corn (control); 2. Soybean; 3. Corn + soybean (in 1 row); 4. Corn (1 row) + soybean (1 row); 5. Corn (2 rows) + soybean (1 row); 6. Corn (2 rows) + soybean (2 rows); Factor B - rates of mineral fertilizers, kg/ha d.r. (Without fertilizers (control); $N_{90}P_{60}K_{90}$; $N_{120}P_{60}K_{90}$.

When setting up the field experiment, the Kodival corn hybrid (FAO 290) and the Bohemians soybean variety were used. The rate of corn sowing is 85,000 pcs./ha; soybeans (in mixed crops with corn) - 210 thousand pcs. / per hectare; soybeans in single-species crops - 700 thousand/ha.

Плануванні експериментів та статистичну обробку результатів досліджень проведено за загальноприйнятими методиками у рослинництві [7].

Results and their discussion.

It is known that the greatest value of mixed crops of corn with leguminous crops lies in the higher yield of digestible protein per unit of forage area [1, 3, 4].

In our research, in the absence of mineral fertilizers, the maximum content of digestible protein in the green mass was recorded on mixed crops of corn and soybeans - 0.51-0.62 t/ha, depending on the method of sowing (Table 1). The minimum yield of digestible protein was noted in single-species corn sowing - 0.44 t/ha.

With the introduction of mineral fertilizers at the rate of $N_{90}P_{60}K_{90}$, the yield of digestible protein per unit area increased in all variants of the field experiment. However, the greatest increase in this indicator was noted for the introduction of a double dose of nitrogen fertilizers in the background $P_{60}K_{90}$.

The maximum increase in digestible protein was obtained with the application of $N_{120}P_{60}K_{90}$ on variants where corn and soybeans were sown in one row - the obtained values exceeded the control by 0.32 t/ha. This indicator was somewhat inferior to the

variants in which, with the same mineral fertilizer background, corn and soybeans were sown in a ratio of 2 rows of cereal and one of the legume component. With this method of sowing, the yield of digestible protein was 0.72 t/ha.

1. Yield of digestible protein from single-species and mixed crops of corn with soybeans per silage depending on the technological measures of cultivation, t/ha, average for 2020-2021.

Variant	Fertilizer application options		
	without fertilizers	$N_{90}P_{60}K_{90}$	$N_{120}P_{60}K_{90}$
Maize (control)	0,44	0,54	0,64
Soy	0,46	0,53	0,55
Corn (1) + soy (1)	0,61	0,76	0,96
Corn (1) + soy (1)	0,51	0,64	0,65
Corn (2) + soy (1)	0,55	0,71	0,72
Corn (2) + soy (2)	0,62	0,64	0,66
LSD_{05}	0,05	0,05	0,06

Therefore, in terms of yield of digestible protein, variants with mixed crops of corn and soybeans prevailed over single-species crops of corn both in the absence of mineral fertilizer and with the creation of a fertilizer background. The maximum values of digestible protein yield were recorded on plots with mixed crops of corn and $N_{120}P_{60}K_{90}$.

According to zootechnical requirements, feed is considered complete if each feed unit is provided with 105–115 g of digestible protein. In Ukraine, each feed unit contains no more than 80-87 g of digestible protein. Deficiency of digestible protein leads to a shortage of 30-35% of livestock production and significant overspending of feed [1, 2]. Cultivation of mixed crops of corn with high-protein crops increases the supply of digestible protein to the feed unit to the level of 95-105 g [4]. This served as a prerequisite for our observation of qualitative changes in green mass in mixed crops.

It was established that in the silage mass of the Kodival corn hybrid, the supply of digestible protein per feed unit, depending on the rate of mineral fertilizers, was 68-71 g, which is significantly lower than the recommended physiological rate for animals (Table 2).

2. Content of digestible protein in one feed unit of silage mass of single-species and mixed crops of corn with soybeans depending on the technological measures of cultivation, average for 2020-2021.

Variant	Fertilizer application options		
	without fertilizers	$N_{90}P_{60}K_{90}$	$N_{120}P_{60}K_{90}$
Maize (control)	68	71	70
Soy	157	154	139
Corn (1) + soy (1)	98	96	95
Corn (1) + soy (1)	98	92	74
Corn (2) + soy (1)	96	92	78
Corn (2) + soy (2)	118	91	76

The silage mass in other variants of the experiment, according to the values of this indicator, prevailed over the control due to the presence of a legume component in it.

The maximum supply of one fodder unit with digestible protein was noted on unfertilized areas of single-species soybean crops - 157 g / feed unit. Among the mixtures of corn and soybeans, the feed unit with the least amount of digestible protein was on the plot where 2 rows of corn and 1 row of soybeans were sown - 96 g / feed unit.

The introduction of mineral fertilizers reduced the supply of digestible protein to the feed unit. It was noted that in the plots of single-species soybean crops, the availability of digestible protein was 154 g / feed unit. for the application of mineral fertilizers at the rate of $N_{90}P_{60}K_{90}$, while for sowing a mixture of corn and soybeans in one row - 96 g / feed unit.

The introduction of a doubled dose of nitrogen fertilizers (N_{120}) against the background of $P_{60}K_{90}$ caused the supply of the feed unit with g / feed unit.

Conclusions and suggestions.

Therefore, in the variants of mixed crops, the supply of the feed unit with digestible protein is higher. The introduction of mineral fertilizers, especially nitrogen fertilizers, inhibits soybean plants in mixed crops and leads to a decrease in their content in the mixture and a deterioration in the supply of digestible protein to the feed unit. The maximum provision of the feed unit with digestible protein was noted in the plot where corn and soybeans were sown in one row with the application of $N_{120}P_{60}K_{90}$. The obtained data should be taken into account when planning high-yield corn crops in mixed crops with soybeans for silage.

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