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CHARACTERISTICS AND NUTRITIONAL CONTENT OF THE NON-TRADITIONAL FODDER PLANT *Polygonum sachalinense* CULTIVATED UNDER THE CONDITIONS OF THE REPUBLIC OF MOLDOVA

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Abstract:

The study on the non-traditional fodder plant for the Republic of Moldova Hrișca de Sahalin (Polygonum sachalinense) was included the content analysis of the main nutrients, the appreciation of the nutritional value of the green mass and the appreciation of the silos prepared from this plant. It was found out, that the green mass of the plant during the pre-branching and branching period contained 84.77-75.0% moisture, 16.06-11.25% crude protein, 2.87-2.42% crude fat, 27.81-36.12% crude cellulose, from 43.47 to 40.78% of extractive substance doesn't contain nitrite and it has an energy value of 0,19 to 0,2 nutrients units. Hrișca de Sahalin can be successfully ensiled. The obtained silage has an olive color with pleasant smell of pickled vegetables and the lactic acid content is about 78-80% of the total organic acids. This plant starts its primary intensive growth in the spring. In the second decade of April it can be used as a supplement to the basic ration for farm animals throughout the green season. Polygonum sachalinense is a multiannual plant. Its exploitation within 10-15 years and under the conditions of the Republic of Moldova can ensures a harvest of 800-1000 quintals of green mass per 1 ha.

Keywords: *experiment, non-traditional fodder plant, Polygonum Sachalinense, green mass, silage.*

INTRODUCTION

In recent years research has been carried out in many countries on the implementation of new species of new fodder plants, non-traditional that are used as sources rich in protein, essential amino acids, other biologically active substances for the purpose of better balancing the rations, increasing the productivity of animals as well as increasing soil fertility, improving the quality of degraded soils, etc. (Teleuta, 2010; Petukhov et al., 1989; Zabarinsky, 1992).

The introduction into the Republic of Moldova of new fodder plants rich in nutritional and biologically active substances is one of the possibilities to expand the spectrum of fodder resources and to diversify animal feed in order to increase the quality of ratites used in animal feed (Bulanenkova, 1970; Zabarinsky, 1992).

Many of the non-traditional fodder plants have a high resistance to drought, various diseases, are tolerant to soil quality (Bogomaz et al., 1970; Mugnieva, 2000).

From the new fodder plants we highlight multi-year species like *Galega oriental*, Silphia, *Polygonum sachalinense*, which for 10-12 years possesses high biomass productivity, about 800-1000 quintals per hectare and offers the perspective of their implementation in the forage crops sector (Danilenko, 2013).

Studying several non-traditional plants for growing as fodder plants under the conditions of the republic, we have decided to subject the non-traditional plant to our *Polygonum sachalinense*, or the Hrișca de Sahalin, to more detailed research.

MATERIALS AND METHODS

In the central area of the Republic of Moldova (Botanical Garden, Chisinau) were conducted research on the growth, development and chemical composition of the plant *Polygonum sachalinense*, in various phases of vegetation - before buttoning, branching, butonization.

The monitoring of the growth and development of the *Polygonum sachalinense* has been carried out since March and has continued throughout the growing season.

During this period were made various measurements, weighing, plant samples were

taken at different stages of growth, prepared silo parties in various capacities (barrels, trenches) and carried out multiple chemical analyzes in the institute's laboratory.

RESULTS AND DISCUSSIONS

The *Polygonum sachalinense* begins its growth periodearly in spring, has a high growth intensity and a long vegetation period. Accelerated growth and accumulation of a large amount of green mass in a relatively short time, prolongs the periods between the vegetation phases that are much longer than in plants of high intensity of traditional fodder. Thus, under the conditions of the Republic of Moldova, the plant reaches to have the height of 1.0 - 1.5 m on April 19, when it is still very young, green and mustard, and is in the intensive period of growth.

During the growth of plants, samples were taken when the plants were of 98-155 cm high, then in the pre- branching phase, the branching phase and the phase before the buttoning.

During the green season the process of growth of plants of *Polygonum sachalinense* was monitored (Table 1).

Table 1. Dynamics of growth of the *Polygonum sachalinense*

Date	Height of stem,cm
25.03.2017	10-12
05.04.2017	50-60
12.04.2017	60-98
19.04.2017	98-155
11.05.2017	205
18.05.2017	270
29.05.2017	357
13.06.2017	400

On April 5, the plants were of 50-60 cm high. After on April 12, the intensive plant growth period began and within 1 month, namely on May 11, the plants had the height of 205 cm. On May 11, 2017, were picked herbs of *Polygonum sachalinense* from the 1 sow, when the height of the plant was 181-239 cm. Data Table 2 represents the content of basic nutrients that were evaluated following the chemical analyzes performed in the Institute's laboratory.

In the period when the plants were already of 98-155 cm high, the total humidity was high at the level of 87.01%, in the pre-branching stage it fell to 84.77%, during the branching phase it constituted 75.0% and in the pre-butonization phase it dropped to 68.53%. So, there is a steady decrease in humidity with the growth and maturation of plants. At the same time, crude protein content decreases from 19.94% in the early phase, 16.06% in the pre-branching phase, and 11.25% in the branching phase, to 9.88% in the pre-butonization phase. Also, the crude fat decreases from 3.35% in the early phase to 1.93% in the pre-buttoning phase. A rather vertiginous increase manifests in crude cellulose, which from 14.91% in the early phase, rises to 27.81% in the pre-branching phase and stops at 36.12-38.53% in the phases branching and before buttoning.

Table 2. Chemical composition of the *Polygonum sachalinense* depending on the vegetation phase (% in dry substance)

Indices	Young plant, intensive growth 19.04.17	Befo-re rami-tion 18.05. 17	Ramific ation 13.06. 17	Before the butonizati on- 22.06.17
Humidity,%	87.01	84.77	75.0	68.53
Dry sub-stance ,%	12.99	15.23	25.0	31.47
Azote ,%	3.19	2.57	1.8	1.58
Crude protein ,%	19.94	16.06	11.25	9.88
Crude fat ,%	3.35	2.87	2.42	1.93
Crude cellulose,%	14.91	27.81	36.12	38.53
Crude ash,%	9.01	7.14	6.73	6.38
SEN,%	44.72	41.44	38.92	38.31
Carotene, mg/kg	30.35	40.0	63.75	66.57
Nutritional units	0.11	0.13	0.20	0.22

Humidity of the plant. An important role in the use of plants in animal feed, both fresh and in various forms of preparation, conservation and preservation, has the moisture content in plants. It is known that both excess water and low humidity have a negative impact on the conservation and subsequent preservation of fodder. In our research, during the vegetation period, plant moisture was very high at the beginning of vegetation and decreased with growth, maturation and aging. Thus, the total humidity in plants in the early growth period (April) is high and ranges between 84.77 and

87.01%. Gradually, as the plant grows, moisture decreases, and in the period when plants are at the harvest stage (June, July, August) gradually decreases to 72.17% and even to 69.11%. Analyzing the moisture content differentiated in stems and leaves, the stems were found to be very musty and contain up to 90.13% water, whereas the leaves have only 81.6%. Due to excessive humidity in the early intensive growing season, the previously made attempts to mow and dry the hay plants were quite difficult and even problematic. Later, in the maturation stages, when the plants reach the thickness of the ground stemof 1.5 cm, the drying of the hay is unacceptable due to the wooding of the stem and the inability of the animals to consume them.

Crude protein. The crude protein content of the dry substance differs greatly depending on the vegetation phase, the age of the plant, the height of the stubble at which the plant was mown. Analyzes made from our research showed that the crude protein in the plant at the beginning of the vegetation is 21.35%, the next stage of growth decreases to 16.68% and the phase before the botonization when the plant is quite high, reaching 4 m, crude protein continues to decrease to 10.2%. At the maturing stage, the crude protein content stabilizes at 10.0% and does not change essentially until the end of vegetation. Following the analysis performed differently in stems and in leavesa rather significant difference in the amounts of crude protein was also found. The crude protein content in the leaves is nearly twice as high as in the stems and is correspondingly 23.78 and 13.54%.

Plants grown on a more impoverished, unprocessed soil throughout the year had a minimum protein content of 9.81% when plants on other parcels contained 16.68%.

The fodder plant corn, which served in our research as a control plant in the spiking vegetation phase, had 7.06% and in the grain milk phase - 8.06% crude protein.

Crude cellulose. As the plants grow and develop, the crude cellulose content also increases considerably. Thus, with the intensive growth and maturation of plants, the crude cellulose content increased considerably from 17.0% in the early growth stage to 29.79% in the pre-branching phase, 35.41 in the branching phase, and 37.51% in the pre-butonization phase. Gross cellulose content is relatively small in *Polygonum sachalinense* - 21.85% compared to green maize - 26.78%. Analyzing the crude cellulose content differentiated in stems and leaves, crude cellulose was found to be higher in the stem - 28.54% and much less in the leaves - 11.81%.

Regarding the vegetation stages, the higher the stage of vegetation, the more the cellulose increases (from 17.0% in April to 29.79% in May) and the protein decreases (from 21.35% in April to 16.68% in May).

Carotene. Carotene is an important feed nutrient. It varies considerably depending on the vegetation phase and depending on the age of the Polygonum Sachalinense plant. During the time as the age of the plants is increased, the carotene content is increased as well from 30.35 mg/kg in the early growth phase to 66.57 mg/kg in the vegetation phase before a botonization. According to our observations and research, this increase is due to the ramification and the leaf grows. Since carotene is concentrated in leaves and the new ramification of branches have a large amount of leaves, it is logical that the total content of carotene in the plant is increased. An astonishingly large carotene content was found out in different parts of the plant such as in stems and in leaves. In our research the leaf carotene have reached 58 mg/kg, and in stems it was only 4.0 mg/kg.

Nutritional units. Following chemical analyzes, it has been found that the energy value of the *Polygonum sachalinense* plant varies depending on the period and the vegetation phase and increases as the plants mature. In the early growth period of plants, the plant's energy value was around 0.11 UN, in the next stage of growth, before branching-0.13, and from the vegetation phase branching stabilized at 0.2 - 0.22 UN/kg.

Table 3. Nutrient content in various parts of the *Polygonum sachalinense* plant (% in dry substance)

Parts of the plant	Total humi-dity	Crude protein	Crude cellu-lose	Carotene mg/kg
the entire plant	85.2	18.20	25.54	41.98
leaves	81.6	23.78	11.81	58.0
stems	90.13	13.54	28.54	4.0

The chemical analysis of the main nutrients in various parts of the *Polygonum sachalinense* plant, found a fairly convincing difference between stems and leaves. Thus, the stems contain a large amount of water – 90.13% and the leaves - 81.6%, the crude protein in the leaves is 23.78% and in the stems only 13.54%, the crude cellulose in the leaves constitutes only 11.81 % and in stems 28.54, carotene is concentrated in leaves at the level of 58%, and in stems only 4.0%.

As a control plant to highlight the similarity of the Polygonum Sachalinenseplant with a traditional culture cultivated in R Moldova, was selected the maize.

Polygonum sachalinense and Maize plants were taken to assess the amount of nutrients in the optimal harvesting stages for feeding the animals as a green meal. Thus, the *Polygonum sachalinense* was harvested in the vegetation phase prior to butonization, and the corn in the grain milk phase.

From the data of Table 4 it appears that the *Polygonum sachalinense* in the pre-butonization phase contains 10.63% crude protein as opposed to 7.06% in maize.

Table 4. Nutrient content determined in *Polygonum sachalinense* and Maize plants (% dry substance)

Plant	Humidity	Crude protein	Crude Cellulose	Crude fat	SEN	Carotene	Nutrient contents
Polygonum Sachalinense 13.06.017	76.81	10.63	36.89	2.19	38.36	63.75	0.16
Maize 9.08.017	77.55	7.06	25.37	1.84	54.99	55.17	0.22

A fairly large difference is in crude cellulose content, 36.89% in *Polygonum sachalinense* and 25.37% in maize. Carotene is not much higher in *Polygonum sachalinense* - 63.85% than in maize - 55.19%. Crude fat 2.19% in *Polygonum sachalinense* and 1.84% in corn, SEN 38.36% in *Polygonum sachalinense* and 54.99% in corn.

As a result, these differences in nutrient content did not essentially influence the energy value of both plants, which is 0.2 UN in the *Polygonum sachalinense* and 0.22 UN in maize. There are also quite large differences between these two plants in terms of exploitation periods, both in favor of one and the other. *Polygonum sachalinense*, being a plant that grows intensely during the early spring, can be used in animal feed starting with the second decade of April and continuing throughout the spring, summer and early autumn 2-3 mows per season.

Another chapter of the research was the study of the capacity of pretation of green massof *Polygonum sachalinense* to preserve by silage.Thus, the green mass of this plant was chopped and ensiled in small volumes under laboratory and in bulk volumes (barrels 75-150 kg, mini slides 400-500 kg) under semi-production conditions. After 60 days (sufficient time to complete biological preservation processes), were taken samples of silage and chemical analyzes were carried out on the nutrient content (Table 5).

Table 5. Nutrient content in the silage of *Polygonum sachalinense* (% of DS)

Total humidity	Crude protein	Crude Cellulose	Crude fat	Carotene,mg	Ca	P	UN
83.31	13.69	27.56	2.89	19.5	0.83	0.32	0.19

In the silage samples taken from the semi-production capacities, the moisture content was found to be 83.31%, the crude protein at the level of 13.69% in the dry substance, the crude cellulose 27.56%, the carotene 19.5 mg/kg, the calcium 0.83% and 0.32% phosphorus.

Table 6. Content and correlation of organic acids in the silage of *Polygonum sachalinense* (%)

Acetic acid		Butyric acid		Lactic acid		The sum of acids	Correlation of acids,%		
free	fixed	free	fixed	free	fixed		acetic	butyric	lactic
0-0.4	0.05-0.12	0	0-0.02	0.09-0.35	0.3-0.92	0.73-1.22	5.42-22.88	0-2.3	76.68-93.95

Regarding the organic acid content a very small amount of acid was found acetic acid (0.02-0.03%), complete absence ofbutyric acid in a free form and a relatively high amount of lactic acid (0.30-0.92%).
The correlation of organic acids in the obtained silage where the lactic acid level is 76.68-93.65% is a desirable for quality ofsilage. The small amount of acetic acid, the
sufficient amount of lactic acid, has led to a good conservation of the green grass of *Polygonum sachalinense* and to the production of a good quality silage
The organoleptic analysis of the silo found that the consistency, appearance, smell, color, correspond to the quality requirements of the silage prepared from herbs

CONCLUSIONS

In the Republic of Moldova the *Polygonum sachalinense* plant is experimentally cultivated in the plots on different lands and for 15 years it has adapted well enough to the local climatic conditions.
The *Polygonum sachalinense* has manifested an amazing growth intensity from the early spring, that in the second half of April reached 98-155 cm high making it possible to use it as a green mass in the spring ration of the early animals.
The content of nutrients in *Polygonum sachalinense* is approaching the traditional green maize plant, with the exception of the crude cellulose that at a certain stage of vegetation as a result of maturing the plant, is high - 32.84-38.62% in dry substance.
The green grass of the plant *Polygonum sachalinense* is well suited to silage in the stages of vegetation before branching, and before butonization.

REFERENCES

Bogomaz V.A., Grozdov B.L., Clevensky H.M.,1970. *Polygonum sachalinense* - a new fodder plant. Publishing House "Bryansk Worker", 1960. P.24-25.

Bulanenkova E.N., 1970. New Silo Cultures in Mordovia // V-th Symposium on New Silo Plants: Tez, Dokl. L., 14-15.

Danilenko I.A., Pesotsky V.F., 2013. Non-traditional, new and forgotten plant species: scientific and practical aspects of cultivation. Materials of the First International Conference September 10-12, Kiev, 3..

Mugnieva L.A., 2000. Efficiency of using fodder from the PolygonumSachalinense in feeding sheep. Author's abstract of the dissertation.

Petukhov E.A., Bessarabova R.F., Kholeneva L.D., Antonova O.A., 1989. Zootechnical analysis of fodder, VO "Agropromizdat", 238.

Teleuță A., 2010. Introduction and study of non-traditional fodder plants in Moldova. Achievements and perspectives. Materials of the International Scientific Symposium «Conservation of Various Plants» celebrated the 60th anniversary of the foundation of the Botanical Garden (Institution) of the Academy of Sciences of Moldova 7-9 October 2010, Chisinau, 425-433.

Zabarinsky H.A., 1992. Sakhalin buckwheat // Southern Russian agricultural newspaper, 6-7.