EFFICIENCY OF BIOPREPARATIONS BASED ON STRAINS OF NITROGEN-FIXING BACTERIA IN THE PRODUCTIVITY OF ALFALFA IN THE CONDITIONS OF CENTRAL YAKUTIA.

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Annotation. Long-term experimental data on the effect of strains of nodule and associative bacteria on the yield of alfalfa, which increase the agrochemical parameters of permafrost soils in Central Yakutia, are presented.

Key words: alfalfa, inoculation, strains, nodule bacteria NB, associative rhizobacteria ARBC, yield.

In modern conditions, when biologization of agriculture is introduced into agriculture, the application of biological bacterial preparations made on the basis of bacteria that stimulate the growth and development of plants acquires a wide interest and practical significance. They have a multilateral positive effect on plants. Under the influence of nitrogen-fixing bacteria, the following processes occur: amplification of symbiotic and free-living fixation of molecular nitrogen, reaching 30-50 kg of nitrogen per hectare over the vegetation period. The value of

alfalfa as a protein culture is determined by high fodder merit, relatively low energy intensity of cultivation, low demand for soil fertility, high nitrogen-fixing capacity. Due to these microorganisms, additional production of physiologically active compounds takes place, including hormone plants, which increase the capacity of the root system. Optimize mineral nutrition and improve the water regime of plants. They participate in the dissolution of hard-to-reach phosphorus compounds that protect the roots from bacterial and fungal infections, suppress stress reactions in plants that increase their resistance to unfavorable external factors [1].

Methods of research. The research was carried out in 1997-2012. at the scientific hospital of the Yakutsk Scientific Research Institute, located 90 km from the city of Yakutsk in the Khangalassky ulus. In the soil-climatic conditions of Central Yakutia the sickle-shaped alfalfa of Yakutskaya yellow variety is cultivated from bean grasses. The hospital is located above the floodplain terrace of the Lena River with a frozen taiga pale middle loamy soil, which in the initial state contains an average of 1.43% humus, 164 mg / kg soil phosphorus, 145 mg / kg potassium, pH 8,06. The objects are nodule bacteria, associative nitrogen fixers from the collection of All-Russian Scientific Research Institute of Agricultural Microbiology, St. Petersburg. In 1999, a local strain of Yakutskiy No. 1 from the permafrost taiga fawn soils of the Khangalassky ulus was identified and in 2007 a patent was obtained [2]. Experience was gained by the method of usual repetitions with a randomized placement of options. The plot area is 7 sq.m., repeatability fourfold. Sowing was carried out manually, with space between rows of 15 cm, 4 lines, depth of seeding - 3-4 cm. Inoculation was carried out before sowing with a rate of 200 g strain per hectare norm of alfalfa seeds. (6 kg / ha, or 40 - 50 plants per 1 sq.m with 100% of the plant life). All surveys and observations were carried out according to the adopted methods, statistical processing of yields - by the method of dispersion analysis (B.A. Dospekhov, 1985) [3].

Observations of the growth and development of plants were carried out according to the method of G.S. Posypanov "Methodological aspects of studying the symbiotic apparatus of legume crops in field conditions" (1983) [4]. The effect of biological preparations on the basis of strains of nodule bacteria and associative bacteria for the growth and development of plants was carried out according to the method: The use of biological products according to the "Technique for assessing the effectiveness of the use of microorganisms that increase the productivity of plants" (All-Russian Scientific Research Institute of Agricultural Microbiology, 2012) [5]. Common methods are used to determine phosphorus, potassium, nitrogen in the laboratory of biochemistry of the Yakutsk Scientific Research Institute of Agricultural. The cleaning was done manually by hand.

To calculate the exchange energy of alfalfa, a methodological manual on agroenergetic and economic evaluation of technologies and systems of fodder production was used (All-Russian Research Institute of Forages named after VR Williams, M., 1995) [6].

Meteorological conditions during the years of research were different.

Vegetation period of 2001-2003 was characterized by a cold, windy spring. In July 2001-2003, at high air temperatures, the moisture deficit was 30.2-33.6 mm, which had an extremely unfavorable effect on the formation of the crop of fodder crops. The second half of the growing season was favorable for the growth and development of plants.

Vegetation period 2004-2005 from May to September was characterized by an early and warm spring, moistened by the beginning of summer and warm temperatures in September. The data of the year were favorable for the formation of the aboveground mass of perennial grasses.

Weather conditions of the research period 2006-2010 were abnormal by the temperature regime, the distribution of atmospheric precipitation in comparison with the average long-term data of meteorological observations, which in many respects influenced the yield of perennial grasses.

The vegetation period of 2011 is characterized by a warm, transient spring, the period May-August is characterized by a sufficiently high heat supply, the nature of deposition and distribution of precipitation is also favorable for the growth and development of plants.

The vegetation period in 2012 is extremely droughty. From May to July, the amount of precipitation (33.6 mm) is 68.4 mm below the average annual norm (102.0 mm). The rains that fell in August (78.5 mm) despite almost double excess from long-term data (41.0 mm) did not have a big impact on the yield of green mass of alfalfa.

Research results:

The purpose of the present studies is to study the effect of inoculation of the seeds of alfalfa with biological preparations based on strains of nitrogen-fixing bacteria on the productivity of alfalfa.

Over the years of research from 1998 to 2012, inoculation of seeds with biopreparation on the basis of strains of nitrogen-fixing bacteria had a positive effect on the yield of green mass of alfalfa sickle-shaped Yakutskaya yellow. (Table 1). The yield of green mass of alfalfa amounted, on average, to the local strain of Yakutskiy No. 1 Sinorhizobium meliloti of 37 t / ha, which is 8 t / ha or 27% higher, with production strain 425a-35t / ha, which is 20% higher with strain 7 Misorine is 17% higher than in the control variant. In all the studied variants, 1 kg of dry matter contained 0.79-0.95 of the feed unit, 9.9 - 10.8 MJ of metabolic energy, which corresponds to or approaches the standard for hay of the first class. For the fodder value, the best variants were the local strain of Yakutskiy No. 1, in which the digestible protein was collected in 174 g respectively.

Table 1. The yield of green mass of alfalfa and the content of exchange energy.

Variants	1998 – 2003	2004 – 2008	2009 – 2012	Average	K5	ME, MJ	fodder unit	digestible protein

Control without processing	31	27	28	29	0,72	9,86	0,78	168
NB 425a Rhizobium	40	31	33	35	0,72	9,90	0,79	170
NB Yakutskiy №1 Sinorhizobium meliloti	42	33	32	37	0,79	10,8	0,95	174
ARBC misorin Arthrobacter mysorens, 7	36	35	30	34	0,74	10,7	0,94	173

Research on the effect of seed inoculation on the agrochemical composition of permafrost soils were continued. (Table 2). In comparison with the agrochemical composition of the soil before sowing of alfalfa seeds in 1997, the difference in content of humus in the soil, on average, is 1.11%. Depending on the options, the humus content in the plow layer from inoculation with strains of nodule symbiotic bacteria increased by 0.75% than in the control variant. Due to the free-living bacteria of the ARBC, the humus content was improved to 0.69%. The effect of the local strain Yakutskiy No. 1, if one compares the variant without treatment, the humus content increased by 0.67%. At the same time, the phosphorus consumption on inoculated variants is less, potassium accumulation is observed, which is typical for cryogenic soils.

Table 2. Agrochemical composition under the old-growth herbage of alfalfa from the use of nitrogen-fixing bacteria from 1997 to 2012.

Strain	Humus,%	N total,%	Phosphor, mpg	Potassium, mpg	pH
Control	2,54	0,22	152	241	7,9

NB	3,29	0,26	182	270	7,8
ARBC	3,23	0,23	169	247	7,6
Yakutskiy №1	3,21	0,20	125	232	7,7

Conclusions. As a result of long-term experimental data, we have established that inoculation with strains of nodule bacteria, also with local strain Yakutskiy No. 1, associative nitrogen fixers for 16 years after their application positively affects the yield of green mass of alfalfa. The cultivation of such a high-protein and drought-resistant culture as alfalfa in Central Yakutia will contribute to a significant strengthening of the fodder base, especially in dry years. It is beneficial to cultivate alfalfa for a long time, selecting strains for seed inoculation with nitrogen-fixing bacteria, increasing the content of humus in the soil, thereby improving the fertility of permafrost soils.

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