Scientific support of the fodder production: V. R. Williams All-Russian Fodder Research Institute (WFRI) activity

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Abstract. It is well known that the production of green feed is very important for the cultivation of farm animals. Green food actually plays a major role in feeding dairy animals. This type of feed provides essential nutrients for milk production as well as the health of dairy animals. Recently, more and more questions arise to the ecology of feed, the soils on which they grow. In Russia, the flagship of scientific research in this matter is the V. R. all-Russian Williams feed production research Institute (WFRI). Forage production, as a scientific discipline, is focused on the study of forage agro ecosystems. The article describes the new results of the Institute in the cultivation of environmentally friendly forage crops and seed propagation, production of field feed and pasture management. Results of research of ecological technologies for preservation and use of forages, technologies of grain-fodder production and utilization are resulted.

1 Introduction

Currently, in the conditions of the need to implement environmental, resource-saving systems of agriculture, research in the system of biogeocenosis is very relevant: soil-plant-feed-animal-livestock products. A living organism is part of the biosphere, part of the earth's crust, it is inextricably linked with it. A peculiar environment of human activity in this system are peat soils. Meanwhile, Russia belongs to the belt of intensive peat accumulation. The area of swamps and wetlands is 320 million hectares, including 130 million hectares with a layer of peat more than 30 cm.

In this regard, it is necessary to create a system of agricultural nature management that meets the principles of biosphere compatibility, in which the increase in agricultural production is based on the integration of the agroecosystem into the anthropogenic disturbed marsh landscape.

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The relevance of the work is determined by the need for scientific justification and production evaluation of organizational and technological measures to preserve the soil cover, sustainable functioning of agroecosystems, effective feed production for dairy cattle on peat soils of the North-East of the European part of Russia.

Forage production is the most large-scale and multifunctional branch of agriculture in Russia, uniting other agricultural divisions in a common system. Thus, the forage production provides:

- animal feed;
- sustainability and efficiency of production for crop production;
- soil fertility for agriculture.

More than 50% of the 78 million hectares of cultivated land and 70 million hectares of local pastures are used for feed production. The share of feed in the unit cost of milk is 54%, in the production of pork-60%, in the production of poultry-more than 70%.

Forage production, as a scientific discipline, is focused on the study of forage agroecosystems, natural pastures, permanent cultivated pastures, perennial grasses and annual forage crops on arable land. All these facilities are characterized by production, soil protection and environmental functions. Such as:

- the source of various feeds for animals;
- resources to increase the resilience of agroecosystems to climate fluctuations;
- increase of soil fertility, including enrichment with biological nitrogen and humus content;
- reduce soil acidity and erosion, improve structure;
- regulation of water, food and air regime of agroecosystems;
- improving the environment;
- aesthetic and ecological role.

All-Russian research Institute of feed. V. R. Williams (WFRI) is currently the leading scientific-methodical, research organization for fodder production in Russia. The main task of the Institute is to develop the theoretical foundations of feed production, methodology, methodology and standards. Our researchers continue the scientific traditions of the leading scientists in the field of feed production and fundamental scientific schools that were established in VFRID more than 100 years ago.

Currently, the main areas of research are:

- cultivation of fodder crops and reproduction of seeds, including medicinal plants;
- production of field feed;
- pasture management;
- technology, conservation and use of feed.

2 Methods

Breeding and research programs are aimed at mobilization, reservation and study of genetic resources of forage crops. Every year, the Institute organizes expeditions to collect samples of the world biodiversity of forage plants, which can be used as source material in breeding projects. At the moment, we have more than 6.5 thousand samples of 235 types of crops. In total, based on the genetic collection, it was necessary to breed 150 varieties, 85 varieties of the new generation were widely distributed in the country, including legumes, grains and cabbage [1-4].

Early-ripening varieties of red clover early-2, trio and other crops allow you to transfer the sowing of clover 300 km to the North and 600 km to the North-West of our country.

Alfalfa varieties are created by our breeders for different regions in accordance with specific economic goals and environmental conditions. For example, the Lada variety was
developed for hay because it is characterized by significant foliage and a protein content of 22-24%. The main features of pasture-88 and meadow-67 are high regrowth and resistance to trampling, so these varieties are usually used to create pastures. Selenium and salt-Resistant varieties were developed specifically for acidic soils with increased tolerance to toxic aluminum ions (Fig. 1).

![Fig. 1. Competitive variety testing.](image)

Fig. 1. Competitive variety testing.

Our specialists adhere to the principles of applying biogenetic approaches to the selection of forage crops, which are based on the maximum use of resources contained in the:
- investigated interactions between the various species of plants;
- in symbiosis between legumes and nodule bacteria; between plants and rhizosphere nitrogen-fixing organisms;
- between perennial grasses and mycorrhizal fungi.

It turned out that Agnia alfalfa is characterized by high symbiotic activity and provides accumulation of 270-300 kg/ha of biological nitrogen.

Considerable efforts of our researchers are focused on the development of new varieties of forage crops for mixed crops and phytocenoses. A leading specialist in winter Vetch breeding Professor Turin promotes mixed crops of Vetch and rye, as well as Vetch and triticale throughout Russia.

### 3 Results and Discussion

The optimal balance between annual crops and perennial grasses, crop rotations are important tools for the production of quality feed, to maintain soil fertility, to resist drought, water and wind erosion, to protect against biotic and abiotic stresses.

For the first time on peat soils of the North-East of Russia complex comparative researches in system "soil - a plant - a forage — an animal — livestock production" are carried out. The use of such soils under perennial grassy vegetation is justified mainly in the hay-pasture regime [4-8]. The data on the quality of plant raw materials and feed, their biological potential, allowing to improve the detailed norms of feeding highly productive cattle. Biologically active additives to the main forages received on peat soils are developed and tested on animals.

We have determined that the agricultural use of peat lands is based mainly on the system of meadow fodder production and pasture farming. Cultivation of perennial grasses,
their mowing in the phase of entering the tube and earing, preliminary drying before harvesting, objective assessment of feed for rationing diets, increasing their usefulness by including biologically active additives can significantly increase the productivity of cattle breeding and improve the quality of milk and beef [9-12].

Studies have shown that peat soils by their nature are significantly different from mineral soils. They are 80.95% consist of organic matter and, in this regard, have specific physical and agrochemical properties, form a special thermal regime. They are distinguished by a significant content of nitrogen-1.77% vs. 0.11% in mineral soil and iron 382 mg per 100 g of soil vs. 14.4 mg in mineral soil.

We found that perennial grasses grown on peat soils have differences in chemical composition compared to plants grown on mineral soils. They contain more organic matter and raw protein. However, their digestibility of nutrients is lower than in herbs grown on nearby mineral soils [13-17]. The content of crude protein in the plants of boneless, grown on peat, was: when mowing in the phase of release into the tube 17.9% (on mineral soil 16.8%), when mowing in the phase of earing - 13.7% (on mineral soil 12.6), when mowing in the flowering phase - 8.6% (7.8%). The digestibility of raw protein of grasses mown on peat land was 75.2% in the phase of emergence into the tube; earing-69.3%; flowering-47.2% (on mineral soil 77.4%, 71.9% and 49.8%, respectively).

As plants grow and develop, the digestibility of all nutrients decreases. Thus, the dry substance of the boneless stalk, mown on peat soil, was digested as follows: when plants were alienated in the tubulation phase by 73.2%, in the earing phase by 66.4%, in the flowering phase - by 50.3%. The coefficients of digestibility of organic matter were 76.1%, 69.1% and 52.4%, respectively (Fig. 2).

![Fig. 2. Nursery for studying the effectiveness of recurrent biotypic selection on artificial Fusarium background.](image)

It was determined that for the preparation of higher-quality bulky feed, it is necessary to use pre-drying of the green mass. This technique allows you to increase the digestibility of dry grass matter from 69.86% to 72.90%, organic matter from 71.07% dried to 74.17%, protein from 71.18% to 73.10%. Feed from peat soils have a peculiar mineral composition. Plants grown on peat bogs contain significantly less zinc, cobalt, copper and more iron. Thus, the content of iron in herbage Timothy meadow of peat soil were in the phase of the
tube 76 mg/kg (control 118 mg/kg) in the earing phase 74 mg/kg (control 182 mg/kg), in flowering phase 78 mg/kg (control 195 mg/kg) [18-21]. We conducted an assessment of the quality of feed from peat soils on young cattle allows us to conclude about the high productive effect of silage from dried Timothy meadow, mown in the early phases of development. When feeding young cattle rations based on silage from dried herbs, harvested in the phase of trubkove daily liveweight gain of steers is 1000 g, in the phase of earing - 871 g, and in the phase of flowering - 600 Beconcentrated feeding cows in summer due to the green pipeline can fully meet the needs of pregnant dry cows (average daily gain in live weight 929 g), however, leads to a significant reduction of live weight of fresh heifers.

The rations developed on the basis of an assessment of forages on the actual data of chemical composition and digestibility (in vivo) allow to detail norms of feeding of cattle, to increase productivity and resistance of animals, to provide effective management of cattle breeding on the peat soil [22-25].

4 Conclusions

Peat soils are unique organogenic formations, characterized by completely different physical and chemical properties than mineral. They consist of 80.95% of organic matter, contain more nitrogen, are poor in potassium, phosphorus and trace elements, have a high moisture capacity and durability, have high heat capacity and low thermal conductivity. Forage production on peat soils should be based on specialized forage crop rotations, dominated by perennial grasses that preserve organic matter and protect the soil from erosion. Meadow fodder production-the basis of agricultural nature management on peatlands involves the development of cattle breeding, first, the breeding of cattle. For conducting ecologically expedient, economically profitable cattle breeding on peat soils the system of forage production including an objective comparative assessment of forages providing the effective organization of work of feed producers and the rations with the original additives allowing zoo veterinary staff to optimize production of milk and beef is developed.

Perennial grasses on peat soils develop well and give high yields. Moreover, the supply of fodder mass on the slopes is more evenly, thanks to the regulated water regime due to the drainage network. Thus, the harvest of boneless stalk when mowing in the third mowing in the phase of entering the tube on the peat was 21%, and on mineral soil only 16%.

Feed harvested from plants grown on peat soils, have a higher content of organic matter, crude protein, but worse digested. In this regard, it is not always correct to use the generally accepted digestibility coefficients to assess the nutritional value of feed from peat soils, since in this case they will be overestimated. Moreover, particularly noticeable distortions observed in the nutritional value of the green mass, mown in the early phases of development: exit into the tube and earing, as well as in the feed prepared from it. The nutrient content of the green mass of boneless, mown in the phase of exit into the tube, on peat soil according to the digestibility coefficients determined by the in vivo method, is 11.22 MJ per 1 kg of dry matter (fig. 2), and when using coefficients for similar grass grown on nearby mineral soil-11.58 MJ OE. The nutrient content of silage from the boneless rump, beveled in the exit phase into the tube, respectively, is -10.81 MJ and 11.21 MJ OE. The difference in nutritional value of 1 kg is not significant, but when projecting it as a whole on a diet consisting of feed from peat soils, a deficit of digestible protein and metabolic energy created.

We expect that scientific support of fodder production will become the strategic direction in agriculture development and will provide feed for animals, fertility of soils and
sustainability of agro landscapes. As a result, all these factors are the base of Russia food safety.

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