Pasture monoculture in conditions of drained peat soils

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Abstract. In this article, on the example of a pasture area in 1935, zaluzheniya, theoretical provisions and practical developments on the creation and use of long-term cultural pastures (DCP) on a drained low-lying peat deposit are presented. The paper shows the environmental and soil protection role of a long-term pasture ecosystem in preserving and extending the life of a peat deposit used as soil. It is noted the peculiarity of the system of grass stand care, the uniqueness of its species diversity, the influence of various factors on the consumption of pasture phytomass by lactating cows. A special place is given to the assessment of the physiological state of grazing animals, their productivity and reproductive functions.

Keywords: peat soil, pasture grass, cow productivity, feedability, podvyalivanie, species diversity, animal condition, soil properties.

1. Introduction

In world agriculture, it has traditionally been the case that hayfields and pastures were allocated mainly to the least suitable land for arable land: overgrown, swampy wastelands and drained swamps. However, there are a sufficient number of examples of effective development of peat bogs for meadow monoculture [1, 2, 3, 4]. It is known that drained modern peat bogs are extremely vulnerable natural objects. Formed over several millennia, they can disappear without a trace within several decades as a result of excessive drainage and intensive use [5, 6, 7]. To extend the operational period of the peat deposit functioning as a soil, many scientists recommend using these objects mainly in meadow grass. One of the most practiced areas is the creation of pastures and the entire pasture infrastructure. The duration of the life cycle of a pasture ecosystem depends on many factors: the Genesis of the swamp itself, the selected grass mixture, the drainage regime, the intensity of grazing, and the care system. The expediency of having prep at the present time is due to many circumstances. So, the huge crowding of animals in modern complexes does not always allow for grazing ruminants. In contrast, organizations with a small number of dairy herds (300-400 heads) must necessarily use the pasture resource in the green conveyor.
This work can be considered as a special and unique case of the intersection of environmental expediency and economic necessity in the framework of a single research and production project, which began in the 30s of the last century. In order to evaluate agroecological potential of peat soil under permanent meadow and pasture advantage of cattle (cattle) were the following main tasks:

- to set the duration of the operation and the role of conservation meadow grazing ecosystem in maintaining S peat;
- to study the effect of fertilizers on the feedability and composition of grass;
- to identify the influence of grazing on the physiological state of animals, their productivity and quality of dairy raw materials;
- to determine the biological role of secretions of cows in the optimization of the grazing ecosystem.

2. Methods and materials

The research was conducted on a typical low-lying drained peat "Gadovskoe" located in the center of the Kirov region (Russia), with a total area of 3000 hectares. Peat sedge, wood-sedge. The degree of decomposition is 30-40%, ash content-7-16%. The object of research is a pasture plot with grass sown in 1935 on low-power peat soil. The herb mixture included: Trifolium repens, Tr. hybridum, L., Poa pratensis, Festuca rubra, F. pratensis, Lolium perenne, Phleum pratense, Alopecurus pratensis, Agrostis alba, Poa palustris. During 85 years of permanent pasture use, there was a significant restructuring in the species composition. In the course of evolution, many sown species almost disappeared, and new ones appeared. Among the well-eaten species, Agropyron repens (38-52%), Poa pratensis (11-18%), Alopecurus pratensis (4-15%), and Trifolium repens (4-10%) dominate. The species composition of the pasture grass mixture, together with the introduced mixed grasses, reaches 60 species. Thus, created in 1935, the pasture herbage sown with 10 types of grasses is close to the best natural flooded meadows typical of floodplains of European rivers. Currently, this area continues to graze highly productive black-and-white cows with a productivity of 9,000 kg of milk from one cow. The mode of use of prep is corral-portioned. Despite a fairly high load (3-3.5 goals / ha), the grass stand continues to function without visible signs of degeneration. The ground water level on the site is within 70-90 cm.

3. Results and discussion

In the long-term concept of rational use of drained low-lying peat soils developed by scientists of the station, a special role in the preservation of organic matter is assigned to perennial grasses. A well-developed root system, whose reserves reach 100-120 C / ha, as if performing the protective functions of the skin coating, maximally reduces the processes of peat oxidation. Observations of soil respiration show that grasses used in mowing mode emit the highest amount of CO₂ compared to annual forage crops. Multiple mowing of grasses can produce up to 7-10 t/ha of CO₂ per season, but almost half of it is immediately used in the process of phytosynthesis. This property of meadow grasses explains and repeatedly reduces the imaginary danger of carbon return in the form of carbon-containing gases to the atmosphere in dangerous quantities when using peatlands in crop production.

A special regime in the soil is created under meadow grasses used in pasture mode. Under these conditions, in contrast to the mowing regime, some of the pasture phytomass remains in the form of mown, and sometimes un-mown uneaten residues. As a result, a semi-decomposed felt-like thermal insulation cushion is formed over decades, which can significantly change many soil regimes during dry periods. The accumulated litter slightly reduces the potability of the herbage, while it protects the peat deposit from mineralization even more reliably. The last sounding of the site showed that over 80 years of operation of the pasture, the peat capacity on it has decreased by only 8 cm. For comparison, under annual crops with a large proportion of row crops, the peat layer has more than halved over the same time. It is necessary to note some agrophysical properties of the upper part of the profile. Under the permanent meadow monoculture, a nutty-lumpy structure is formed, the proportion of calcium humates increases to 20% of the total mass of humus, and deposits of Fe³⁺ oxides are visually recorded in the upper and lower layers of the profile. A distinctive feature of pasture use of meadow ecosystems is that
regularly grazing livestock leaves behind a significant amount of natural biological deposits in the form of feces and urine. Observations show that for 118 days of the pasture period, a dairy herd of 146 heads releases about 100 tons of feces and 30 thousand liters of liquid secretions on the territory of 25 hectares. Calculations show that the soil thus gets about 4 kg / ha of P₂O₅; 13.8 kg / ha-K₂O, 7.4 kg / ha of CaO and 25.5 kg / ha of total nitrogen. All these and other elements are immediately included in the general cycle of pasture biogeocenosis. To fully provide 3-4 cycles of bleed, despite the partial return of individual nutrition elements with biological secretions, additional energy is needed in the form of various fertilizers. In terms of improving the fertilizer system for old-growth grass stands, several clarifying schemes with mineral and organic fertilizers were studied. The largest increase was obtained when using mineral fertilizers at a dose of N₉₀P₆₀K₉₀, which provides the collection of OE up to 22 GJ / ha. The average consumption of herbs in the bleed cycles is from 70 to 80%. The use of litter manure (20 t/ha) reduces consumption by 10-18%. The temporary cessation of any fertilizer application in the second year leads to a significant decrease in herbage consumption and the appearance of poorly eaten, harmful and even poisonous plants: Geranium pratense, Potentilla anserina, Ranunculus, Glechoma hederacea, etc.

It is known that an adult animal should have a daily diet of up to 50-60 kg of dry matter. Due to the high natural humidity of the grass stand, it is very difficult to do this in pasture conditions. To balance the diet in terms of nutritional value and, above all, in terms of fiber content, the method of light drying of pasture phytomass was used. Pre-mowing the grass for 4-5 hours before grazing increases the amount of dry matter by 20-30%. Further drying (up to 12 hours) increases the amount of water-soluble carbohydrates in dry matter by up to 4.2%, and the digestibility of dry matter, crude protein, and fiber increases by up to 70-79%. As a result, the energy saturation of 1 kg of green mass rose to 4.0 MJ, the food content increased by 7%, and the productivity of cows increased by 11.3%. Longer podvyalivanie (12-17 hours) is not recommended, because it worsens the quality of raw materials and its palatability. It was found that moderate podvyalivanie allows you to reduce the amount of concentrates in the daily diet by 30% [8].

The unique species diversity of long-term pasture herbage with the dominance of different-ripening, well-eaten grass species (Agropyron repens, Poa pratensis, Alopecurus pratensis, etc.), high resistance to trampling and degradation make the experienced herbage extremely attractive for permanent grazing of different age groups of cattle. For several years, as part of the research and production experience, a comparative assessment of pasture and stall keeping of animals was carried out on all dairy livestock. The scheme is very simple: one farm of 200 heads is grazed throughout the season, the second is in stable mode. The next year, the regime on farms was reversed. Tables 1 and 2 compare the results of both modes. From these tables, it can be seen that the difference in milk productivity between groups of cattle during the calendar year is quite insignificant. During the entire observation period, a lower fat content in milk was observed at the pasture content, but the mass fraction of protein consistently indicates in favor of grazing.

**Table 1.** Comparative assessment of productivity of pasture and stable keeping of livestock in 2014

| Options               | may    | june   | july   | august | september |
|-----------------------|--------|--------|--------|--------|-----------|
| Milk yield per 1 head per month, kg |         |        |        |        |           |
| Pasture maintenance   | 660    | 587    | 648,5  | 693    | 600,5     |
| Stable maintenance    | 650    | 598    | 619    | 654,5  | 596,5     |
| Gross milk yield per month, C |         |        |        |        |           |
| Pasture maintenance   | 620,4  | 551,8  | 610,0  | 651,4  | 564,5     |
| Stable maintenance    | 611,0  | 562,1  | 581,9  | 615,2  | 560,7     |
| Mass fraction of fat in milk, % |        |        |        |        |           |
| Pasture maintenance   | 3.71   | 3.66   | 3.59   | 3.57   | 3.68      |
| Stable maintenance    | 3.87   | 3.84   | 3.91   | 3.95   | 4.14      |
| Mass fraction of protein in milk, % |        |        |        |        |           |
| Pasture maintenance   | 3.22   | 3.11   | 3.12   | 3.13   | 3.25      |
Stable maintenance                  3,07  3,04  3,01  3,03  3,13
Pasture maintenance           85    87    85    90    87
Stable maintenance           85    78    75    74    75
Incidence of endometritis, (heads)
Pasture maintenance          13    12    14    10    9
Stable maintenance           18    16    19    17    15
Duration of treatment of patients with endometritis, (days on average per 1 head)
Pasture maintenance          6     7     5     4    4
Stable maintenance           14    12    15    16   14
Hypofunction of the ovaries and follicular cyst, (heads)
Pasture maintenance          8     7     4     3    4
Stable maintenance           11    9    10     8   10

A very important indicator of animal health is resistance to diseases of the reproductive organs. With pasture content, the incidence of endometritis is 26.3-33.3% lower than with stable content, and the same pattern is observed in winter. Resistance to this disease in grazed cows is significantly higher, while the duration of treatment is significantly reduced. The appearance of the first sexual cycles in cows after calving occurs when grazing on 18-24 days, with stable maintenance-on 25-28 days, with the norm of 18-22 days. All this once again points to the need to organize grazing for ruminants in terms of increasing the productive longevity of the entire dairy herd.

4. Conclusion
1. Long-term pasture grass, filling the green conveyor as much as possible, performs an extremely important ecological function to protect the peat deposit from premature anthropogenic development.
2. A moderate load, proper care of the pasture, a corral-portion mode of use of pasture grass with elements of podvyalivaniya allows the herbage, despite the abundant variety of grasses, to function for many decades without visible signs of degeneration.
3. Experimentally the advantage of grazing high-yielding cows in comparison with farmyard content.
4. Long-term cultural pastures should occupy a leading place in the ecological framework of the forest-meadow post-bog agricultural landscape.

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