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The Nutritional Value Of Pasture Forage And The Assessment Of The Vegetation Index For Growing Sheep Breed Dzhalginsky Merino.

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ABSTRACT

The article deals with the issues of assessing the nutritional value of pasture forage and vegetation index for growing sheep of the Dzhalginsky merino breed in the conditions of the steppe regions of the Stavropol Territory. The introduction of remote assessment methods in pasture livestock farming allows optimizing the rearing of a group of repairing young sheep and reducing the time to reach production parameters by 5-8%. Sheep of the Dzhalginsky merino breed is characterized by resistance to climatic conditions and is adapted to growing in drought conditions.
Keywords: pasture forage, nutritional value, vegetation index, sheep, Dzhalginsky merino.

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INTRODUCTION

To solve global issues related to the growth of the world population, mankind needs to change the methods of agricultural activity. After 30 years, in order to provide food for the entire world population, 70% more food will be needed. Reducing the quantity and quality of fertile land, climate change, high energy costs – all this will seriously hinder the production of a sufficient amount of food. To increase crop yields and reduce costs in the current environment allows the concept of "smart" agriculture.

Agricultural exploration of the territory is one of the most effective ways to use aerospace monitoring. The range of issues that can be resolved from images obtained using satellite photographs and images from technological equipment of unmanned aerial vehicles includes both the tasks of quickly obtaining information about the composition and condition of crops, potential yields, diseases and damage to crops by pests, and the problem of land inventory, biomass estimates, studying the dynamics of agricultural land use.

The advantage of the materials obtained in the course of remote aerospace surveys is the uniformity and comparability of the data obtained for vast areas, greater visibility, modernity and permanence, which is a decisive factor for solving the above problems. The development of a pasture livestock system based on the use of digital aerospace technology and telemetry is a new modern direction for the development of the livestock industry of the Eurasian Economic Union (EAEU) member countries, designed to solve the numerous problems of restoring soil fertility and pasture for animals.

To characterize the vegetation cover, different vegetation indices (VI, NDVI, EVI) are used, which are obtained on the basis of an analysis of the spectral brightness in the red and near-infrared zones [12]. The main assumption about the use of vegetation indices is that some mathematical operations with different remote sensing channels can provide useful information about vegetation. This is confirmed by a multitude of empirical data. The second assumption is the idea that the open soil in the image will form a straight line (spectral line) in the spectral space. Almost all common vegetation indices use only the ratio of red to near-infrared channels, suggesting that in the near infrared region lies a line of open soil. It is understood that this line means zero amount of vegetation. The first vegetation index on the basis of reflection was the index of reflection coefficients (Ratio VI, RVI), later this index was improved and named as the difference normalized vegetation index - NDVI.

A number of researchers studied the question of which spectral channels are most suitable for characterizing individual biophysical parameters of agricultural crops. Spectral measurements of the reflectivity of cotton, potato, soybean, corn, and sunflower were carried out. The characteristics considered included biomass, leaf index, plant height (Prasad S. et al. [13]). It was established that the strongest correlation with the characteristics of crops was observed in narrow ranges of red (650-700 nm), green (500-550 nm) and near-infrared (900-940 nm). The center of sensitivity to humidity is in the range of 982 nm.

Recently, precise remote positioning systems are becoming more and more firmly integrated into the pasture livestock system, helping to optimize production processes and pasture use time, which can significantly affect the efficiency of pasture fertility restoration for grazing large tracts of farm animals and applying aerospace monitoring data in the livestock industry.

The market of unmanned aerial vehicles in various branches of agriculture is also developing in Russia, despite the not very favorable regulatory and legal regulation. Among the most active market participants are companies such as Pilotless Technologies (Novosibirsk), Geoscan (St. Petersburg), Autonomous Aerospace Systems - GeoService Krasnoyarsk) and ZALAAERO (Izhevsk). The range of services provided by these companies for agriculture is quite wide. For example, the company “Geoscan” offers agricultural producers assistance in inventorying farmland, creating field mapping, monitoring equipment and the condition of crops, calculating NDVI and other indices, and supporting and controlling agrotechnical measures [9].

Among the many innovative technologies, an important place in providing information is occupied by Earth remote sensing technologies: space imagery and imaging using unmanned aerial vehicles. Such information is undeniably reliable and displays a real picture of the state of the agricultural land, vegetation, and grazing land [1].

Modern aerial photography equipment has gone a long way to development, and today companies involved in the development of these devices offer a wide range of cameras that perform surveys from an aircraft. Traditionally, digital cameras are divided into two categories: metric and non-metric. If aerial photography is carried out with an unmanned aerial vehicle, then you should pay attention to the weight of the camera: non-metric weighs no more than 1 kg and the lightest of metric 3DAS - about 32 kg [11].

Pictures taken from such equipment are already being used in Russia for managing agricultural land. At the federal level, in 2012-2013, an “Atlas of agricultural land” was created, in the preparation of which satellite images were used to determine the boundaries of agricultural land. Space monitoring data is successfully used in the regions of Russia, including in the South of Russia - in the Krasnodar Territory and in the Stavropol region. In the Kaluga region, for four years now, on the basis of satellite imagery, information has been updated on the current state and use of land resources in order to re-develop agricultural land, redistribute land and taxation [10].

At the same time, the issue of using the remote nutritional assessment of pasture forage and vegetation index for growing Dalginian merino sheep breeds remains poorly studied, since these animals are characterized by outstanding meat qualities and are adapted to growing conditions in the arid zone of the Stavropol Territory.

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MATERIALS AND METHODS

Pasture feed for research was selected during the main vegetation period of plants (June-July) and studied by standard generally accepted methods.

Moisture of the feed was determined by the difference between the mass of the sample before and after drying at a temperature of 130 °C for 40 min and calculating the mass fraction of moisture.

The chemical composition of the feed was determined in the laboratory of the Scientific and Technical Center “Feed and Metabolism” of Stavropol State Agrarian University on the equipment of the firms INGOS (Czech Republic), FIBRETHERM (Germany) and VELP SCIENTIFICA (Italy.)

Raw protein feed was determined by ashing the organic matter of the sample to be analyzed with sulfuric acid in the presence of a catalyst, alkalizing the reaction product, distilling and titrating the released ammonia, calculating the mass fraction of nitrogen and calculating the mass fraction of crude protein by multiplying the result by converting the mass fraction of nitrogen to the mass fraction of raw protein, equal to 6.25 (according to Kjeldahl) [5].

Crude fiber was determined (according to Genneberg and Shtoman) by a method based on the sequential processing of the sample of the test sample with acid and alkali solutions, ashing and quantitative determination of the organic residue by the gravimetric method. The content of crude fiber is expressed as a mass fraction in% or in grams per 1 kg of dry matter [4].

The crude fat in the feed was determined by the method of extraction of crude fat from a sample of diethyl or petroleum ether in the Soxhlet apparatus. removing the solvent and weighing the non-fat residue [2].

Crude ash in the feed was determined by determining the mass of the residue after combustion and subsequent calcination of the sample [3].

Calcium in feed was determined by the method of organic ashing of the analyzed sample, processing the resulting ash with a solution of hydrochloric acid, precipitating calcium in the form of calcium oxalate, followed by dissolving the precipitate with a solution of sulfuric acid to form oxalic acid, which is titrated with potassium permanganate [6].

Phosphorus in the feed was determined by dry ashing of the sample with calcium carbonate and heating the residue with hydrochloric and nitric acids (for organic feed) or in wet ashing of the sample with a mixture of sulfuric and nitric acids (for mineral compounds and liquid feed). An aliquot of the hydrolyzate is mixed with a molybdovanadate reagent and the optical density of the resulting yellow solution is measured at a wavelength of 430 nm [7].

Groups of animals for research were formed on the principle of steam analogs from replacement youngsters of sheep of the Dzhalga merino breeding farm of the Stavropol Territory of Russia. The number of rams in each group was 100 heads, age 4 months. The study was carried out for 60 days.

In our studies, groups of sheep were grazed on pastures, the botanical composition of which consisted of legume-cereal plants (25: 75%): Onobrychis, Medicago, festucapratensis, Loliumperenne. The pasture ecosystems were studied using an AC-32-10 unmanned aerial vehicle and DJI 900 hexacopter equipped with a Canon M10 camera and vegetation index calculation software (NDVI).

Studies were conducted in the centers of collective use: The Center for Collective Use "Educational and Scientific Testing Laboratory (UNIL)", the Center for Collective Use "NTC Feed and Metabolism" and using a unique scientific installation "Laboratory of Milk Quality Selection Control" based on FSBEI HE «Stavropol State Agrarian University».

RESULTS AND DISCUSSION

The value of the vegetative index of pasture plants in the groups on which experimental groups of animals were grazing ranged from 0.41 to 0.61. Depending on the NDVI index value, the nutritional value of pasture forage was at a different level (Table 1).

Table 1: Nutritional value of pasture forage, M ± m

Indicators	NDVI		
	0,41	0,61	Average
Crude protein,%	2,90±0,03	4,55±0,03	3,72±0,03
Total humidity,%	31,49±5,45	42,97±4,92	37,23±5,74
Crude fiber,%	25,78±1,79	18,13±0,91	21,95±3,83
Crude fat,%	1,39±0,03	1,75±0,29	1,57±0,18
Crude ash,%	3,36±0,04	3,84±0,27	3,60±0,24
Calcium,%	0,39±0,01	0,41±0,01	0,40±0,01
Phosphorus,%	0,23±0,01	0,20±0,03	0,22±0,01

In the group of feeds with an INDV value of 0.61, the content of crude protein was higher than in the group where the NDVI index was 0.41 to 1.65 abs. %, total moisture 11.48 absl. % raw fat 0.36 abs. % crude ash at 0.48 absl. % calcium 0.02 absl. % phosphorus 0.03 absl. %, and crude fiber is less by 7.65 abs. % respectively.

At the same time, in the group of pasture feeds with the value of the NDVI index of 0.61, the indicators of crude protein, total moisture, raw fat, raw ash, and calcium, on average, 5.0-57.0% exceed those of the group of pasture feeds with an index value NDVI 0.41. In the opposite relationship are indicators of vegetation index and the content of crude fiber and phosphorus.

Conducting the control cultivation of repairing young sheep showed that the nutritional value of pasture forage directly affects the productive quality of repairing young sheep. The average live weight of the livestock of young sheep in the experimental groups at the beginning of the experimental period was almost at the same level of 23.57 - 23.81 kg (Table 2).

Table 2: Productive qualities of young stock, M ± m

Indicators	Group	
	I	II
The average live weight at the beginning of the experience, kg	23,57±0,56	23,81±0,48
The average live weight at the end of the experiment, kg	34,29±1,12	35,27±1,15
Average daily weight gain, g	178,60±4,10*	191,00±3,80*

* Statistically significant differences with $p < 0.05$

The statistically significant difference in the average daily gain in live weight (6.5%) suggests that it is advisable to graze the maintenance of young sheep on pastures, whose vegetative index is not lower than 0.60. At the same time, the vegetation index NDVI sufficiently reflects the accumulation of nutrients in plants, which coincides with the research of Prasad S. (1999). In our opinion, the range of measurements of the vegetative index of 500-550 nm rather accurately reflects the change in the nutritional value of pasture plants.

It is advisable to select the optimal pasture area to reduce labor costs and conduct a remote assessment of pasture forage with the use of unmanned aerial vehicles, for example, an AC-32-10 aircraft type aircraft or a DJI 900 hexakopter equipped with a Canon M10 camera and software for calculating the vegetation index (NDVI).

CONCLUSION

- When rearing Dzhalgin merino sheep breeds, it is advisable to use remote methods to determine the vegetation index using unmanned aerial vehicles, for example, an AC-32-10 aircraft type aircraft or a DJI 900 hexacopter equipped with a Canon M10 camera and software to calculate the vegetation index (NDVI).

- When choosing a pasture area for growing rearing sheep Dzhalginsky merino breed, it is advisable to use territories with an NDVI vegetative index of 0.6, which will allow animals to realize the genetically determined developmental potential at 187-195 g of average daily weight gain.

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