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School
PROBLEMS OF ASSESSMENT AND MANAGEMENT OF NATURAL RESOURCES

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E.D. Zhaparkulova[2]*, M.S. Mirdadaev[2], A.A. Duysenkhan[2], D. Murat[1], J. Moisey[1]

[1]Warzaw University of Life Science, Warzaw, Poland
[2]Kazakh National Agrarian Research University, Almaty, Kazakhstan
**ermekull@mail.ru*

EXPERIENCE IN USING INNOVATIVE TECHNOLOGIES RESTORING THE PRODUCTIVITY OF DEGRADED LAND IN SOUTH KAZAKHSTAN

Abstract

It should be noted that irrigated soils of magnesium salinization, as well as soils with a high sodium content in the PPK, are characterized by increased swelling, increased peptization of colloids and a decrease in the stability of the agrostructure, deterioration of the filtration properties of soils, high rates of removal of humus and an increase in water consumption to obtain a unit of production. When watering, soils swim, and during inter-row treatments, hard-to-break blocks are formed. To combat These phenomena should apply a chemmeliorant - phosphogypsum, by improving the technology for controlling mass transfer in the reclaimed stratum.

Keywords: Productivity, degradation, salinization, yield, chemical reclamation.

Introduction

Currently, a huge experience of chemical reclamation of soils has been accumulated, by introducing calcium-containing compounds to displace the exchange Na^{+} or Mg^{2+} from the PPK and replace it with the Ca^{2+} ion. Taking into account the degree of salinization of soils and the power of solonets horizons, the norms for the application of chemical meliorants are determined by the amount of exchange sodium exceeding 10% of the saturation capacity, when the normal development of plants is ensured, or by the difference in calcium absorption by saline and zonal soil (supplementation method) [1,2]. The second method involves increasing the calcium content in the absorbing complex to 90%. With this method of determining the rates of application of land reclamation, the costs are inadequate to the increase in agricultural yields. cultures, therefore, their economic efficiency decreases.

From 2021-2022, Kazakh Research Institute of Water Management LLP conducts research work under the World Bank contract No. 7199446 dated 23.02.2021 "Innovative and practical solutions for the accelerated restoration of productivity of degraded irrigated

lands". To assess the ecological and reclamation state of irrigated lands, pilot plots were selected with the laying of research options in the Zhambyl region and Turkestan regions (Figure 1-2). The irrigated lands of the pilot plots are dominated by saline soils.

Methods and materials

Pilot plot No. 1 (PU-1) is located in the Zhambyl region (Talas village, Shukhrat peasant farm) with an area of 2 hectares, the cultivated crop is corn (Figure 1).

Pilot plot No. 2 (PU-2) with an area of 2 hectares, cultivated crop - cotton. Peasant farm "D. Artikbashov" in the village of Stary Ikan, Turkestan region (Figure 2). In these peasant farms, doses of chemical reclamation (phosphogypsum) and biohumus are being tested.

It has been established that the irrigated lands of the pilot plots in the Zhambyl and Turkestan regions have alkaline soils of magnesium salinization.

The soil cover on THE PU-1 is represented by irrigated serosems - light brown, relatively loose, carbonate from the soil surface with an undifferentiated profile. *Humus horizon of low power (0-25 cm),* light colored.

The soils are low-powered, the maximum humus reserve is noted for the horizon 0-20 cm (1.554-2.279%). The power of the sub-arable humus layer decreases with depth and is 0.752-0.824% (Figure 3).

The soils of PU-1 are slightly saline in terms of salinity, in the horizon 0-60 the content of the sum of salts is 0.094-0.120%, and in the meter horizon 0.101-0.190%. According to the depth of occurrence of the upper boundary of the salt horizon, they are classified as surface saline, since with the depth the amount of salts decreases, compared to the upper horizons.

Figure 1 - Plan-scheme of the pilot section No. 1 (PU-1) in the village of Talas, Zhambyl region

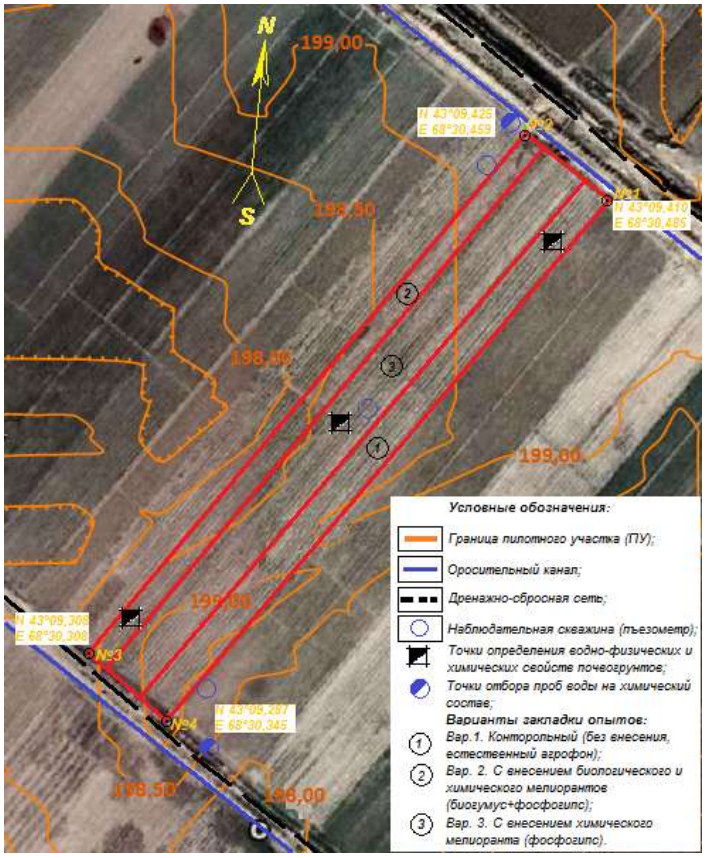

Figure 2 - Plan-scheme of the pilot section No2 (PU-2)
in the village of St. Ikan of Turkestan region

Figure 3 - Selection of soil samples for chemical analysis and shipment of chemical reclamation to the pilot site (PU-1) in the village of Talas, Zhambyl region

On the soils of the pilot site, two types of salinity chemistry are noted: the main soda-chloride and soda-sulfate. In percentage terms, with the presence of toxic salts from 52.9% to 79.7% with a predominance of sodium carbonate ($NaHCO_3$), sodium chloride (NaCl) and magnesium sulfate ($MgSO_4$). The maximum values of the content of toxic salts were

detected at point T-1 and T-2 in all horizons (end and middle of the field), the minimum - at point T-3 (the beginning of the field).

According to the degree of alkalinity - slightly alkaline (the pH index for the horizon 0-100 cm ranges from 7.47-7.64, Table 1). There is a high alkalinity of the upper horizons (0-40 cm), maximum pH = 7.50-7.82, which can be expressed in individual spots inside the field or in the spring period of poor germination of crops during sowing. The chemical properties of alkaline saline soils are mainly related to the presence of soda in the *soil* - $NaHCO_3$, i.e. with an increase in the sodium carbonate content for the upper horizons, it will be accompanied by outbreaks of alkalinity, especially after irrigation.

The soil cover on THE PU-2 is represented by irrigated southern serozems - light, medium-lumpy, carbonate from the soil surface with an undifferentiated profile (Figure 4). *Humus horizon of* medium *power (0-40 cm),* light colored. Soils are low-powered, the maximum humus reserve is noted for horizons of 0-40 cm (1.144-2.200%).

Figure 4 - Selection of soil samples for chemical analysis and application of chemical reclamation to the pilot site (PU-2) in the village of St. Ikan of Turkestan region

The soils of PU-2 are slightly saline in terms of salinity, in the horizon 0-60 the content of the sum of salts is 0.109-0.134%, and in the meter horizon 0.104-0.147% (Table 2). According to the depth of occurrence of the upper boundaries of the salt horizon, they are classified as deep-salty, since with the depth the amount of salts increases, compared to the upper horizons.

At the pilot site, a type of salinity chemistry is noted: chloride-sulfate. In percentage terms, with the presence of toxic salts from 46.7% to 71.4% with a predominance of sodium chloride (NaCl), sodium sulfate (Na_2SO_4) and magnesium sulfate ($MgSO_4$). Maximum values of the content of toxic salts were detected at point T-1 and T-2 in all horizons (end and middle of the field), the minimum - at point T-3 (the beginning of the field).

According to the degree of alkalinity - alkaline (the pH index for the horizon of 0-100 cm ranges from 7.73-7.78. The chemical properties of alkaline saline soils are mainly related to the presence of soda in *the soil* - $NaHCO_3$ (in T-1, the content for the layer of 0-20 cm is 0.021 mg-eq / 100 g, for 60-80 cm - 0.030 mg-eq / 100 g).

Results and discussion

Research have established that the level of soil productivity depends not only on the norms of application of chemicals, the rate of their dissolution and removal of metabolic products from reclaimed horizons, but also on technological methods of application. For example, in the practice of reclamation of solonets soils, several methods of applying gypsum or calcium-containing materials are used: for plowing, in two steps (half for plowing, half for an inverted saline horizon for disking), into the saline horizon with simultaneous soil treatment: two-layer application to horizons A and B special machines) [1,2]. The best time to apply chemotherapy is the autumn period. In non-irrigated conditions, it is advisable to use it in a steam field (in the culture rotation system), where the accumulated moisture accelerates the chemical interaction of the chemmeliorant with the PPK.

In irrigation conditions, when groundwater lies closely and participates in sub-irrigation, and there are no gypsum bearing horizons in the soil cover (the gypsum content in the meter layer <0.5%), salinization, alkalinization of soils occurs, therefore their physicochemical properties deteriorate. This leads to a decrease in the reserves of humus and nutrients, alkalinization of soil solutions, disaggregation and soil compaction [3, 4]. In such conditions, the use of gypsum, clay (60-90% gypsum) or other neutral calcium-containing materials will not provide the desired results, since a calcite film is often formed on the surface of small particles ($CaCO_3$). Therefore, the problem of stable salinization of alkaline soils can be solved by adding acids or finely ground gypsum (<0.25 mm) to the water during the periods of vegetation irrigation.

The low level of technical condition of the existing collector-drainage network does not always provide the necessary lowering of the groundwater level and their diversion from the irrigated area, and therefore there is a deterioration in the reclamation state of irrigated lands. An acute shortage of water resources and water availability of irrigated lands during the growing season is observed in the Turkestan region (Figure 5). The results of the studies showed that the volume of actual water intake is lower than the planned. For the growing season of 2021, the volume of water intake for irrigation decreased by up to 2 times.

Figure 5 - Difficulties of watering agricultural crops
in the Turkestan region due to the shortage of water resources

For a practical solution to the accelerated restoration of the productivity of degraded irrigated lands , experimental options were laid with the introduction of phosphogypsum and biological reclamation (biohumus) into the soil (see Figure 1). At the pilot site No. 1 (PU-1) for phenological measurements, the height of corn was: on the control version - 190-200 cm, on the version with the introduction of biological reclamation (biohumus) and chemical meliorant (phosphogypsum) - 230-240 cm (Figure 6).

a) b)

Figure 6 - Phenological observations of the growth and development of maize
(a - control option, b - option with the introduction of phosphogypsum + biohumus)

According to the results of a laboratory study of functional diagnostics on the equipment of Aquadonis, samples of vegetable corn juice conducted on June 1, 2021, a lack of phosphorus, calcium and copper was revealed (Figure 7).

According to the results of the assessment of biological yield on PU-1 on the control version (without application), the mass of 1000 grains was 307.67 g, on the version with the introduction of phosphogypsum - 330.33 g, on the version with the introduction of phosphogypsum + biohumus, respectively - 403.37 g.

At the same time, it is known that climatic conditions, economic activity, economic viability (availability of financial resources) and technical equipment of farms and agricultural associations also predetermine the timing and methods of applying chemical meliorants. Taking into account the evolving situation, it is advisable to use the following technological techniques and schemes of reclamation work:

Figure 7 - The content of macro- and microelements in corn in the functional diagnosis of corn plants (as a percentage of the norm)

In the production of early-ripe crops (winter wheat, vegetables, corn for silage)

1) After harvesting, autumn ploughing is carried out. The depth of plowing is 25-30 cm on weakly fused soils, 30-35 cm on medium-fatted soils and 35-40 cm on highly axillary soils, when the estimated norms of chemmeliorant exceed 8 tons / ha.

2) In a dry and windy autumn, when it is possible to blow out the chemmelirant, it is introduced by plowing and sealed into the soil by harrowing diagonally.

3) In wet autumn, when precipitation falls after the application of the chemmeliorant, the need to protect it from blowing disappears.

4) In case of heavy rainfall, after ploughing, chemmeliorants should be applied in winter on frozen soil or snow, since their introduction on moist soil will lead to its compaction.

5) With a lack of financial resources, when plowing is postponed for the spring period, until loans are obtained, chemmeliorants are introduced in the autumn and sealed into the soil by disking.

In the production of medium- and late-ripening crops (cotton, corn for grain, sunflower, vegetable and melon)

1) After harvesting crops, autumn ploughing is carried out. The degree of soil merging predetermines the depth of plowing. On weakly drained soils, it will be 25-30 cm, medium-merged 30-35 cm, strongly fused 35-40 cm.

2) Before the onset of the period of mass precipitation, chemmeliorants are applied by plowing. For uniformity of their application, spreaders RUM - 5 or 1 - RMG - 4 should be used.

3) After intense precipitation, when the surface horizons are waterlogged, chemmeliorants are applied on frozen soil or on snow. This technique will protect the surface horizons of soils from compaction and improve their water-physical properties.

4) In case of financial difficulties or lack of equipment (due to increased demand) for autumn ploughing, chemmeliorants are introduced to the surface of the earth and sealed into the soil by disking.

5) It is desirable to complete all work on the introduction of chemmeliorants before the onset of the period of mass precipitation or negative average daily air temperatures. Winter thaws and spring rains will accelerate metabolic reactions, and moisture-charging watering will ensure the washing out of metabolic products.

Conclusion

The proposed technological methods of introducing chemical meliorants, taking into account changes in climatic conditions, financial and technical resources of the agricultural producer, will provide the maximum possible improvement in soil properties and obtain an increase in yield, the cost of which will ensure the payback of the costs of chemical reclamation within 2-3 years. The latter indicator can be reduced to 1 year in the case of the use of phosphogypsum on alkaline and saline soils, where in the last 15 years almost no phosphorus fertilizers were used. The listed methods of restoring the productive capacity of low-productive soils provide for improving the agrophysical and biological state of irrigated lands, enhancing the biological activity of soils through the accumulation of organic matter, increasing the resistance of the soil structure to the destructive effects of irrigation water, increasing the absorbency of soils and the accumulation of Ca^{2+} in the composition of absorbed bases.

The use of improved technology for the application of phosphogypsum and biohumus ensures, relative to the technologies used, the sustainable development of irrigated agriculture, the reduction of costs for chemical reclamation by up to 30%, the increase in profits in farms and agricultural associations up to 50%.

Thus, in the chemical reclamation of low-productive soils, it is necessary to take into account all the factors that affect the rate of sorption processes and apply appropriate technological techniques. Optimization of recommended measures will ensure radical improvement of soils and increase the economic efficiency of farms and agricultural associations.

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INFORMATION ABOUT THE AUTHORS:

Zhaparkulova Yermekkul - Professor of the Department "Water Resources and Melioration" of the Kazakh National Agrarian Research University, Kazakhstan, Almaty, st. Abaya 8, ermekull@mail.ru

Mirdadaev M. - Senior teacher of the Department "Water Resources and Melioration" of the Kazakh National Agrarian Research University, Kazakhstan, Almaty, st. Abaya 8, ermekull@mail.ru

Duysenkhan Ayana- doctoral student of the Department "Water Resources and Melioration" of the Kazakh National Agrarian Research University, Kazakhstan, Almaty, st. Abaya 8, zhan__zhan@list.ru

Murat Daulet - Master degree in Environmental Engineering, student, Warzaw University of Life Science, Poland, Warzaw, Novoursynowska 166, Building 33, dauletmurat8080@gmail.com

Moisey Jozef - Professor of the Warzaw University of Life Science, Poland, Warsaw, Novoursynowska 166, Building 33.

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D.S. Tungatar*, A.G. Zhandiyar
NJSC «Kazakh National Agrarian Research University»
**tungatar_danat@mail.ru*

ASSESSMENT AND USE OF WATER RESOURCES

Abstract

This article considers the use of water resources by all sectors of the economy in Almaty region of Kazakhstan. According to the results of the research, it was found that for the period 2016-2020, the total withdrawal of water resources for use by water users in Almaty region as a whole has increased from 3605.445 to 3883.446 million m^3 that was 7%. The information base of the research was the reporting of the basin inspection, as well as the works of domestic and foreign scientists on water use issues. Results of this article on assessment of water resources and their use will serve as a basis for development of recommendations on rational water resources use in the country.

Keywords: water resources, water use, water basin, economic sectors, water withdrawal.

Introduction

Effective water management is the ability to balance the available water resources of an area and the demand for them, while preventing environmental degradation.

At present, the situation in water resources use is as follows: with a large number of existing methodological developments of sectoral and local water use, there is no concept of regional water use, no unified methodological framework, integrated water resources use at scale of large regions, economic and geographical areas. Until now, the rational use of water resources that takes into account modern environmental and socio-economic requirements on a regional scale on a unified ecological and geographical basis is not enough scientifically substantiated. Therefore, in this paper, the study of the current state of water resources use in Almaty region is extremely important not only scientifically, but also practically. As is known, the development of the economy of the Republic of Kazakhstan as a whole, in the context of territorial-industrial complexes, regions and individual cities, largely depends on the availability of water resources. Water resources management in the country is based on the basin principle of management [1, 2]. Based on the basin principle of water resources management, the territory of the Republic is divided into 8 river basins: Aral-Syrdarya, Balkhash-Alakol, Yesil, Irtysh, Zhaiyk-Caspian, Nura-Sarysu, Tobyl-Torgay and Shu-Talas. Water resources of Almaty region belong to the Balkhash-Alakol water basin.

Materials and research methods

The Balkhash-Alakol basin occupies a vast territory in south-eastern Kazakhstan and part of the contiguous territory of China. The area of the basin within the Republic of Kazakhstan is 415 thousand square kilometers, the length from west to east is more than 900 km, from north to south - 680 km. The population in the Kazakh part of the basin is

about 3.3 million people. The main part of it lives in Almaty region and amounts to 1.6 million people. There are 1.5 million people living in rural areas.

A distinctive feature of the basin is its orographic and climatic heterogeneity and a great variety of natural conditions.

The climate of the basin is sharply continental, but it is heterogeneous due to its considerable latitudinal extent and great differences in the relief structure. In the northern plains and lowlands, there are large daily and annual fluctuations in air temperature, cold winters, and long, hot and dry summers. High temperatures and a dry climate are characteristic of the deserts of the Southern Pre-Balkhash region. In mountainous areas, climatic features are very heterogeneous. Precipitation regime and values, temperature and humidity, wind speed and direction are conditioned by altitude and forms of relief. The mid-mountain zone is characterized by a moderate climate, while the highlands are characterized by a harsher climate. Precipitation is distributed unevenly over the seasons of the year. In Pre-Balkhash, about 60-70% of annual precipitation falls on the warm period of the year (April-October). The highest monthly amount of precipitation on the northern coast of Lake Balkhash and in the deserts of the southern Pre-Balkhash region falls on the spring months (April-May), and in the lowland areas of the Kazakh shallow gorge on the summer months (June-July). In mid-mountain areas the share of precipitation of the warm period increases to 70% of the annual amount, and in the highlands slightly decreases. In the mountains, the accepted boundaries of the warm period do not reflect the actual nature of precipitation distribution. The highest monthly precipitation totals in the lower belts of mountains occur in spring (April-May) and autumn (October-November) periods. At higher altitudes there is one maximum of precipitation (May-July). The presence of high mountain ranges in the south, south-east and east, low mountains in the north and west of the basin - determines the main direction of the flow of rivers. Most rivers flow from south-east to north-west [3, 4].

There are more than 765 rivers and temporary watercourses (about 90% of rivers belong to the basin of lake Balkash, the rest to the basin of Alakol group of lakes) and lakes and artificial water bodies on the territory of Balkash-Alakol basin. The total overall water area of water bodies of the basin is about 22700 square kilometers. The largest water bodies are Lakes Balkhash and Alakol, which form two independent water basins - Balkhash lake basin and the basin of Alakol group of lakes.

The average long-term annual volume of surface runoff of Balkash-Alakol hydrographic basin's rivers is 22.1366 billion m^3.

The main consumers of water resources of the basin are irrigated agriculture, public utilities, industry, energy, rural settlements, livestock, fisheries. Industries that do not consume, but use water are recreational facilities, water transport, hydropower.

Results

The analysis of the state accounting data reflecting the state of water use and water withdrawal by sectors of the economy, river basins and administrative territories of Balkash-Alakol basin for 2020 allows the following conclusions. The number of reported water users in the basin was 600. Analysis of water users taken into account shows that most of them are agricultural producers (70%), industrial enterprises (14%) and housing and communal services (16.0%).

The total fresh water withdrawal for the basin in 2020 was 3883.446 million m^3, including 3617.932 million m^3 from surface sources and 265.514 million m^3 from groundwater, (including 1.306 million m^3 of mining waters). Compared with 2019, the total water withdrawal increased by 58.406 million m^3, which is 2%.

The volume of water withdrawn for use by industries was 3,883,446 m^3, including:

- public utilities - 248.797 mln. m^3;
- watering of green spaces - 0,762 mln. m^3;
- industry - 331,64 mln. m^3;
- Agriculture - 3,285.156 mln. m^3;
- Fishery - 9,358 mln. m^3;
- other needs - 7,683 mln. m^3;
- redistribution -0,018 mln. m^3.

Analysis of the total volume of fresh water use in the context of sectors of the economy and economic regions of the Balkash-Alakol Basin Inspection in 2020 are shown in Tables 1 and 2.

Table 1 - Water use by region for the period 2016-2020

№	Name of regions	2016	2017	2018	2019	2020
1	Almaty city	239,171	238,358	248,31	258,234	262,707
2	Almaty region	3181,767	3272,949	3488,77	3342,051	3386,7634
Total		3420,938	3511,307	3737,08	3600,285	3649,4704

According to the data in Table 1, we can conclude that during the period 2016-2020, the total withdrawal of water resources for use by water users in Almaty region as a whole has increased from 3605.445 to 3883.446 million m^3 (7%).

Table 2 – Water use by sectors of the economy

№	**Sectors**	**2016**	**2017**	**2018**	**2019**	**2020**
1	Fisheries	17,142	6,824	12,94	12,563	9,358
2	Housing and public utilities	217,245	226,445	221,21	237,295	228,833
3	Industry	261,127	273,815	324,30	335,02	331,538
4	Agriculture	2293,905	2363,181	2740,75	2634,7	2685,543
5	Watering of greenery					0,762
6	Other needs	-	-	-	0,367	7,863
Total for BABI		**2789,419**	**2870,265**	**3299,25**	**3220,4**	**3263,72**

The total amount of used water bodies is 3263.720 million m^3, from underground 257.671 million m^3 (including mining 1.288 million m^3).

The water situation in 2020 in the Balkash-Alakol basin, in particular in the Almaty region, was a critical situation on the lack of irrigation water during the growing season, where the irrigated area is more than 600 thousand hectares. Low-water year was observed, as in all rivers of Almaty region indicator of river runoff was lower than norm by 50%, and in Ile river 70% in comparison with long-term data of river runoff [5].

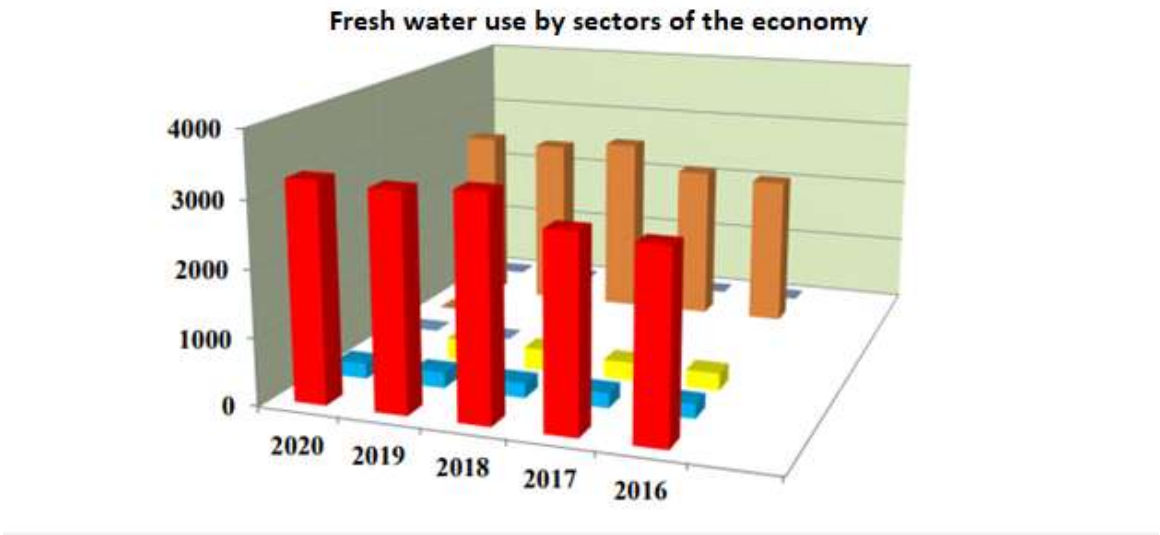

Figure 1 – Diagram of water use by sectors of the economy

Conclusion

It follows from all of the above that water resources in the territory under consideration are distributed unevenly, and the water balance in many areas is unfavorable for sectors of the economy and the population. The most significant water resources are concentrated in the mountainous areas, somewhat less in the plain part and insignificant in the foothill areas.

In this regard, the issues considered in this paper are caused by the urgent need to rationalize the use of water resources. Increasing tensions in the water balance of the state level and individual regions, requires radical approaches to solving the problem of regional water use, before specifying their solutions in individual sectors of the economy.

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INFORMATION ABOUT THE AUTHORS

Tungatar Dana – PhD student, Water Resources and water use, kazakh National Agrarian Research University, Republic of Kazakhstan, 050010, Almaty, Abay ave.,8, e-mail: tungatar_danat@mail.ru

Zhandiyar Aman – PhD student, Water Resources and water use, kazakh National Agrarian Research University, Republic of Kazakhstan, 050010, Almaty, Abay ave.,8

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Sh. Kapar[2]*, K. Zhanymkhan[2], E. Bolat[1], R. Kustina[1], A. Aitbaev[1]

[1]Warzaw University of Life Science, Warzaw, Poland
[2]Kazakh National Agrarian Research University, Almaty, Kazakhstan
**sholpan_83@inbox.ru*

THE DETERMINATION OF ECOLOGICALLY ULTIMATE ALLOWABLE LOADS IN THE DRAINAGE BASIN OF THE CARATAL RIVER BASIN

Abstract

Based on the equation of hydro-chemical balance of the water of river basins and iodine factor dependence, which characterizes the relative productivity of semi-submersible water vegetation from river flow and the content of pollutants, a mathematical model has been developed to determine the environmentally acceptable maximum load in the catchments of the river basin, including predicting the concentration of water pollutants in the river, and an acceptable level of non-returnable water consumption and ecological runoff, which are realized for determination of the maximum permissible level of natural-technogenic load in the basin of the river Karatal.

Keywords: catchment of the river basin, ecology, water, substance, pollution, norm, productivity, hydro-chemical balance equation, load, model.

Introduction

The progressive pollution of the basins of small rivers as a result of the anthropogenic activities of urban and industrial facilities is one of the most actual problems of modern ecology science. The actuality of the problem is related to the fact that the channels of these rivers take the main technogenic load from agricultural and industrial enterprises - the nature of users who are sometimes at a sufficiently large distance from each other and belong to different administrative-territorial units in the catchment areas of river basins. At the same time, streams perform a transport function and transfer toxic pollutants from some territories located in the upper reaches of the river, on which they were formed and entered into a streams, and on others - adjacent areas located downstream, which are forced to take on this toxic and polluted stream for induced recharge. Thus, the transfer of pollutants is polluting in nature and causes a number of problems not only ecologically, but also regulatory and economic, which requires the need to develop methodological support for determining the ecologically acceptable maximum load in the catchment areas of river basins.

The purpose of the study is to assess the allowable impact level in the catchments of the Karatal river basin and, on the basis of them, to develop a mathematical model to determine the ecological flow, allowable limits for irrevocable water consumption and pollution, ensuring the sustainability of the aquatic ecosystem.

Materials and research methods

Based on the equation of hydrochemical balance of substances in the catchments of river basins and the relative productivity of vegetation from river runoff and the content of pollutants, as a function system allowing to describe the behavior of the aquatic system in a state of stable equilibrium, taking into account the influence of natural and anthropogenic factors, a mathematical model is obtained that characterizes the equation balance of substances, relative to concentration (C_p):

$$C_p = \frac{g_б \cdot C_б \cdot}{(A \cdot g_б + g_{bon})} + \frac{g_{bon} \cdot (K_b \cdot C_б + K_{nз} \cdot C_б)}{(A \cdot g_б + g_{bon})} - \frac{b_{\max} \cdot S(w) \cdot S(c)}{(A \cdot g_б + g_{bon})},$$

Here A- is a dimensionless indicator, characterizing the ratio of the natural flow of the river (flow rate) (Wr) to the volume of river flow ($W_б$); $g_б$-water flow module from catchment area, l /s * km2; g_{bon}- module of water demand in the catchment of the river basin; $C_б$- specific removal of substance from a unit of catchment area; $b_{\max}$ - the specific maximum volume of substances absorbed by aquatic vegetation per unit volume of water, kg / m3; K_b- ratio of return water; $K_{nз}$- coefficient of groundwater; $S(w)$- indicator that takes into account the effect of the volume water in the river on the vegetation productivity; $S(c)$ - indicator that takes into account the effect of pollution in river water by the substance under consideration.

The function $S(w)$ and $S(c)$ characterizing the relative productivity of aquatic vegetation from river flow (W_i) and the content of pollutants (C_i) are one-factor dependencies, having the form of dome-shaped curves, well described by formula V.V. Shabanov:

$$S(\varphi) = \left(\frac{\varphi_i}{\varphi_{opt}}\right)^{\gamma \cdot \varphi_{opt}} \cdot \left[\frac{(1-\varphi_i)}{(1-\varphi_{opt})}\right]^{\gamma \cdot (1-\varphi_{opt})},$$

here $S(\varphi)$- is a relative productivity of water semi-submersible vegetation; φ_i – the actual value of the considered environmental factor; φ_{opt}- optimal value of the considered environmental factor; γ- parameter of self-regulation of semi-submersible aquatic vegetation.

Thus, the mathematical module characterizing the substance balance equation with respect to concentration (C_p) makes it possible to determine the ecological allowable exposure limits based on the Le Chatelier-Brown principle, which states that “an external influence that brings the system out of balance stimulates processes that tend to weaken the results of this influence”.

Results of the study

Based on the developed mathematical model for assessing the ecological allowable limit of natural and man-made impact on the environment of small rivers, a numerical experiment was conducted to determine the maximum allowable level of water use of the Karatal river taking into account not only the volume or discharge of polluted wastewater from cities and industrial facilities, as well as incoming collector-drainage waters from from the territory of irrigated arrays.

In this case, the dependence function of the relative productivity of water semi-submersible vegetation on river flow ($S(w)$) and the content of pollutants ($S(c)$) will be represented as a product of the function ($S(w,c)$): $S(w,c) = S(w) \cdot S(c)$.

Assessment of the relative productivity of semi-submersible aquatic vegetation in the watersheds of the Karatal river basin was estimated at the following values: γ = 5.0 - the parameter of self-regulation of semi-submersible water vegetation [ ]; φ_{opt}^{w} = 0.70 is the relative optimal value of the permissible limit of the irretrievable water intake; φ_{opt}^{c} = 0.30 is the relative optimal value of the content of pollutants in the waters of the river basin; φ_i = 0-1 is the range of variation of the considered environmental factors (table 1 and figure 1).

Table 1 - Relative productivity of semi-submersible aquatic vegetation in the Karatal river basin

Range of change of the considered environmental factors (φ_i)	Indicators of relative productivity of water semi-submersible vegetation		
	$S(w)$	$S(c)$	$S(w) \cdot S(c)$
0,0	0,000	0,000	0,000
0,1	0,005	0,464	0,002
0,2	0,052	0,864	0,045
0,3	0,185	1,000	0,185
0,4	0,396	0,897	0,355
0,5	0,665	0,630	0,418
0,6	0,896	0,399	0,358
0,7	1,000	0,182	0,182
0,8	0,867	0,054	0,047
0,9	0,463	0,005	0,002
1,0	0,000	0,000	0,000

As can be seen from Figure 1, the relative productivity of semi-submersible aquatic vegetation ($S(\varphi)$) depending on the range of variation of the considered environmental factors (φ_i), having the form of dome-shaped curves, shows that their maximum values are located in the zone of optimal values of the environmental factors (φ_{opt}).

Herewith, the maximum value of the dome-shaped curves of the product of the function ($S(w,c)$), taking into account the combined effect of the volume of water in the river ($S(w)$) and pollution of the river water to certain substances ($S(c)$) is within 0.40, which characterizes the lower limit of the maximum possible value of ecological flow, ensuring the environmental sustainability of natural systems in the watersheds of the river basin.

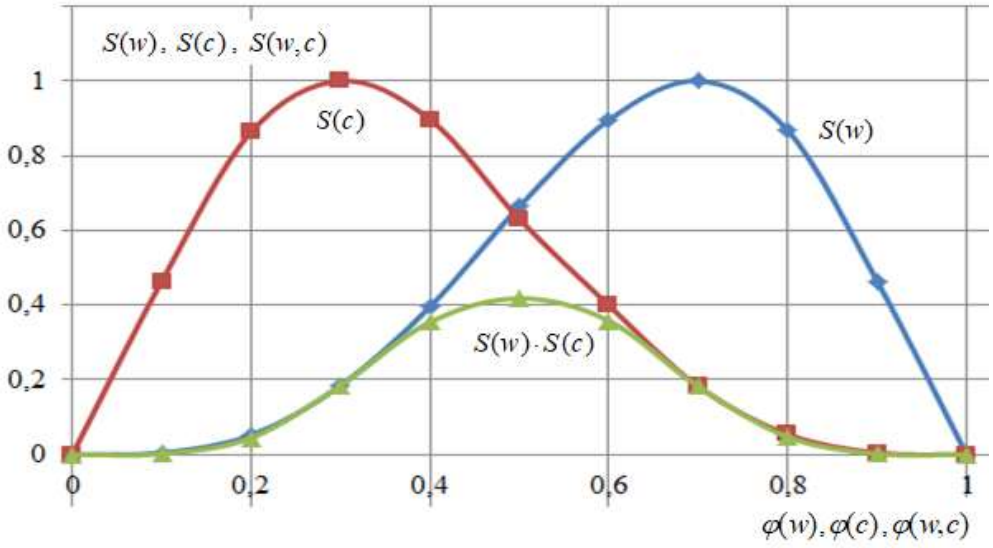

Figure 1 - Relative productivity of semi-submersible aquatic vegetation ($S(\varphi)$) of the Karatal river basin depending on the range of variation of the considered environmental factors (φ_i)

Based on the use of the hydrochemical balance equation of a river flow substance, that is, the first two terms can be used to assess the external impact on the river ecological system, denoting them as a certain concentration(C_{pm}), characterizing the effects of natural and man-made activities that have formed intrawater processes where water self-purification occurs river basins:

$$C_{pm} = \frac{g_{б} \cdot C_{б}}{(A \cdot g_{б} + g_{bon})} + \frac{g_{bon} \cdot (K_b \cdot C_{б} + K_{нз} \cdot C_{б})}{(A \cdot g_{б} + g_{bon})},$$

here C_{pm}- concentration of river water formed under the influence of natural and man-made activities.

Herewith, the volume of the substance absorbed by water semi-submersible vegetation is determined using the third term equation of the hydrochemical balance of the substance of river runoff:

$$C_{pb} = \frac{b_{\max} \cdot S(w) \cdot S(c)}{(A \cdot g_{б} + g_{bon})} = C_b \cdot S(w) \cdot S(c),$$

here $C_{pb}$is the indicator of self-cleaning ability of semi-submersible water vegetation, i.e. $C_b = b_{\max} /(A \cdot g_{б} + g_{bon})$.

If river water concentration is known (C_{pm}), which are formed under the influence of natural and man-made activities, then taking into account the self-purification ability of semi-submersible aquatic vegetation (C_{pb}), substance balance equation, relative to concentration (C_p), has the following form:

$$C_p = C_{pm} - \frac{b_{\max} \cdot S(w) \cdot S(c)}{(A \cdot g_{б} + g_{bon})} = C_{pm} - C_b \cdot S(w) \cdot S(c).$$

The analysis of mathematical models characterizing the substance balance equation with relative to concentration (C_p) shows that the derivative of the function describing the change in the stationary state of the system according to the factors under consideration, that is W_i и C_i, must be increasing: $dC_p / dw > 0$, $dC_p / dc > 0$.

It should be noted, firstly, the function adequately meets the condition when, for the normal development of aquatic semi-submersible vegetation, according to the law of Y. Liebig, a number of circumstances are required at the same time so that it loses biological stability, enough critical situation for one of the considered factors, secondly, one-factor dependences $S(w)$ and $S(c)$ are determined by concentration $C_б$, but not C_p, since the latter is the result of the action of self-purification of the ability of water semi-submersible vegetation (C_{pb}), thirdly, to determine the maximum allowable impact of the natural-man-made system C_p, the derivative of the function is taken only according to the variable parameters of the state of the river(W_i, C_i); fourthly, the maximum allowable concentration of river water is determined at a fixed value of the river flow of water and vice versa fixed level of river pollution.

For determining the maximum allowable impact of the natural and man-made system in the watersheds of the Karatal river basin, the following value of the aquatic ecosystem is used:

A = 0,35 - dimensionless indicator characterizing the ratio of the natural flow of the river (the rate of flow or environmental flow) (W_p или $W_э$) to the volume of river flow ($W_б$); b_{max} =0,20 - the specific maximum volume of substances absorbed by aquatic vegetation per unit volume of water, kg / m3; drain module from the catchment (l / s * km2); $g_б$ = 3,55 drain module from the catchment (l / s * km2); K_b == 0.50 is the return water coefficient; $K_{пз}$ =0,25-groundwater ratio; C_p^{opt} =0,30- the concentration of a substance in a river that is optimal for water semi-submersible vegetation (g / l); C_p^{max} =1,00 – maximum concentration of a substance in a river for water semi-submersible vegetation (g / l) (table 2 and figure 2).

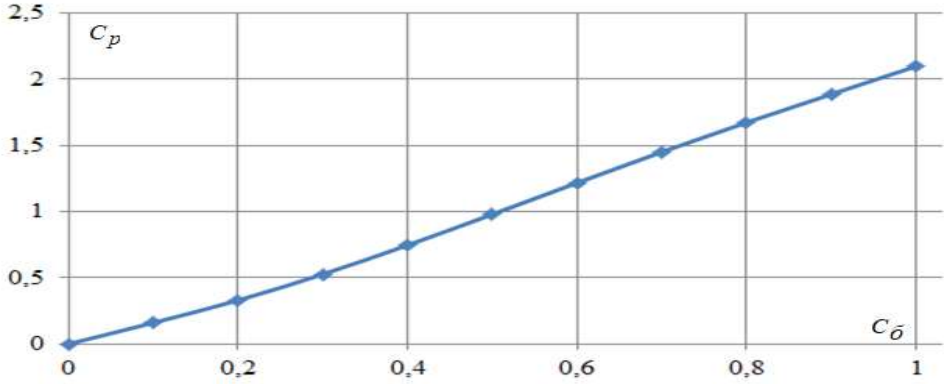

Figure 2 – Dependence of water concentration (C_{pm}) in the catchments of the river basin, which is formed as a result of natural and man-made activities from the specific removal of the substance from a catchment area unit ($C_б$).

Table 2 – Determination of the maximum allowable range of the impact of the factors under consideration in the catchments of the Karatal river basin

Indicators	The range of impact of the considered environmental factors ($C_б$)										
	0,0	0,1	0,2	0,3	0,4	0,5	0,6	0,7	0,8	0,9	1,0
A	0.350	0.350	0.350	0.350	0.350	0.350	0,350	0,350	0,350	0,350	0,350
$g_б$	3.550	3.550	3.550	3.550	3.550	3.550	3.550	3.550	3.550	3.550	3.550
$A \cdot g_б$	1,242	1,242	1,242	1,242	1,242	1,242	1,242	1,242	1,242	1,242	1,242
g_{bon}	0.700	0.700	0.700	0.700	0.700	0.700	0.700	0.700	0.700	0.700	0.700
$A \cdot g_б + g_{bon}$	1,942	1,942	1,942	1,942	1,942	1,942	1,942	1,942	1,942	1,942	1,942
$g_б \cdot C_б$	0,000	0,355	0,710	1,065	1,420	1,775	2,130	2,485	2,840	3,195	3,550
$\frac{g_б \cdot C_б}{(A \cdot g_б + g_{bon})}$	0,000	0,183	0,365	0,548	0,731	0,914	1,097	1,280	1,463	1,646	1,829
$K_b + K_{nз}$	0,750	0,750	0,750	0,750	0,750	0,750	0,750	0,750	0,750	0,750	0,750
$(K_b + K_{nз}) \cdot C_б$	0,000	0,075	0,150	0,225	0,300	0,375	0,450	0,525	0,600	0,675	0,750
$(K_b + K_{nз}) \cdot C_б \cdot g_{bon}$	0.000	0.053	0.105	0.158	0.210	0.263	0.315	0.368	0.420	0.473	0.525
$\frac{g_{bon} \cdot C_б (K_b + K_{nз})}{(A \cdot g_б + g_{bon})}$	0,000	0,027	0,054	0,081	0,108	0,135	0,162	0,189	0,216	0,243	0,270
C_{pm}, g / l	0,000	0,210	0,419	0,629	0,839	1,049	1,259	1,469	1,679	1,889	2,099
$S(c)$	0.000	0.464	0.864	1.000	0.897	0.670	0.399	0.182	0.054	0.005	0.000
$S(c) \cdot b_{\max}$	0.000	0.097	0.173	0.200	0.179	0.134	0.080	0.036	0.011	0.001	0.000
$\frac{b_{\max} \cdot S(c)}{A \cdot g_б + g_{bб}}$	0.000	0.050	0.089	0.102	0.092	0.069	0.041	0.018	0.005	0.001	0.000
C_p, g / l	0.000	0.160	0.333	0.527	0.747	0.980	1.218	1.451	1.674	1.888	2.099

Thus, as can be seen from Figure 2, which was built on the basis of data from Table 2, the change in water concentration (C_{pm}) in the catchments of the Karatal river basin as a result of natural and man-made activities, the concentration of water in the river (C_{pm}) increases with an increase in the specific removal of matter from a unit of the catchment area ($C_б$).

For a system analysis of the behavior of a function $Y(C_p) = f(\varphi)$, it is necessary to consider its derivative with respect to the considered environmental factors, that is $Y'(C_p) = f'(\varphi)$, then the derivative of these functions can be represented as follows:

$$Y'(C_p) = \lim_{\Delta\phi \to \infty} \frac{f(\phi + \Delta\phi) - f(\phi)}{\Delta\phi} \approx \frac{f(\phi + \Delta\phi) - f(\varphi)}{\Delta\phi}.$$

Thus, depending on the concentration of pollutants in the river ($C_б$), the determination of its production from the concentration of pollutants in the river $dC_p / dC_б$, without taking into account the self-purification ability of semi-submersible aquatic vegetation, is made in a tabular form (Table 3) and is presented in Figure 3.

Table 3 - Determination of the driving function $dC_p / dC_б$ from the concentration of pollutants in the river, without taking into account the self-purification ability of semi-submersible aquatic vegetation depending on the concentration of pollutants in the river Karatal ($C_б$)

$C_б$	C_p	$dC_p / dC_б$
0,0	0.000	1,00
0,1	0.160	1,60
0,2	0.333	1,73
0,3	0.527	2,39
0,4	0.747	2,20
0,5	0.980	2,33
0,6	1.218	2,38
0,7	1.451	2,33
0,8	1.674	2,23
0,9	1.888	2,14
1,0	2.099	2,11

The graph shows the derivative (Figure 3), the range of concentration ($C_б$) in the waters of the Karatal river basin, within which the Le Chatelier-Brown principle is fulfilled, that is, the minimum concentration value ($C_б^{min}$) is 0.30 g / l and the maximum concentration value ($C_б^{max}$) -0.60 g / l in non-returnable water consumption ($1 - A$)=0,75.

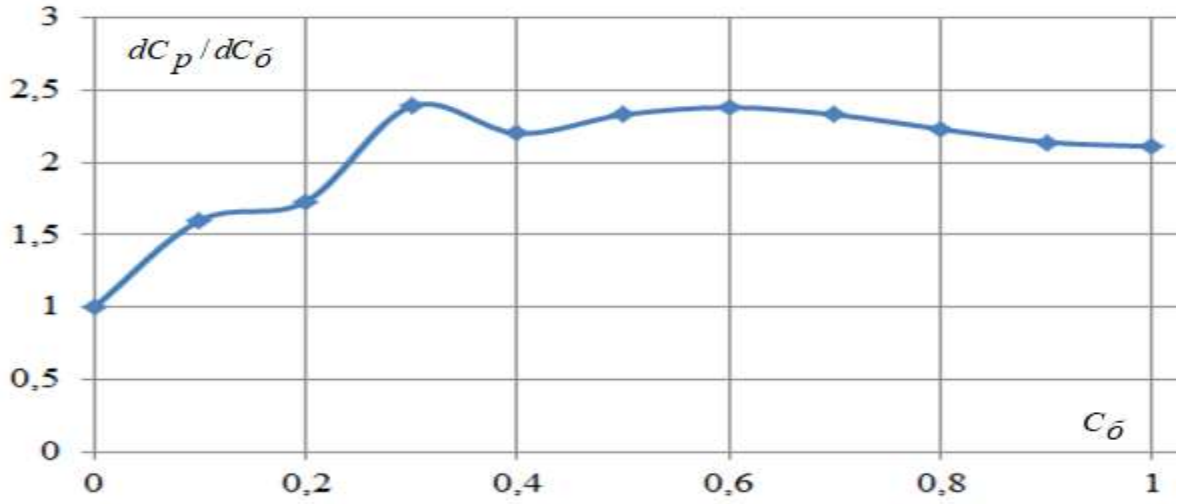

Figure 3 – Graph of dependence of the driving function $dC_p / dC_б$ from the concentration of pollutants in a river, without taking into account the self-purification capacity of semi-submersible aquatic vegetation depending on the concentration of pollutants in the river ($C_б$) Karatal

As, it can be seen from Figure 3, the concentration of pollutants from the flow of water of the river Karatal, formed as a result of natural and man-made activity ($C_б$) and its $dC_p / dC_б$ derivative of the concentration of pollutants in the river comparing with the relative productivity curve of water semi-submersible vegetation ($S(\varphi)$) depending on the range of variation of the considered environmental factors (φ_i), it can be seen that the maximum value of the function is observed within the range of 0.40-0.60, which shows the possibility of using them to estimate the maximum allowable value of river flow, ensuring the environmental sustainability of the natural system of river basins.

On the basis of these principal positions, it can be determined the maximudm permissible level of use of the volume or flow of water in river basins, that is, it can be determined the maximum permissible level of anthropogenic load on the ecological system using the following formulas:

$$W_n = W_p \cdot S(w) \cdot S(c),$$

$$Q_n = Q_p \cdot S(w) \cdot S(c),$$

here W_n, Q_n - the maximum permissible level of use of the volume or flow of water flows in river basins, km3 or m3 / s; W_p, Q_p - the volume or flow of water formed in river basins, km3 or m3 / s.

Therefore, based on the use of the equation, for determining the maximum allowable level of use of the volume or flow of water in river basins, it is possible to determine the volume ($W_э$) and consumption of environmental flow ($Q_э$), ensuring the environmental sustainability of the natural system of river basins:

$$W_э = W_p \cdot [1 - S(w) \cdot S(c)],$$

Table 4- Forecast calculation on the use of water resources in the catchments of the Karatal river basin

Settlement period	Indicators	Q_o, m³/s	W, million m³	C_v	C_s	River water flow at various sufficiency, m3 / s						
						5%	10%	25%	50%	75%	90%	95%
Hydrological station - the village of Karatal, located at the exit of the foothills of the Zhetisu Alatau												
1932-1986	Q_p, m³/s	25,0	789	0,23	0,69	35,50	32,70	29,60	24,30	20,90	18,20	16,80
	Q_n, m³/s					21,30	19,62	17,76	14,58	12,54	10,92	10,08
	$Q_э$, m³/s					14,20	13,08	11,84	9,72	8,36	7,28	6,72
1987-2009	Q_p, m³/s	34,9	1100	0,24	0,72	50,10	46,00	41,50	33,90	28,80	25,00	23,10
	Q_n, m³/s					30,06	27,60	24,90	20,34	17,28	15,00	13,86
	$Q_э$, m³/s					20,04	18,40	16,60	13,56	11,52	10,00	9,24
Hydrological station - the village Naimensuk, located on the flat territory of the basin of Lake Balkhash												
1932-1986	Q_p, m³/s	71,9	2269	0,33	0,89	115,00	103,00	89,70	68,00	54,30	44,30	39,60
	Q_n, m³/s					69,00	61,80	53,82	40,80	32,58	26,58	23,76
	$Q_э$, m³/s					46,00	41,20	35,88	27,20	21,72	17,72	15,84
1987-2009	Q_p, m³/s	77,4	2443	0,29	0,78	119,00	107,00	94,90	74,60	61,10	51,10	46,20
	Q_n, m³/s					71,40	64,20	56,94	44,76	36,66	30,66	27,72
	$Q_э$, m³/s					47,60	42,80	37,96	29,84	24,44	20,44	18,48

$$Q_э = Q_p \cdot [1 - S(w) \cdot S(c)].$$

On the basis of mathematical models, for determining the ecological flow and maximum allowable level of water use of river basins and the average annual water consumption in various facilities of the Karatal river in the period 1932-2009, a forecast was calculated to determine the ecological flow and non-returnable water consumption in the regional economy (table 4).

When building a forecast calculation to determine the ecological flow and non-returnable water consumption in economic sectors in the catchments of the Karatal river basin, the following provisions were taken into account, that is, first, the calculation period was considered within the past (1932-1986) and the present (1987-2009) which show changes in water consumption in rivers on a time scale, and secondly, information and analytical materials were used to assess changes in the flow of water in rivers on a spatial scale.

Hydrological posts - Karatal village, located at the exit of the foothills of the Zhetisu Alatau and Naimensuk, located on the flatland basin of Lake Balkhash, which allow developing a management system and regulation of water resources, ensuring rational and effective use for the development of industries in the regions.

Conclusions

Based on the equation of hydrochemical water balance of river basins and iodine factor dependencies characterizing the relative productivity of semi-submersible water vegetation from river flow and the content of pollutants, a mathematical model has been developed to determine the environmentally acceptable load in watersheds of the river basin, including predicting the concentration of pollutants in the river water, a acceptable level of non-returnable water consumption and ecological runoff, which are realized us to determine the maximum permissible level of natural and technogenic load Karatau Basin, showing the possibilities of their use for the planning, management and regulation of river basin water resources to ensure the sustainability of the natural system of the region.

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INFORMATION ABOUT THE AUTHORS:

Kapar Shekarban - PhD, associate Professor of the Department "Water Resources and Melioration" of the Kazakh National Agrarian Research University, Kazakhstan, Almaty, st. Abaya 8, sholpan_83@inbox.ru

Zhanymkhan Kurmanbek - PhD., associate Professor of the Department "Water Resources and Melioration" of the Kazakh National Agrarian Research University, Kazakhstan, Almaty, st. Abaya 8, mr.aidynbek@mail.ru

Yerkebulan Bolat - Master degree in Environmental Engineering, student, Warzaw University of Life Science, Poland, Warsaw, Novoursynowska 166, Building 33, vip.4200@mail.ru

Rinda Kustina - Master degree in Environmental Engineering, student, Warzaw University of Life Science, Poland, Warsaw, Novoursynowska 166, Building 33, tel 0818-0998-0313, rinda.bp@gmail.com

Aziz Aitbaev - Master degree in Environmental Engineering, student, Warzaw University of Life Science, Poland, Warzaw, Novoursynowska 166, Building 33, rockfell67@gmail.com

School
GREEN ECONOMY

UDC 620.95

A. Chistyakova*, S.V. Ilvitskaya

Federal State-Funded Educational Institution of Higher Education
"State University of Land Use Planning", City of Moscow
**nchistyakova15@gmail.com*

MICROALGAE AS A CLEAN ENERGY OF THE 21ST CENTURY

Abstract

Today in the spotlight, microalgae are presented as an energy alternative to oil, capable of producing energy in three forms: hydrogen, biofuel or biogas. Microalgae are lipid-rich microscopic organisms that grow by photosynthesis in fresh or sea water, depending on the species. Analyzing the real productivity of microalgae and the profitability of the industrial processes associated with them, one can note the undeniable advantages of this culture of use in various industries. This sector offers interesting prospects for the global community with higher yields and positive environmental conditions.

Keywords: microalgae, energy, bioeconomy, sustainability, environment, photobioreactor.

Introduction

Microalgae are among the first living creatures, appearing around 3.5 billion years ago. Their use (and therefore their collection) is very old and probably predates Neolithic agriculture. Their production is more recent and their spectrum of use very wide because of their adaptation to all environments. This results in a wide range of technology choices. Their development remains conditioned by economic models that are currently uncompetitive in their competitive universe, mainly because we have not yet emerged from the “civilization” of fossil carbon and heavy industry. The low price of non-renewable energies (oil, gas and coal) and the absence of policies resolutely oriented towards sustainability are delaying the energy, ecological and social transition. Our entry into the age of sustainable development should allow microalgae to experience strong growth, because they are often in line with the requirements of the bioeconomy: circular, carbon-free, decentralized and therefore territorialized economy, in participatory networks [1, p. 96]. In the second case, it is a question of promoting integrated sustainable rural development. A new economic model is to be invented. It will be based on the concept of "territorialized circular bioeconomy" and its base will be family farming networked with its upstream and downstream by relying on sensors and platforms for sharing knowledge, inputs and channels. logistics. Microalgae grown using robust processes can play an

important role in waste management and as a source of energy and food co-products with high added value.

Methods and materials

Microalgae, with several thousand potentially usable species, constitute a major reservoir of bioresources with multiple applications that have already reached the commercialization stage (inputs for agriculture, supplements for human and animal food, components for cosmetics, molecules for the pharmaceutical industry) or under development for markets with a near horizon (air and water pollution control, biomaterials) or more distant markets (biofuels). The interest of microalgae resides, on the one hand, in their ability to substitute fossil carbon with renewable carbon, a strong trend driven by consumers and civil society, and on the other hand, in their exceptional surface productivity making it possible to preserve for priority uses of rare natural resources (agricultural land and water), by promoting alternative energies [2, p. 161]. The main obstacles to the development of the sector are due to the low price competitiveness of products due to heavy material and immaterial investments. In warm countries, these generic assets and constraints are amplified by well-identified natural and socio-economic conditions (biodiversity, solar energy, potential for economic growth on the one hand, global warming, food insecurity, institutional deficit on the other). Adapted development of the microalgae sector must therefore be imagined, with priority to be given to peripheral rural areas [3, p. 161]. This model can be described as a territorialized circular bioeconomy whose pivot would be constituted by microalgal farms.

Microalgae can indeed be used in a wide variety of fields such as:

• Agriculture: inputs for organic farming and agroecology (fertilizers and health treatments for plants and animals through biomimicry: natural defense stimulators and phytohormones);

• Human nutrition: direct consumption of algae or extraction of additive components (coloring pigments: carotenoids, and blue, red, yellow and green pigments; texturizers; aromas; fatty substances);

• Human and animal phytopharmacy (pigments, essential amino acids; antioxidant molecules of interest: catalase, polyphenols, tocopherols; antibacterials that can replace antibiotics in certain cases, prophylactic drugs in nutrition: unsaturated fatty acids, omega3 and omega6; anti-inflammatories and anti-mutagens; restoration of cellular resistance to cancer; anti-angiomatic activity; practically all vitamins A, B1, B6, B12, C, E; prophylaxis in neurology and ophthalmology);

• Animal feed: aquaculture (fish and shellfish, the only food source for hatcheries and interest in controlling toxicity), farm animals and pets (pet foods), as a source of protein and/or supplements nutritious;

• Cosmetics: many products contain, in their formulations, ingredients derived from microalgae;

• Energy production: mainly diesel algofuels, but also ethanol and biogas (using microalgae as inputs in methanisation);

• Biosourced materials: algal bioplastics, adjuvants for construction (concrete and bitumen, building materials), adhesives, polysaccharides, polyesters and hydroxy acids;

• Depollution (or bioremediation): sanitation, and management of industrial and organic waste in urban and rural areas.

The advantages of products from microalgae compared to other biomass sources:

• A much higher productivity than terrestrial plants, in particular because of their shorter reproductive cycle;

• The possibility of developing new uses for biomass without creating tensions on the markets for food raw materials (numerous co-products);

• The possibility of cultivating seaweed at sea or on non-arable land without competition either with food for land use (giving priority to food crops with the aim of food security);

• The possibility of providing environmental services alongside their production: water treatment and CO2 recovery (carbon sink).

Results and discussion

There are several benefits, but three of them really stand out. In terms of biomass per square meter, these microalgae are more efficient than agricultural products. For example, a crop of rapeseed, soybeans or wheat contains about one gram of dry matter per square meter per day. In microalgae grown under the same conditions, production ranges from 5 to 10 grams, which limits the size of the cultures. These microscopic organs can produce up to 20,000 liters of oil per hectare per year under moderate conditions, three times more than the optimal oil palm. The latter produces only 6,000 liters per hectare per year, and this is in subtropical conditions.

The second solution is that the cultivation of microalgae takes place in ponds or bioreactors fed by sea water, which avoids the use of fresh water supplies. An important element for developing countries, but also for Western countries. Finally, the conscious way of growing microalgae does not take over arable land, which avoids disputes about first-generation biofuels. Finally, the potential for capturing and reusing atmospheric CO2 (by recovering the carbon) is much higher than that of crops and forests [4, p. 103].

Under optimal cultivation conditions, the productivity of microalgae can be high (approximately 100 t/ha/year in dry matter) and yields are 2 to 3 times higher than those of the most productive terrestrial crops. In addition, the surfaces to be mobilized and the water and nutrient resources necessary for the cultivation of micro-algae make it possible to envisage the absence of competition with agricultural production. Consequently, algae constitute an alternative bioenergetic system to plants, capable of providing various energy vectors such as bioethanol, biogas or lipids (biodiesel, biokerosene). If the biomass yield potential of micro-algae is much higher than that of terrestrial plants and their metabolic flexibility suggests remarkable productivities in lipids or other energy compounds, several major obstacles remain for the domestication of one or more species of algae for the production of renewable bioenergy. The biodiversity of micro-algae, for example, has been little explored with a view to such applications; the species studied today are more so as model species [5, p. 270]. With regard to the culture devices to be implemented, the various systems used on land for the production of micro-algae (basins, lagoons, photobioreactors, etc.) have only very rarely gone beyond the experimental stage – which is insufficient in a large-scale production target specific to biofuels. The harvesting of algae and the extraction of lipids are crucial steps insofar as recent studies have shown that current technologies mobilize more energy than they are capable of recovering.

Conclusion

This new context of consumption is favorable to raw materials from renewable resources, with low environmental impact, job creators and generators of recoverable co-products (energy, ecological waste management, biomaterials), which – under certain conditions – is the case of microalgae. In summary, microalgae constitute a very abundant and diversified source of raw material leading to numerous applications. Subject to suitable and competitive economic models compared to other components of biomass, they can make a major contribution to the opening of new markets and to sustainable development.

A conducted analysis showed that the opportunities exist in terms of potential markets in the main bioresource sectors: agriculture, food and non-food agro-industries, pharmaceutical and cosmetic industries, renewable energies, building and infrastructure, waste management, as a result of research, by producers of inputs and components of natural origin (organic carbon as a substitute for fossil carbon). The advantages of microalgae within bioresources come from the remarkable qualities of their products in all their numerous applications (food, health, energy, materials, remediation), from their exceptional surface productivity (potential yields per hectare nearly 10 times higher than that of cultivated plants) and therefore to a limited occupation of the land), their multifunctionality (co-products) creating value. The constraints are also of an economic nature, due to weak competitiveness with products from conventional agriculture and industry, and competition with other bioresources. As in any emerging sector, problems of technological choice arise, but should be resolved by experimental programs.

Subject to the reservations made above, particularly in terms of national and international public policies, the advantages offered by microalgae could tomorrow constitute solid competitive advantages based on a triple ecological and environmental performance (enhancement of biodiversity and circular economy), economic (products sought by consumers and co-products) and social (job creation, territorial development, particularly in rural areas).

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INFORMATION ABOUT THE AUTHORS:

Chistyakova Anastasia – Postgraduate student, Russian Federation, Federal State-Funded Educational Institution of Higher Education "State University of Land Use Planning". City of Moscow, e-mail: nchistyakova15@gmail.com

Ilvitskaya S. V. – Supervisor, Professor, Doctor of Architecture, Head of the Department of Architecture, Federal State-Funded Educational Institution of Higher Education "State University of Land Use Planning". City of Moscow.

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I.A. Pavlovich*, S.M. Baraishuk

Belarusian State Agrarian Technical University, Minsk, Belarus
**mrchesel20@gmail.com*

THE USE OF HYDROGELS IN MIXTURES TO REDUCE THE TRANSIENT RESISTANCE OF THE SOIL - GROUNDING DEVICE.

Abstract

A method for reducing the resistance of the ground loop for high-resistance soils by using mixtures based on hydrogel is considered as backfill materials. Based on the results of the research, an analysis was made of the effect of mixtures on soil resistivity, the seasonality factor and the resistance of the ground loop at various temperatures and humidity.

Keywords: Grounding resistance, grounding device, electrical resistivity of the soil, contact resistance, frozen soil

Introduction

The electrical resistance to the spreading current of grounding devices depends on many factors, such as the electrical resistance of the ground electrode materials, the quality of the contact connections of the ground loop elements, and the loop configuration. But the most important role is played by the resistivity of the soil in the near-electrode space, its porosity, moisture content, and the seasonal coefficient of change in soil resistivity.

The soil resistivity at the point of contact of the grounding device with the soil determines the qualitative and quantitative characteristics of the current spreading. Its value determines the type of contour and its geometric parameters. At high values of soil resistivity, the contour dimensions may become unacceptable. At the same time, to ensure the specified technical characteristics of the circuit, various methods of influencing the ground at the place of grounding installation can be used.

Methods for improving the parameters of the grounding device

The resistance to current spreading of the grounding device depends on the types of soil (sand, clay, limestone), the size and density of particles, humidity and temperature, as well as the chemical composition of the soil, the presence of acids, salts, alkalis in it [1, 2]. For the seasonal Influences in soil resistivity, in turn, the determining parameters are humidity and temperature [2 - 4]. It can be concluded that an increase in the ability of the

soil to retain water, with minerals and salts dissolved in it, in the near-electrode space improves the properties of the grounding device.

According to previously known data [3], the optimal content for the dissolution of mineral salts is soil moisture content of more than 16%. From the graph (Fig. 1) it can be seen that when the moisture content of the mixture is less than 18%, the specific electrical resistance of the soil increases, since the transport function of mineral salts dissolved in the soil decreases.

Sufficient soil moisture at the installation site of the grounding device is an important component of a stable value of the electrical resistance of the ground loop. Hence the need to maintain soil moisture constant. This can be achieved by transferring the circuit to a soil area with high humidity (for example, a wetland), deepening to groundwater (vertical modular ground electrode systems), and periodically moistening the location of the grounding device. In addition, there are recommendations for the use of backfill with moisture-retaining substances, for example, from bentonite clays. We also suggested using hydrogel additives.

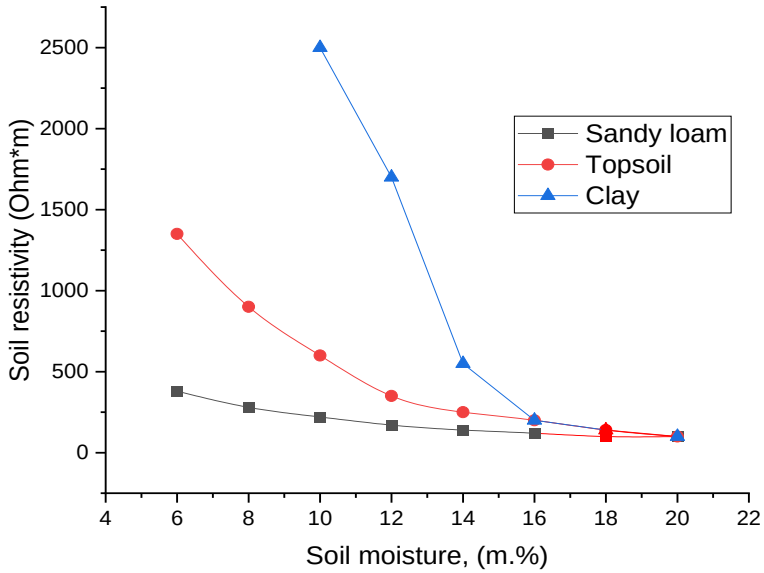

Figure 1 - The dependence of the mixture resistance on humidity.

Thus, the ground electrode will work best around which an area with good contact, optimal humidity and concentration of mineral and conductive substances is formed in the soil.

Another important factor of influence is the ability to perform its functions at different temperatures. In particular, at negative temperatures, unbound moisture in the soil freezes, while the electrical resistance of the soil is high [3-5], and when thawed, everything returns. This also leads to the need to bind the liquid to reduce the effect of its freezing.

Fluctuations in the resistance of grounding devices during the year leads to the need to increase the number of electrodes in the circuit, the depth of their occurrence, in order to compensate for the increase in resistance. The need to provide a regulated value of grounding resistance leads to overconsumption of materials of grounding conductors, an increase in the volume of installation work, which leads to an increase in costs. When

installing ground loops, various methods are used to reduce the resistance of grounding devices, such as the use of various types of electrode materials, as well as the use of various types of additives (electrolytes) and replacing the soil in the near-electrode space with another having a lower resistivity than the original soil, and some other [7-10].

According to known studies, soil resistivity can be reduced by the use of sodium chloride, magnesium sulfate, copper sulfate and calcium chloride or similar substances in the near-electrode space [2, 10, 11]. The most widely used is the use of table salt and magnesium sulfate. The method of using these chemicals is reduced to the treatment of the near-electrode space, so that there is no direct contact with the electrode of the grounding device, in order to avoid the activation of corrosion processes. This treatment must be repeated periodically, since substances are washed out, their use also increases the rate of corrosion of the materials from which the ground loop is made. To prevent the rapid destruction of the electrodes, it becomes necessary to use protective coatings, which must have sufficient conductivity.

Previously, we proposed a method for reducing the electrical resistivity of soil based on the use of carbon-containing powders together with water-retaining additives and plasticizers. In this work, we studied the effect of hydrogel concentration on conductivity. Replacement of part of the soil in the near-electrode space with this mixture can reduce soil resistance [11]. Such a mixture can also be used as a filler for matrices around the electrode, for example, concrete shells or sleeves made of conductive and filtering material, as geotextiles.

The decrease in this indicator is due to the fact that the hydrogel binds moisture in the soil. Water associated with the hydrogel does not wash away minerals from the soil, and when introduced into the mixture of carbonaceous fillers and clay, it allows to further reduce the resistance of the soil. In addition, the use of this method allows to reduce the freezing temperature of the soil. When studying the effect of the mixture used based on cross-linked copolymers of potassium and ammonium salts of acrylic acid on the seasonality factor, it was possible to determine that it is reduced to 20% compared to the control ground electrode.

Experimental part

A. Field experiment

When conducting full-scale experiments on sandy loam soil, grounding devices (ground loops) were mounted, which are a vertical composite electrode made of galvanized steel with a diameter of 16 mm and a depth of 3 m and a horizontal fragment of a connecting strip 4x50 mm of the 3 meters length. The reference devices were assembled without the use of any additives. In the near-electrode volume of the soil of the experimental contours, treatment was carried out with a mixture with different concentrations of hydrogel and graphite, or with its individual components. Systematic measurements of the resistance values of grounding devices were carried out for more than four years by a four-wire method using a grounding device resistance meter Sonel MRU-200 at different temperatures and humidity of the environment and soil, the error of such measurements did not exceed 10%.

In addition, a series of measurements of the electrical resistivity of the soil at the site of the experimental and reference circuits was carried out using the method of vertical electrical sounding.

The results of studies of experimental circuits are shown in Fig. 2

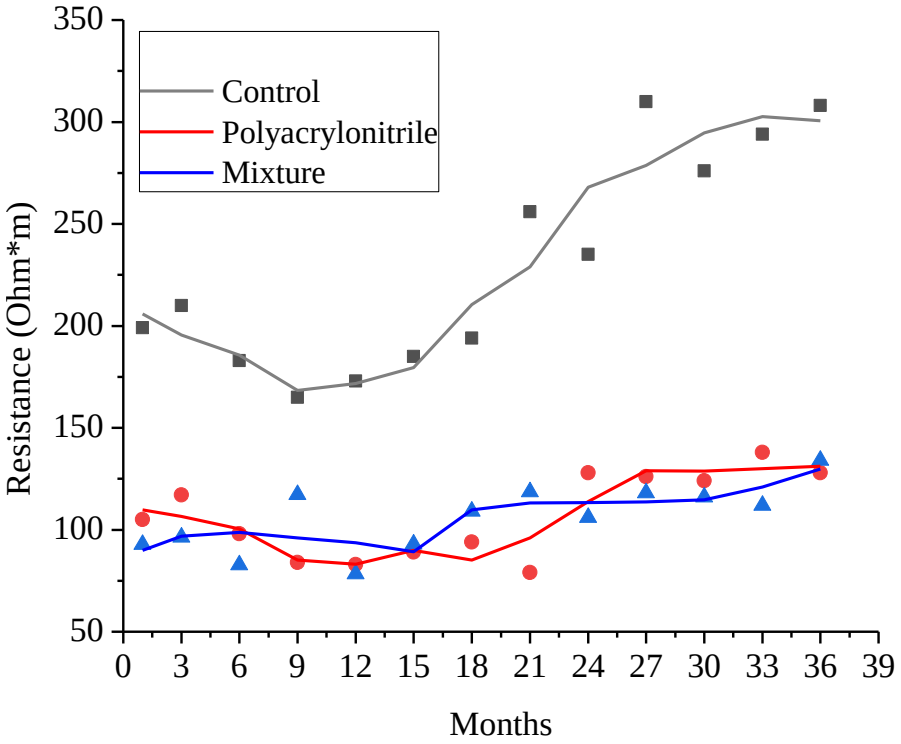

Figure 2 - Results of continuous measurements
of real grounding devices for 3 years.

The resistances of the reference grounding device (grey curve) as well as devices with the mixture composition being developed (blue curve) are shown in Fig. 2. The dynamics of measuring the resistance of a grounding device treated with one component was also analyzed: hydrolyzed polyacrylonitrile (red curve). Because hydrolyzed polyacrylonitrile is the main moisture stabilizing component of the mixture.

From the obtained measurement results, it can be concluded that the grounding device has the lowest resistance value, the near-electrode space of which is treated with an experimental mixture to reduce the spreading resistance of grounding devices containing hydrogel and graphite. The use of mixtures allows not only to reduce fluctuations in the spreading resistance of the ground loop, but also to reduce its resistance in comparison with the control loop.

The graphs show a strong influence of climatic fluctuations on the electrical resistance of the control grounding device (red line) and its significant decrease with the use of hydrosorbs in the backfill (sulfur and blue lines), this phenomenon was described in more detail by us earlier in [13]. As can be seen from the graphs, the influence of seasonality when using mixtures and hydrogel is reduced to 20% compared to a reference grounding device. And if, during the installation of vertical electrodes, their near-electrode space is also treated with a mixture, - up to 25% compared to the control values. At the same time,

the use of conductive additives in mixtures makes it possible to reduce the resistance to current spreading by up to 3 times with the same configuration of grounding devices.

B. Laboratory experiment

Laboratory measurements of soil resistivity depending on the amount of introduced hydrogel, humidity and temperature were carried out according to the method similar to that described in [12] and present in Fig. 3.

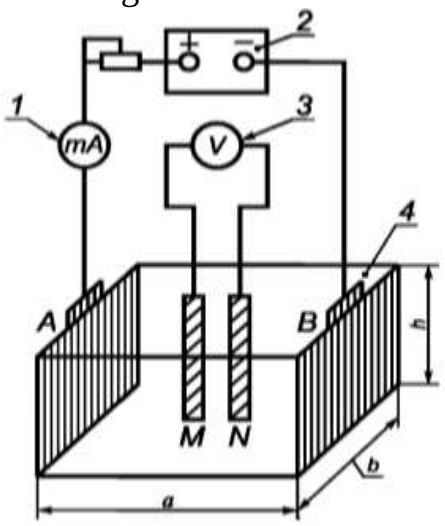

Figure 3 - Scheme of the installation for determining the electrical resistivity of the soil in the laboratory: 1 - milliammeter; 2 - current source; 3 - voltmeter; 4 - measuring cell.

Studies were carried out on the dependence of the electrical resistivity of the mixture on temperature. To do this, the entire measuring cell shown in Fig. 4 A cell made of Plexiglas, rectangular in shape with internal dimensions: a=100 mm; b=45 mm, h=45 mm. External electrodes (A, B) 44x40 mm in size (40 mm - electrode height) in the form of rectangular stainless steel plates with a leg to which the conductor-current lead is attached, while one side of each plate, which is adjacent to the end surface of the cell, is isolated; internal electrodes (M, N) made of copper wire or rod with a diameter of 1 to 3 mm and a length of 10 mm more than the height of the cell.

External electrodes are installed close to the inner end surfaces of the cell. When collecting the cell, the plates are placed to each other with non-insulated sides. Then the mixture was placed into the cell, and it was compacted in layers. The internal electrodes were installed vertically, lowering them to the bottom along the central line of the cell at a distance of 50 mm from each other and 25 mm from the end walls of the cell.

The electrical resistivity of the mixture ρ, Ohm•m, was calculated by the formula:

(1)

where V - the voltage drop between the two inner electrodes, V;

I - current strength in the cell, A;

S - surface area of the working electrode, m;

R_{MN} - distance between internal electrodes, m.

The electrical resistivity of the mixture was determined by a four-electrode circuit at direct current. External electrodes with the same working surface area S are polarized with

a current of a certain strength and the voltage drop V is measured between two internal electrodes at a distance between them.

Fig. 4 shows the results of measurements of the specific resistance of a mixture of soil with hydrolyzed polyacrylonitrile in various proportions.

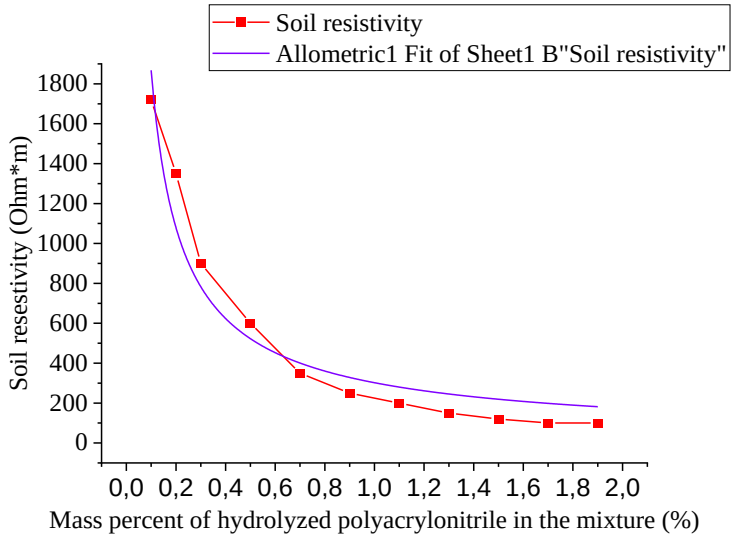

Figure 4 - The results of measurements of the specific resistance of a mixture of soil with hydrolyzed polyacrylonitrile in various proportions

As can be seen from the graph presented in Fig. 5, when hydrogels obtained by swelling of hydrolyzed polyacrylonitrile with a dry weight of more than 1.3–1.5% of the soil mass are introduced, moisture stabilization occurs, and a further increase in concentration does not lead to a decrease in soil resistivity, which indirectly indicates to obtain optimal soil moisture, which is in good agreement with the results presented in [1-4].

To measure the resistance, a sample of the mixture was poured with distilled water to the required mass fraction of water content and frozen to -20°C, and then gradually thawed at room temperature.

For example, Fig. 5 shows the results of a study for a mixture containing 18% graphite and 1.5% hydrogel in the composition.

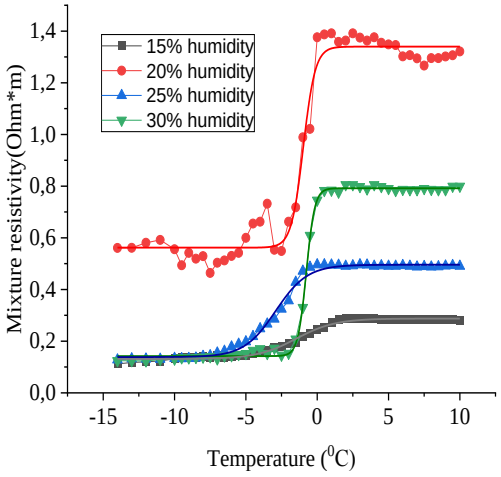

Figure 5 - The dependence of the resistivity of the mixture on temperature

As can be seen from the graph, the freezing temperature is from -3.5 to -2^{0}C. In addition, on the graph for such a composition of the mixture, we see an anomalous (in comparison with those known from works [2, 4, 6] for ordinary types of soils) behavior of resistivity, namely, its decrease when the mixture freezes. Such a phenomenon can be interpreted by the consolidation of the conductive parts of the graphite contained in the mixture.

When studying the influence of the mixture on the seasonal factor, it was found that when a horizontal strip is filled with a mixture, the seasonal resistance coefficient is reduced to 20% compared to the control grounding device.

If, when installing vertical electrodes, their near-electrode space is also treated with a mixture (when installing modular earth electrodes, the bushing, passing through the soil, expands the hole in the soil and this space is filled with a waterlogged mixture), the seasonal resistance coefficient in this case decreases to 25% compared to the control values for the initial scheme.

Conclusion

In the course of the research, an anomalous change in the resistivity of the mixture for measurement in the process of temperature change was established when using hydrosorbable compositions based on polyacrylonitrile hydrolyzate in combination with dispersed graphite in their composition. Many years of field experience has shown that the use of such mixtures when backfilling grounding devices can reduce the seasonal resistance coefficient fluctuations on the ground loop by up to 25%, as well as reduce the resistance of the grounding device by 3 times.

Compared to known compositions using mineral and electrically conductive additives, the proposed method stabilizes the resistance along the circuit by binding moisture to the hydrogel, which makes such a composition more effective.

The next direction of research will be to study the possibility of further reducing the freezing point of the soil and establishing the effect of the mixture on the corrosion of the elements of the grounding device.

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INFORMATION ABOUT THE AUTHORS:

Pavlovich I.A. – assistant of the department of practical training of students of the Belarusian State Agrarian Technical University, 220023 Republic of Belarus, Minsk, Independence Avenue, 99, e-mail: Mrchesel20@gmail.com

Baraishuk S.M. – Ph.D., Scientific adviser, Belarusian State Agrarian Technical University, 220023 Republic of Belarus, Minsk, Independence Avenue, 99.

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A.M. Malden*, A.A. Tengaeva

Kazakh National Agrarian Research University
**amaldenova.00@mail.ru*

ANALYSIS OF CREDIT SCORING METHODS

Abstract

This article provides an analysis of credit scoring methods. Credit scoring has important consequences for banking policy and the banking system as a whole. Credit scoring modeling methods not only affect new modeling procedures, but also the changing technological environment, the structure of consumer spending and the types of loans they seek, and therefore the types of loans that may default. More attention should be paid to the default period during the loan period, as well as the separation of slow payers, irregular payers and payers. It is shown that the analysis of the importance of the variables used in the development of evaluation models is not taken into account in the published research work on credit scoring.

Keywords:credit scoring, model, credit valuation, valuation methods, banking, finance.

Introduction

The information collected by banks or financial institutions about the applicant is used to make a quantitative assessment of each applicant. Credit scoring methods are expanding to include more applications in different areas. In addition, the idea of reducing the likelihood of a client default, which involves the risk of the client, is a new role of credit scoring, which will help financial institutions, especially banks, to maximize the expected income from this client. At the beginning of this century, the use of credit scoring became more widespread, especially with the advent of new technologies, such as the introduction of advanced assessment methods and criteria such as Gini and the area under the receiver performance curve, and advanced computing technology. In the scientific literature on credit scoring [1, 2]; Textbooks on classification issues are also limited, and in recent years a number of articles in international journals have discussed different methods of assessing creditworthiness in different areas [3].

Credit scoring is the use of statistical models to determine the probability that a potential borrower will default on a loan. Credit scoring models are widely used to evaluate business, real estate and consumer loans. In addition, credit scoring is a set of decision-making models and methods that help lenders provide consumer loans. These methods increase who gets a loan, how much to borrow, and what operating strategies increase lenders' profitability for lenders.

In the credit scoring model, experts usually use their historical experience with debtors to obtain a quantitative model of the distribution of favorable and unfavorable loan applications. Applying for a loan using a credit rating system is basically an independent

process and is applied consistently to all loan decisions. As a result, we can say that credit scoring allows professionals to quickly assess their creditworthiness. In addition, credit scoring allows leading companies to improve customer service and retain reliable customers. Using a statistically obtained credit score, the analyst can, of course, distinguish between eligible applicants and non-eligible applicants. On the other hand, credit scoring is a statistical problem related to the data used to develop the model, has also been criticized for its assumptions about the exact statistical methodology used to score points. Despite the criticism of credit scoring models, these models can be considered as one of the most successful models used in business and finance [4].

Credit scoring requires little information to make decisions, as credit scoring models include only variables that are significantly related to their statistics. Its models try to correct the distortions that may arise from reviewing the history of redemption of accepted applications, not all applications. They assume that this is how the rejected applications will react if they are accepted. Assessment methods are usually based solely on the characteristics of those who have accepted and subsequently failed to meet their obligations. Credit scoring models take into account the characteristics of both good and bad payers, and valuation methods are usually aimed at learning about bad payers and reflect the relationship between the introduced variables and the behavior at maturity, which is not possible in the case of valuation methods.

Credit points use any description of the client, the actual connection with the possible payment can be justified. At the same time, sometimes economic factors are not taken into account. In addition, when using credit scoring models, customers may sometimes have characteristics that make them worse than good payers, but they may be accidental (incorrect classification problem). Statistically, the credit scoring model is "incomplete" because it does not take into account, among others, some variables that can predict the client's debt repayment. But if the credit scoring model does not have all the possible variables, it usually does not classify some people correctly. Another critique of credit scoring models is the possibility of indirect discrimination.

Methods and materials

The use of credit scoring reduces the cost of the credit process and the expected risk associated with bad credit, improves credit decision and saves time and effort. The decision to accept or reject a client's loan can be confirmed by valuation methods and / or credit valuation models. Valuation methods are based on both past and present experience of credit analysts, whose customer evaluations include their ability to repay the loan, guarantees and the nature of the client. Due to the rapid growth of funds invested in loans and the need for quantitative assessment of credit risk, financial institutions, including banks, began to use credit valuation models.

The purpose of credit scoring models is to differentiate credit customers into good or bad loans, or to predict bad creditors [6]. Therefore, the problem of scoring is related to the classification analysis.

Categorizing good and bad loans is very important and is the goal of a credit valuation model. Thus, the need for an appropriate classification method is obvious. But what determines the category of a new applicant? From the literature review, characteristics such as gender, age, marital status, dependents, telephone availability,

education level, occupation, time at current address, and credit card availability are widely used to create assessment models [7]. In some cases, the list of variables has been expanded by including the spouse's personal information, such as age, salary, bank account, and so on. Of course, other variables are used less when creating valuation models, such as the TV area code, the weeks following the district court's final decision, poor account status, business hours, bank hours, and more.

It follows from this discussion that there is no optimal credit scoring model procedure, including a precise number of variables or variables, a specific threshold, a specific sampling criterion, and a careful consideration of the various banks that may apply.

Advanced statistical methods such as neural networks and genetic programming offer alternatives to traditional statistical methods such as discriminant analysis, probation analysis, and logistic regression. The essence of the use of such networks lies in their ability to model very complex functions, and, of course, this contradicts traditional linear methods such as linear regression and linear discriminant analysis. Probabilistic neural networks typically teach the proposed situations faster than multi-layer direct communication networks and classify them as the same or better than multi-layer direct communication networks. However, a number of complex algorithms for learning neural networks are available. At the same time, Genetic programming is one of the most successful alternatives to traditional methods recently used in this field. Genetic programming is used to automatically detect sufficiently discriminant functions and applied traits at the same time. Heterogeneous neural networks can only fit large data sets, but genetic programming can work well with even small data sets. It is useful to discuss some of the previously mentioned methods of credit scoring modeling [8]. but genetic programming can work well even with a small data set. It is useful to discuss some of the previously mentioned methods of credit scoring modeling [8]. but genetic programming can work well even with a small data set. It is useful to discuss some of the previously mentioned methods of credit scoring modeling [8].

Linear regression methods have become an important component of the analysis of any data related to the description of the relationship between the response variable and one or more independent variables. Linear regression has been used in applications to assess creditworthiness, as two classes of tasks can be represented using pseudo-variables. Instead, Poisson's regression model can be used to account for situations where the client produces different levels of partial payments.

Discriminant analysisIs a simple parametric statistical method for distinguishing between two groups. Many researchers agree that the discriminatory approach is still one of the most common ways to classify customers as good credit or bad credit. This method has long been used in applications to assess creditworthiness in various fields. Thus, the credit scoring model based on the discriminatory approach is mainly used for statistical analysis to classify variable groups into two or more categories.

Probit analysis is another traditional method that has been used for many years in applications to assess creditworthiness, a method of finding the values of coefficients, such as the probability of a single value of a dichotomous coefficient. Within the probite-model,

a linear combination of independent variables becomes a normal distribution of its cumulative probability value.

Table 1 shows the results of the classification of different assessment models studied by Guillen and Artis. In Table 1, the model has the highest overall coefficient of correct classification - 71.9% [9].

Table 1 – Classification results for different scoring models

Model	Total correct classification (%)	Correct classification of good (%)	Correct classification of bad (%)	Bad accepted into the good group (%)
Discriminant analysis	65.4	62.2	78.0	8.1
Linear regression model	55.1	47.0	87.5	6.2
Probit model	71.9	76.4	54.1	13.1
Poisson model	62.4	57.7	81.8	7.3
Negative binomial II model	63.3	58.9	80.6	7.6
Two step procedure	64.9	61.1	79.8	7.6

Neural networks have become a practical technology that is successfully used in financial institutions in many areas, including banks. Applications such as credit card fraud, bankruptcy prediction, bank bankruptcy prediction, mortgage applications, option pricing, and more were presented as financial areas where neural networks could be successfully used. They solve many problems, such as pattern recognition, and use the architecture of direct communication networks, such as multi-layer direct communication networks and probabilistic neural networks, which represent most of these applications. Several models of credit scoring have been studied using probabilistic neural networks.

Table 2 – Comparison of the bad risk rates using different scoring techniques

Scoring technique	Bad risk rate (%)
K - NN (any D)	43.09
K - NN (D = 0)	43.25
Logistic regression	43.30
Linear regression	43.36
Decision tree	43.77

Table 3 – Comparing classification results for different scoring models

Scoring model	Correctly classified results (%)	
	Testing	Overall
Weight of evidence model	52.16	54.99
Probit analysis	82.69	81.93
Genetic programming - best program (GPp)	82.93	83.28
Genetic programming - best team (GPt)	83.89	85.82

Genetic programming is one of the latest methods used in the field of credit scoring. It began as a set of genetic algorithmic methods and can be considered as an extension of genetic algorithms.

Table 3 summarizes the results of the predictive classification of two models of genetic programming studied by Abdou and two traditional methods (weight of evidence and trial analysis) [10].

Results and discussion

Most studies comparing different methods have shown that complex statistical methods, such as neural networks, genetic programming, and fuzzy algorithms, are better than traditional, grounded conformity assessment criteria. However, simple classification methods such as linear discriminant analysis and logistic regression also give very good results in this regard. Markov models were also considered. As a result, it became clear that the best statistical method used to build credit scoring models and the best method for all data sets are still insufficient. At the same time, A comparison of different statistical approaches shows that more sophisticated methods, such as neural networks and genetic programming, work better in terms of their high predictability than traditional methods such as discriminant analysis and logistic regression. However, the results of some studies have shown that the predictive capabilities of the two approaches are quite similar to complicate their differences. These statistical methods help loan decision makers to predict current or new bank customers with both good and bad credit, and based on their characteristics and "credit" information, performance evaluation criteria have helped them choose the best model based on their goals and objectives. The results of some studies have shown that the predictive capabilities of the two approaches are similar enough to complicate their differences. These statistical methods help loan decision makers to predict current or new bank customers with both good and bad credit, and based on their characteristics and "credit" information, performance evaluation criteria have helped them choose the best model based on their goals and objectives. The results of some studies have shown that the predictive capabilities of the two approaches are similar enough to complicate their differences. These statistical methods help loan decision makers to predict current or new bank customers with both good and bad credit, and based on their characteristics and "credit" information, performance evaluation criteria have helped them choose the best model based on their goals and objectives.

Conclusion

Credit scoring methods are a useful tool to help banks control a number of risks. Credit scoring programs and applications are actively developing in various fields, especially in finance and banking. In addition, the use of hybrid methods, such as neural and discriminant methods, offers a promising way to improve the ability to classify and predict.

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INFORMATION ABOUT THE AUTHORS:

Malden Asem Maratovna - undergraduate, "Kazakh National Agrarian Research University", Republic of Kazakhstan, Almaty, Abay St., 8, e-mail: amaldenova.00@mail.ru

Tengaeva Aizhan Abdenovna - Candidate of physical and mathematical sciences, professor, Kazakh National Agrarian Research University, Republic of Kazakhstan, Almaty, Abay St., 8, e-mail: aijan0973@mail.ru

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B. Khudayarov[1], L.Sharipov[1]*, G. Akhmetkanova[2,3]

[1]National Research University "Tashkent Institute of Irrigation and Agricultural Mechanization Engineers", Tashkent, Uzbekistan
[2]Vytautas Magnus University, Kaunas, Lithuania
[3]Kazakh National Agrarian Research University
**l-sharipov@list.ru*

THE SIGNIFICANCE OF PRESS DEVICE DESIGNS FOR JUICING SUGAR SORGHUM STALKS

Abstract

This article presents the results of the experimental analysis of design parameters and operating principles of installations for extracting juice from sugar sorghum stalk by various installations and methods of maximum extraction of stalk juice and also gives the results of the optimum device for extracting juice with regard to the analysis of efficacy and lack of the best result of the process.

Keywords: Sugar sorghum, stem, screw device, roller device, principle of operation, design parameters, juice yield.

Introduction

Sugar sorghum is a crop that can provide the population with sugar-containing products, as well as be used in feeding animals and obtaining renewable energy sources - biofuels (ethanol).The greatest urgency this task has acquired for the conditions of sugar sorghum production in farms. The number of these farms has recently increased intensively, and more than half of the production of both livestock and crop products is concentrated here. The role of sugar sorghum in such farms is quite large, its products are used in feeding animals (green mass, silage, grain), in the food and feed industry, as well as in the production of food directly for the members of these farms. High prospects of its use and in obtaining biofuels [1]. In the above-mentioned each sphere different types of devices and methods are used, the parameters and modes of which should provide an increase of efficiency of fractionation of stem mass of sugar sorghum.

One ton can produce 550 liters of juice from the stem, which contains 18-24% sugar. Breeders have created varieties that give up to 91-100 tons of green mass, which means that they can produce 50-53 t / ha of juice and 10-15 t / ha of sugar per hectare. It was noted that Uzbek breeders have a role to play.

The corn crop also has ecological properties. If broad-leaved forests per hectare absorb 16-18 tons of CO_2 from the atmosphere, oats in the same area absorb 55 tons of CO_2 [2].

Methods and materials

In our study 3 varieties of sugar sorghum "Uzbekistan 18", "Orange-160" and "Carabosh" were studied. Sugar sorghum can be divided into three parts depending on the structure of the crop at the time of treatment: stem part, panicle part and leaf part (Fig. 1).

I-Stem part II. Broom corn III. Leaf part

Figure 1. Parts cut for processing sugar sorghum.

To date, a lot of scientific work has been done on extracting juice from the sugar sorghum stalk. Different methods have been applied: such as cutting the stalk into certain sizes and feeding the cut stalks into a screw squeezer (Fig. 2), squeezing juice from different parts of sugar sorghum stalks by rollers (Fig. 3).

Figure 2.Obtaining juice by cutting to certain sizes and passing through a screw device

The technology of juicing in farms is still not widespread, which is explained by the lack of equipment for this purpose. One of the ways to solve this scientific and practical problem is to justify the process of juicing with the help of roller working bodies.

Results and discussion

Experiments were carried out in different ways in order to separate the juice from the stems of sugar sorghum.In the course of studies with the help of auger device cut sugar sorghum stems were studied by cutting them into different sizes from 20 to 100 mm, with unchanged auger size 773 cm.

Indicators of juice separation depend on the size of the cut stalk (table 1).

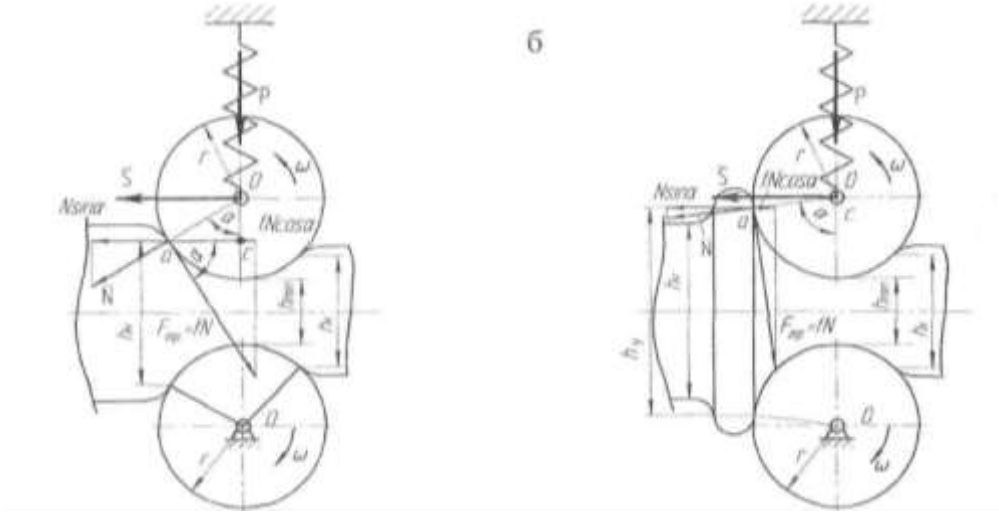

Figure 3. Calculation diagrams of feeding rollers when dragging smooth materials (a) stem with nodular surface

Table 1 – Results of juice extraction from sugar sorghum stems cut into different sizes

Dimensions of cut pieces(l), mm	**Share of sliced pieces,%**	**Juice yield,%**
$l \leq 20$	65	25
$40 \geq l \geq 20$	70	50
$60 \geq l \geq 40$	70	50
$80 \geq l \geq 60$	80	42
$100 \geq l \geq 80$	80	40

When conducting experiments with roller devices to separate the juice from the stems of sugar sorghum it was found out:

The greatest influence on the amount of juice obtained from the stems of sugar sorghum and energy intensity of the process is the gap between the pressing rollers, the speed of movement of the pressed material, the multiplicity of pressing.

Conclusion

Therefore, it was determined that depending on the cutting of the stem of sugar sorghum can be obtained up to 50% of the liquid mass using a screw device, but in order to reduce the loss of juice, as well as saving energy, the use of a roller device will be more appropriate.

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INFORMATION ABOUT THE AUTHORS:

Berdirasul Khudayarov - Doctor of Technical Sciences, professor, National Research University “Tashkent Institute of Irrigation and Agricultural Mechanization Engineers”, Uzbekistan, Tashkent, st. Kori Niyazov, house 39, b.xudayarov1@tiiame.uz,

Laziz Sharipov - Master's student, National Research University “Tashkent Institute of Irrigation and Agricultural Mechanization Engineers”, Uzbekistan, Tashkent, st. Kori Niyazov, house 39, l-sharipov@list.ru

Gulnar Akhmetkanova - Master of agricultural sciences, Bolashak International Scholarship Research Intern, Vytautas Magnus University, Lithuania, Kaunas, LT-52261 Studentų str. 11, Akademija, 1990.gaa@mail.ru

School
LAND AND FOREST MANAGEMENT

UDC 551*578.46

M.V. Tikhonova, A.V. Buzylev, E.M. Ilyushkova*

Russian State Agrarian University - Moscow Timiryazev Agricultural Academy,
Moscow, Russia
**e.ilyushkova@rgau-msha.ru*

COMPARATIVE ANALYSIS OF SNOW COVER DYNAMICS IN VARIOUS ECOSYSTEMS

Abstract

The article deals with the formation of snow cover in various ecosystems of one urban district. Snow cover in any ecosystem is an important climatic factor that protects the root system of plants from freezing in winter, and during the snowmelt period provides plants with additional moisture. The conducted studies have demonstrated the properties of various ecosystems for the retention of snow and the formation of snow cover in one study area. They also proved the importance of the forest stand and its functions in the formation of snow cover.

Keywords: forest ecosystem, snow cover, precipitation, anthropogenic ecosystem, urban forest, purple osier (Salix purpurea).

Introduction

The process of urbanization on our planet is still active. The anthropogenic load on the environment is large. If the rates of such spread are met, then they may lead to a worldwide ecological catastrophe. most susceptible to climate change, the spread of forests, the crisis of natural resources, environmental pollution by toxic communities. Snow cover in any ecosystem is an important climatic disease that protects the root system of plants from freezing in winter, and during the snowmelt period, plants bear fruit with increased moisture.

Methods and materials

A study of the assessment of the snow cover of the population in 2022 in the northern district of the city of Moscow. The first polling station, urban forest - Forest Experimental Station (LOD) RGAU-MSHA named after K.A. Timiryazev. The second section is the Ecological Station of the RGAU-MSHA named after K.A. Timiryazev with plantings of purple osier *(Salix purpurea)* (Figure 1).

On the territory of the Forest Experimental Station the research was carried out along a transect of 900 meters, in five key areas with different mesorelief and excellent vegetation and tree cover. The key sites were located on different variants of the mesorelief: № 1 and № 2 were laid out on a straight, slightly sloping short slope of a

moraine hill with a northeastern exposure: in the middle - 2 (SSV), and in the lower part of slope 1 (PSV), site № 3 is located on a flattened on the top of the moraine hill - VMX and is an automorphic system with deep groundwater, № 4 and № 5 are located on the opposite gentle slope of an increased length of the southwestern exposure: in the middle and lower parts of the slope of a slightly concave shape.

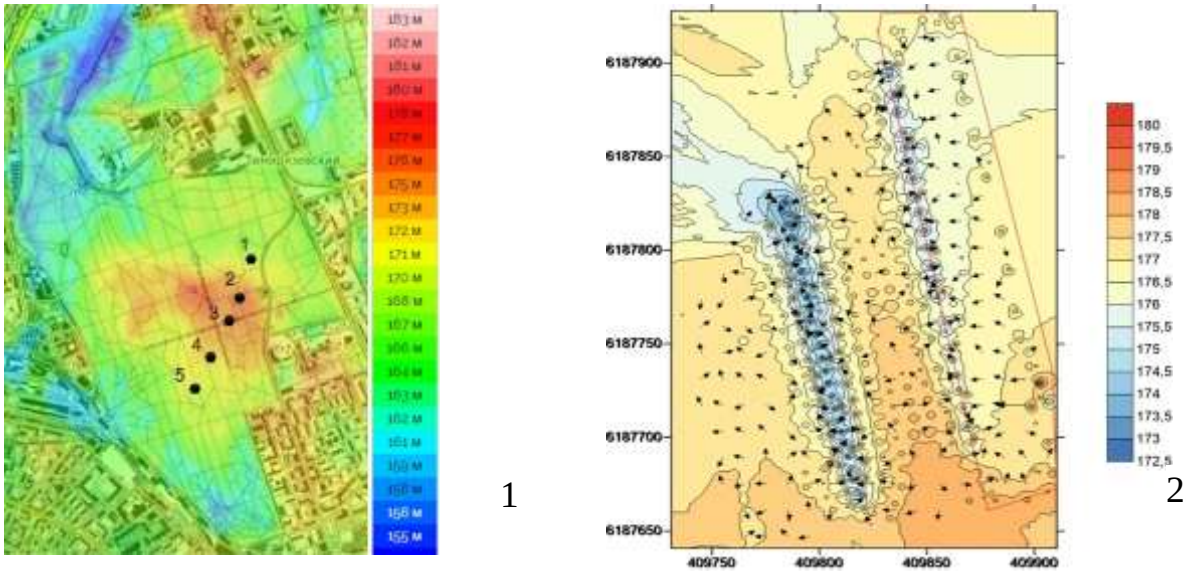

Figure 1. Location of constitutional sites
(1-LOD, 2-Ecological Station)

The plots have differences in the percentage of projective ground cover, crown density and species composition of the forest stand, which is the main factor in the formation of snow cover on the plots. The first three key areas in the main species composition are represented by deciduous trees, such as: pedunculate oak (*Quércus róbur*), Norway maple (*Acer plantanoides*), heart-leaved linden (*Tilia cordata*), drooping birch (*Betula pendula*), coniferous stand in the form of Scotch pine (*Pinus sylvestris*) is presented singly and is not widely distributed. And in key sites 4 and 5, the species composition of trees is represented by coniferous species, such as Scotch pine (*Pinus sylvestris*) and Norway spruce (*Picea abies*). Norway maple (*Acer plantanoides*) occurs, but in much smaller numbers [2]. It is the rock composition and crown density that are the main factor in the formation of snow cover.

The second area of research is the Ecological Station of the RGAU-MSHA named after K.A. Timiryazev. In July 2018, 346 seedlings of purple willow *(Salix purpurea)* were planted, by 2021 out of 346 seedlings 282 remained. The territory of the Ecological Station has small depressions in the microrelief, which leads to uneven formation of snow cover. Due to the open area and low planting height, snow is blown (the average height of Willow is about 70 cm). 10 key sites were selected to determine the height of the snow cover in order to assess the uneven distribution of snow, taking into account microdepressions and anthropogenic load on the site [1].

Results and discussion

Based on the results of the analysis of the snow cover height for 2022, it can be concluded that the accumulation of snow in the forest ecosystem on the territory of the Forest Experimental Station exceeds the snow height on the territory of the Ecological Station by almost 2 times (Figure 2).

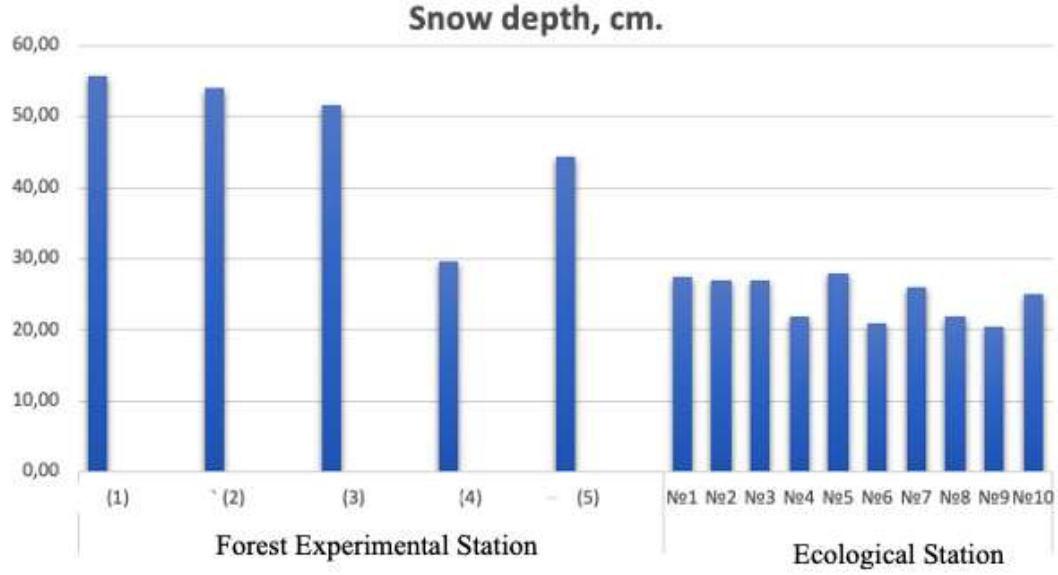

Figure 2. Snow depth in the study areas in 2022

On the territory of the LOD, the height of snow cover in key areas with deciduous tree species ranges from 55 cm to 51 cm, and in areas with coniferous trees - 29 cm and 44 cm, which indicates a difference in crown density and its significance in the formation of snow cover, which will further affect the moisture reserve of territories and plant nutrition.

The territory of the Ecological Station is open, because Willows do not have dense crowns, the formation of snow cover occurs with the maximum blowing of snow from the site. The maximum snow height was 28 cm at the point where there is a decrease, which contributed to a greater accumulation of snow. The average snow depth was 24.6 cm across the entire area.

Conclusion

Based on the results of the analysis of the snow cover height for 2022, it can be concluded that the accumulation of snow in the forest ecosystem on the territory of the Forest Experimental Station exceeds the snow height on the territory of the Ecological Station by almost 2 times.

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INFORMATION ABOUT THE AUTHORS:

Tikhonova Maria Vasilievna - Ph.D., Associate Professor of the Department of Ecology, RGAU-MSHA named after K.A. Timiryazev, Russia, Moscow, Timiryazevskaya st, 49 tmv@rgau-msha.ru

Buzylev Aleksey Vyacheslavovich - Senior Lecturer, Department of Ecology, RGAU-MSHA named after K.A. Timiryazev, Russia, Moscow, Timiryazevskaya st, 49, axe@rgau-msha.ru

Ilyushkova Elena Mikhailovna - master student of the Department of Ecology, RGAU-MSHA named after K.A. Timiryazev, Russia, Moscow, Timiryazevskaya st, 49, e.ilyushkova@rgau-msha.ru

School
PLANT PRODUCTION MANAGEMENT

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Ahmadzai Samiullah, K. Yerzhanova*, K. Jolamanov

Kazakh National Agrarian Research University, Almaty, Kazakhstan
**KEM_707@mail.ru*

IMPROVEMENT OF ELEMENTS OF WHEAT CULTIVATION TECHNOLOGY IN THE CONDITIONS OF JALALABAD DISTRICT OF AFGHANISTAN

Abstract

The paper presents data on improvement of elements of wheat cultivation technology in conditions of Jalalabad district of Afghanistan. To increase the yield and improve the quality of grain the main problem today is to improve the elements of cultivation technology, optimize the irrigation regime and the system of applying the new herbicides against weeds, yield, stability, adaptation of the crop to adverse environmental conditions. Issues of increasing crop yields have an important scientific and practical importance, so to solve them scientists from different countries are making significant efforts to conduct research in different areas (sowing dates, seeding rate, soil treatment, irrigation regime, application of various fertilizers). In the conditions of Jalalabad district of Afghanistan, studies on sowing dates and seeding rates and yield determination were conducted on spring wheat crops. According to the results of researches by sowing dates and norm of spring wheat seeding the most effective was variant of sowing in the 1st decade of April with 120 kg/ha seeding rate, the crop capacity was 18,1 c/ha and the highest economic efficiency was established in this variant - 98,7%.

Keywords: spring wheat, sowing dates, seeding rate, yield, economic efficiency.

Introduction

Agriculture is one of the main sectors of the country's economy, which has its own characteristics. The main task before the management and specialists of the sector is to make agriculture a profitable industry, which will produce competitive products, export them and steadily replenish the country's budget. The competitiveness of the agro-industrial complex and its products is determined by the level of achievements in the development of agrarian science and scientific and technological progress. As stated in the main directions of social and economic development, increasing sowing production, producing qualitatively new varieties, wide application of advanced technologies in farming, implementation of science-based system in agriculture are the actual directions of increasing grain production [1-3]. At present, along with the use of the achievements of advanced farms, it is necessary to study the intensive technology of wheat cultivation in peasant farms, production cooperatives. The growth of grain crops production is

associated not only with the increase of sown areas, but also depends on the degree of wheat yield [4-6].

Food security is the main mechanism of economic and political stability. Of course, if advanced innovative technologies are fully used on every hectare of land in the agro-industrial complex, good yields of cereal crops, including wheat, can be obtained. The high importance of cereal crops in the national economy is determined by the high value of their products and the possibility of comprehensive use [7, 8].

Grain is the main source of food for mankind, fodder for farm animals, raw materials for industry. The importance of grain crops in animal husbandry is also not inferior.

Scientific novelty of the research is the influence of sowing dates and seeding rate on the yield of spring wheat in the conditions of Jalalabad district of Afghanistan. In each soil and climatic zone, sowing of grain crops should be carried out in the best for them agrotechnical terms, ensuring the formation of the highest yields. To establish the correct timing of sowing of crops it is very important to know the minimum and optimum soil temperatures, as well as the available moisture reserves necessary for germination and emergence of seedlings. The yield value, the quality of the seed produced and the rational use of the seed all depend on the correct selection of the sowing rate. The seeding rate is determined for each crop and even for the variety, taking into account the biological characteristics, soil and climatic conditions, tillage, sowing methods and other conditions.

Among the important innovations of this work we should also mention interrelation of valuable features and properties of spring wheat in a farm, agro-biological regularities of production quantity changes and scientific substantiation of opportunities to increase the crop yield. The terms of sowing and seeding rates in relation to a particular region are considered, as well as the effect on the yield of spring wheat, and the economic efficiency is calculated [9].

Materials and methods

Afghanistan is an agricultural country where many fruits, vegetables and nuts are grown. The backbone of Afghanistan's economy has traditionally been agriculture. Most of the cultivated land belongs to small peasant farms. Tillage crops are selected and cultivated according to the topography, climate and terrain elevation. Cereals are grown in areas with an altitude of up to 2,700 m above sea level. As the altitude increases, the focus shifts from rice to maize, then to wheat and even higher to barley [10].

The main and strategically important branch of crop production is grain production. Therefore, the accelerated development of grain production industry is one of the priority tasks of the state agricultural policy of Afghanistan to ensure food security of the country, which predetermines the introduction of valuable and cost-effective crops into production.

Research work on influence of sowing dates and seeding rate on spring wheat yields in 2020-2021 was conducted in the farm "Yusuf" located in Jalalabad province.

The object of the study was soil - sierozem soils, variety Irodia bahori (old type of soft spring wheat, drought tolerant).

In order to conduct research on the effect of sowing dates and seeding rate on spring wheat yields the following variants of experiments were adopted:

Table 1 - Experimental options

Timing of sowing	Seeding rates, kg/ha
3rd decade of March (control)	80
	120
	160
1st decade of April	80
	120
	160
2nd decade of April	80
	120
	160

Results and discussion

Crop growth and development depend on the natural and climatic conditions of the growing environment (heat, moisture, soil characteristics) and biological features of the crop and is an important factor in plant life.

Seed germination is a complex physiological process that begins with the development of the rootstock sprout using nutrients in the endosperm. As a result of further root development, it becomes capable of aphthotrophic nutrition. For viable seeds to germinate, moisture, heat and oxygen are essential.

Only those seeds that have undergone biological rest are viable and can germinate normally under favourable conditions.

One of the indicators that characterize the ability of the studied spring wheat seeds to adapt to a particular region, grow and develop is the duration of their germination period. It is known that the growing season of plants goes through several phenological stages. Their course depends directly on the formation of the morphological structure of the plant, such as the formation of new organisms, leaves, stems and generative organs.

The passage of the stages of germination of spring wheat varied depending on the biological characteristics of the variety, the characteristics of the climate of the region. The duration of vegetation period of spring wheat varieties allows the formation of crop groups, consisting of forms or species that can fully use the soil and climatic conditions of the region, for each of its growing season, as the vegetation period and its duration allow to recommend farms, taking into account that the known varieties can be cultivated in the same soil and climatic conditions.

According to the results of researches in conditions of Jalalabad province duration of vegetation period of cereal crops, including spring wheat, when observing correct agronomic requirements reaches 92-107 days (Table 2). Similar results were obtained in experiments carried out in 2021.

There were slight differences in the vegetation period (number of calendar days) in the experimental plots with different timing and seeding rates.

All this indicates that conditions of warm summer period in Jalalabad province are suitable for sowing grain crops for food and fodder purposes. All is confirmed by the results of the obtained grain yield of this crop.

Table 2 - Development phases of spring wheat depending on sowing dates and seeding rate, days

Options for experience		Sowing and sprouting	Sprouting-cutting	Spike-milk maturity	Full ripeness
Timing of sowing	Seeding rates, kg/ha				
3rd decade of March (control)	80	13	58	55	98
	120	13	59	57	92
	160	13	61	58	95
1st decade of April	80	9	52	47	98
	120	9	54	48	101
	160	9	58	50	107
2nd decade of April	80	10	48	45	92
	120	10	49	47	95
	160	10	51	48	98

Significant differences were observed in the phenological stages of spring wheat. In the wheat crop the germination stage of seeds depending on the time of sowing and seeding rate varied from 9 to 13 days, i.e. with a difference of 4 days.

Yield levels of wheat varieties vary according to their biological phenotypic characteristics and the influence of agro-ecological factors. Biological characteristics include height, tillering, number of grains in the ear, 1000 seed weight, and the effect of sowing time and seeding rate on these indicators is significant.

According to the research programme, full plant maturity and grain yield per plant were determined. In addition, the number and weight of grains in the ear were weighed. Grain production of cereal crops is formed of a number of sections called the elements of yield structure: number of plants before harvesting (frequency of plant growth) per square metre; number of plants, number of grains, weight of 1000 seeds at standard moisture content, etc.

In recent years, during the period of declining agriculture and preservation of land productivity, the use of improved methods of cultivation of crops on crops has been considered.

Results of the research prove that sowing terms and seeding rates of spring wheat crops contribute to significant increase of crop yields.

As already noted, the yield of spring wheat is influenced by the optimum sowing dates and seeding rates. Analysis of obtained yield data shows that sowing dates and seeding rates in spring wheat crops have an impact in increasing grain yield in Jalalabad province conditions.

According to results of the research in the farm "Yusuf" the spring wheat yield obtained in the control variant was within 9.3-13.5 c/ha, in the third variant, where seeding was done in the second decade of April, it varied 12.3-17.5 c/ha, and the highest yield was obtained in the second variant with seeding rate of 120 kg/ha - 18.1 c/ha (Table 3).

In the course of the experiment it was established that the most effective variant in the conditions of the farm "Yusuf", is the 2nd variant, where sowing was carried out in the 1st decade of April with seeding rate of 120 kg/ha.

Table 3 - Yield of spring wheat depending on sowing dates and seeding rate, kg/ha

Options for experience		Yield, c/ha
Timing of sowing	Seeding rates, kg/ha	
3rd decade of March (control)	80	9,3
	120	13,5
	160	12,8
1st decade of April	80	12,1
	120	18,1
	160	17,7
2nd decade of April	80	12,3
	120	17,5
	160	16,8

Conclusion

Analyzing the results of the conducted scientific research, appropriate conclusions were made aimed at increasing the yield of spring wheat in the conditions of Jalalabad province in the farm "Yusuf".

The estimation of economic efficiency of spring wheat cultivation depending on terms of sowing and seeding rate shows that at sowing terms of April 1-10 and seeding rate of 120 kg/ha the highest yield of 18.1 c/ha was obtained, conditional net income was 12 590 tenge per hectare, the level of profitability was 98.7%, compared to other variants.

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INFORMATION ABOUT THE AUTHORS:

Ahmadzai Samiullah - 2nd year Master's student of Agronomy, Kazakh National Agrarian Research University, 8 Abay Ave, Almaty, Republic of Kazakhstan

Yerzhanova K.M. - Scientific Secretary of Research Institute of Agroinnovation and Ecology, Professor of Agronomy Department of Kazakh National Agrarian Research University, 8 Abay Ave., Almaty, Republic of Kazakhstan, E-mail: KEM_707@mail.ru

Zholamanov K.K. - professor, head of department of Land resources and cadastre of Kazakh National Agrarian Research University, 8 Abay Ave., Almaty, Republic of Kazakhstan, E-mail: kzh06@mail.ru

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G.O. Syrlybayev, N.A. Barlykova, K.Zh. Kulanbay*

Kazakh National Agrarian Research University, Almaty., Kazakhstan
**kalamkas.kulanbay@kaznaru.edu.kz*

FODDER PRODUCTION IN THE PEASANT FARM OF IP «AIDARBAYEV»

Abstract

Studies have been conducted on the conditions of maintenance, the number of dairy cattle on the farm, and the availability of feed. The research program included familiarization with the structure of sown areas for fodder crops grown on arable land, their productivity, assessment of their feed qualities, the availability of available livestock in feed for all types of feed, the balance of the feeding diet. The research program included taking soil samples for their granulometric and chemical composition, taking samples of ready-made feed to study their feed qualities. In the course of the research, recommendations on agrotechnics for the cultivation of forage crops are given. A method for calculating the need for feed for the existing livestock of animals and recommendations for their optimal number in relation to the capabilities of the feed base of the farm is proposed.

Keywords: soil, fertility, feed, yield, availability of feed, dairy farm, calculation of feed needs.

The purpose of the study was to get acquainted with the feed base of the peasant IP "Aidarbayev", the availability of dairy farm feed for the existing livestock of dairy cattle, recommendations for improving the feed base from field feed production, familiarization with the methodology of express calculation in the needs and provision of feed for all types of feed, recommendations on the balance of the feeding diet by type of feed.

In Kazakhstan, there is now an acute issue of the availability of feed in farms of their own production, corresponding to zoohygienic standards [1, 2, 3, 4].

The basis for carrying out research. The research was carried out according to the budget program for 2018 – 2020. Code: BR06349618 "Transfer and adaptation of technologies for automation of technological processes of livestock production based on model farms in dairy cattle breeding from 100 cows and above in different regions of the Republic of Kazakhstan".

Research results. According to the research program, the structure of sown areas for fodder crops was studied, soil samples were taken for granulometric and chemical analysis, samples of ready-made feed for feed qualities. The average productivity of fodder crops for 2018-2020, the dynamics of the number of cattle and the availability of their feed were determined. The need for feed is calculated and a method for calculating the need and availability of feed is proposed.

The farm “Aidarbayev” is located in the north-western part of the Enbekshikazakh district of Alma-Ata region in the village of Saimasai (kaz. Saimasai, former.

Alexandrovka). The administrative center of the Saimasai rural district is 37 km south-east of Alma-Ata with geographical coordinates 43°26,- 43°40, 30, north latitude and 77°26.07" east longitude from Greenwich with absolute elevations of 600-700 meters above sea level.

Soil and climatic conditions of the area. The climate determines the halo of the spread of agricultural crops, the possibility of their promotion and development in a multi-year context, the basic techniques of agricultural technology. The weather of the current year affects the conditions of growth, development and yield of crops. The most important factors of plant life, as is known, include light, heat, moisture, air, nutrients, while none of the factors can be replaced by another.

The climate of the area is sharply continental. Winter is mild, summer is hot. Average temperatures in January are -6 to -10 ° C; July 20-24 °C. The amount of precipitation on the plain is 200-400 mm on average per year, on the mountain slopes 550-700 mm.

Table 1 - Climate graph of the district on average for 2018-2020.

	January	**February**	**March**	**April**	**May**	**June**	**July**	**August**	**September**	**October**	**November**	**December**
Average temperature (°C)	**-6,8**	-5.4	1.3	9.9	15.4	20.2	22.7	21.7	16.3	8.5	0.7	-4.2
minimum temperature (°C)	**-11,8**	-10.4	-3.6	4.2	9.8	14.3	16.7	15.3	9.8	2.8	-4	-8.7
maximum temperature (°C)	**-1,8**	-0.4	6.3	15.6	21.1	26.2	28.8	28.1	22.8	14.3	5.5	0.3
Precipitation rate (mm)	**29**	**29**	57	92	97	59	35	28	27	48	43	30

The summer of 2019 in the Almaty region was abnormally hot. In July and in the greater part of August, the daytime temperature was above 40 degrees Celsius.

Relief and soil characteristics. The territory of the farm is located in the foothill zone of the Trans-Ili Alatau. The terrain is flat with a noticeable slope to the north. According to the relief and soil and vegetation cover, the territory of the farm is divided into three parts.

1. The lowered saz plain.
2. Undulating plain.
3. Gently sloping plain.

Meadow-chestnut, light chestnut and meadow gray soils predominate on the floors of the farm. There are also small areas of dark-meadow and meadow-saline soils, as well as dark chestnut soils [5].

The humus horizon reaches 30-40 cm . The humus content in the upper soil horizons is 2.5-3.6% or more. According to the mechanical composition of the soil, they belong to medium and heavy loamy, coarse-dusty. Heavy mechanical composition, unfavorable physical properties of the soil, stickiness in the wet state, compaction and hardening during drying leads to high resistance during plowing, the formation of a lumpy field surface, strongly requires the application of organic fertilizers. According to the analysis of the granulometric composition, the amount of the sum of the last fractions (less than 0.01 mm) makes it possible to attribute the upper horizon up to 40 cm (arable) to medium and heavy loamy (Table 5). The soils at the experimental site contain few mobile forms of phosphorus 8-16 mg / kg of soil, the content of easily hydrolyzable nitrogen is 50-106 mg / kg, nitrate nitrogen 10-28 mg / kg (according to Mechinin).

The content of exchangeable potassium is quite high 500-1100 mg/kg. Thus, the soils on the farm need phosphorus and nitrogen fertilizers.

Chemical analysis of soils on arable lands in the Aidarbayev farm showed a predominantly slightly alkaline environment, with the exception of a salt marsh hearth (Table 3). Slightly alkaline soil environment is typical for this area. The soils are well studied here, since the Kazakh National Agrarian University's agricultural farm is located on this territory and scientific research has been conducted here for decades.

The highest content of free nitrogen on loamy soils without salt marshes is 0.486%. The humus content on the arable lands of the Aidarbayev farm is slightly higher than that of the neighboring Adal farm. Its content here is about 2.13 to 3.12%. The content of sulfates is from 00.3 to 0.05%. In terms of the content of calcium and magnesium in the cultivated areas, farms are similar to the neighboring farms of “Adal”, respectively from 0.014 to 0.112 calcium and from 0.013 to 0.016 magnesium. A detailed chemical analysis of the soils of arable lands of the Aidarbayev farm is given in Table 3.

The structure of acreage in the peasant farm “Aidarbayev” on average for 2018-2020. The availability and availability of seeds of fodder crops in the Aidarbayev farm, as well as the specialization of the farm – dairy cattle breeding, determined the structure of the acreage on the arable land of the farm with the appropriate set of fodder crops.

The arable land area of the farm is 1,644 hectares. Alfalfa for hay on an area of 352 hectares, corn for silage 190 hectares, winter triticale 225 hectares, sweet clover 264 hectares, spring barley 512 hectares, corn for grain 51 hectares and soybeans 50 hectares are grown on arable land for the needs of feed production. Spring barley is actively used for fodder purposes, as a grain crop and in feed mixtures. Barley straw is also used for the needs of animals. Based on the composition of animals, various feed mixtures are actively used, such as silage with mixed feed and beer pellets, haylage from alfalfa and sweet clover and other feed mixtures. Farms also plan to additionally sow another variety of winter triticale on an area of 50 hectares, which is going to be purchased from the farm ”Adal". Thus, the structure of crops consists of the specialization of the farm, the availability of livestock and seed material.

Table 2 Provides a detailed analysis of the granulometric composition of the soil in the Aidarbayev farm along the horizons of the arable layer.

Sampling depth, cm.	% Hygroscopic moisture	Fraction content, mm.								Sum of particles 0,01	The amount of absorption, the heater reading 0.01
		3	3 - 1	Sand		Dust			Ил 0,001		
				1-0,25	0,25-0,05	0,05- 0,01	0,01-0,005	0,005-0,001			
0-10	2,2	0,67	1,06	3,08	10,34	32,93	12,76	14,92	22,17	52,64	1,0
10-20	2,4	0,37	1,01	2,88	5,07	34,06	10,64	14,14	24,00	46,95	1,3
20-30	3,0	0,35	0,72	2,12	9,61	35,65	15,52	17,37	24,96	56,93	1,2
30-40	2,8	0,35	0,37	1,33	3,01	40,95	13,10	19,83	26,04	59,29	1,1
40-50	2,6	0,33	0,35	1,33	3,05	41,08	14,68	17,68	17,88	58,88	1,1

Table 3. Chemical composition of the soil in the Aidarbayev farm

Name soils	Indicators per 100 g of soil, %								
	pH (hydrogen index)	Total nitrogen	Humus	Alkalinity (CO_3-)	Alkalinity general (HCO_3-)	Chlorides (Cl-)	Sulfates (SO_4^{2-})	Calcium (Ca_2^+)	Magnesium (Ma_2^+)
Loamy (normal without salt marshes)	8,05	0,486	3,12	-	0,037	0,052	0,005	0,028	0,016
Salt marsh hearth	7,92	0,361	2,13	-	0,029	0,178	0,005	0,112	0,014
Light brown	8,33	0,355	2,41	-	0,068	0,052	0,003	0,014	0,013

The types of soils on the farm are Chestnut. Soil samples were taken for chemical analysis from fields where agricultural crops are cultivated. The analysis of soil samples was carried out in the laboratory of Kazniizhik LLP

Table 4. Structure of acreage in the Aidarbayev peasant farm for 2018-2020.

Name of agricultural crops	**Area, ha**
Alfalfa for hay	352
Soy	50
Corn for grain	51
Corn for silage	190
Triticale winter	225
Donnik	264
Spring barley	512
Total:	**1 644**

In total, the farm has 2080.5 hectares of crops. The table does not include a garden of 236.2 hectares and other 85.09 hectares.

Table 5. The number of animals in the farm “Aidarbayev" for 2018-2020.

Group of animals	Number of heads	Weight, kg
Cows	481	259 617
There are no	31	14 670
Chicks of 2017	25	9 950
Chicks of 2018.	130	42 200
Chicks of 2019.	65	4 330
The bull of 2019	48	3 350
Bulls for fattening	56	18 510
Total:	**836**	**352 627**

Results of chemical analysis of feed

During the research of the fodder base of the Aidarbayev farm, feed samples were taken for chemical analysis. Samples of forage plants were taken for analysis, which had already been removed from the fields by this time.

The feed analysis was carried out in the testing center of the Kazakh Scientific Research Institute of Animal Husbandry and Feed Production LLP.

According to the results of the analysis of feed in the Aidarbayev farm, the following data were obtained: the dry matter content, depending on the type of feed, ranged from 26.05% to 87.60%, protein from 2.87% to 30.20%, fat from 1.06 to 3.92%, fiber from 2.54 to 27.24%, feed units per kilogram of feed from 0.21 to 1.15 units. Detailed data on the analysis of feed taken on the farm are given in Table 6.

The gross collection of feed in the farm “Aidarbayev" on average for 2018-2020.

As can be seen from Table 7, the Aidarbayev farm uses a fairly extensive list of agricultural crops for fodder purposes, which allow it to supply animals with all types of feed.

Table 6. Results of chemical analysis of feed from Aidarbayev farm in Enbekshikazakh district of Almaty region, in terms of natural humidity

NAME OF THE SAMPLE	IM	HM	TM	DM	In its natural form, %										Feed units. kg	DP, g	EE MJ	EFU
					Protein	Fat	Fiber	N-FES	Sugar	Starch	Ash	Ca	P	Carotene, mg				
Alfalfa hay	16,70	4,36	20,33	79,67	9,91	3,25	23,66	34,10	3,75	-	8,75	1,03	0,33	18,24	0,49	64,43	7,47	0,75
Corn silage	69,80	7,14	71,96	28,04	2,87	1,06	6,25	15,72	1,57	4,86	2,14	0,27	0,02	6,28	0,21	17,79	2,98	0,30
Rapeseed	31,72	4,1	34,51	65,49	19,12	3,41	9,70	33,26	-	16,46	0,96	0,21	-	16,59	0,59	152,95	8,26	0,83
Compound feed (barley)	9,40	3,31	12,40	87,60	10,96	1,72	4,62	68,03	-	45,30	2,27	0,25	0,42	-	1,15	77,83	11,10	1,11
Haylage (alfalfa+sweet clover)	52,70	6,59	55,82	44,18	5,58	1,70	10,07	22,19	-	-	4,64	0,61	0,09	14,33	0,31	37,40	3,71	0,37
Barda is dry	10,90	3,68	14,18	85,82	30,20	3,92	6,24	39,31	-	14,08	6,15	0,16	0,05	-	0,81	157,07	7,19	0,72
Barley straw	12,40	3,82	15,75	84,25	6,39	2,72	27,24	44,83	7,80	2,80	3,07	0,29	0,07	32,59	0,38	16,63	6,14	0,61
Barley beer pellet	71,82	7,56	73,95	26,05	6,54	2,62	2,54	12,44	-	8,79	1,92	0,03	0,10	-	0,29	47,73	2,82	0,28
Feed mixture (silage+compound feed+beer pellet)	38,60	5,87	42,20	57,80	11,05	2,21	6,32	33,85	-	32,36	4,36	0,10	0,18	-	0,71	78,47	6,71	0,67

Note: IM– initial moisture; HM – hygroscopic moisture; TM – total moisture; DM – dry matter; N-FES – nitrogen–free extractive substances; DP - digestible protein; EE – exchange energy; EFU – energy feed unit.

Table 7. Gross feed harvest in the Aidarbayev farm for 2018-2020.

Name of agricultural crops	**Area, ha.**	**Yield, hundredweight /ha**	**Gross collection, hundredweight**	**Output of feed units, hundredweight**
Alfalfa for hay	88	60,0	5 280	2 587
Haylage (alfalfa+sweet clover)	528	300,0	158 400	49 104
Corn for grain	51	68,0	3 468	4 647
Corn for silage	190	280,0	53 200	11 172
Spring barley	512	30,0	15 360	17 664
Winter triticale for green fodder	225	300,0	67 500	13 500
Barley straw	512	36,0	18 432	7 004
Total:				**105 678**

Provision of fodder in the farm "Aidarbayev". According to scientific recommendations on the diet of cattle feeding, the need for different types of feed based on the number of animals and the actual availability of feed in the farm were compared. Table 8 shows the estimated need for feed by type of feed for the available livestock and Table 9 shows the actual availability of feed.

Table 8. Estimated demand by types of cattle feed in the Aidarbayev farm in centners of feed units

Types of livestock	Number of heads	Feeding rate per 1 head per year, in centners of feed units	Total feed required,ц. in centners of feed units	Types of feed, in centners of feed units			
				Green 50%	Rude 25%	Juicy 15%	Concentrated, 10%
Cattle	780	49,2	38 376	19 188	9 594	5 756,4	3 837,6
Bulls for fattening	56	49,2	2 755,2	1 377,6	688,8	275,52	413,28

Table 9. The real provision of feed in the Aidarbayev farm in the central unit for 2018-2020

Types of livestock	Number of heads	Feeding rate per 1 head per year, in centners of feed units	There are total feeds available, in centners of feed units	Types of feed, in centners of feed units			
				Green 50%	Rude 25%	Juicy 15%	Concentrated, 10%
Cattle	780	49,2	102 678	12 000	50 941	10 872	6 000
Bulls for fattening	56	49,2	3 000	1 500	750	300	460

As can be seen from Table 9, the Aidarbayev farm, according to our approximate calculations, can fully provide its livestock with all types of excess feed, with the exception of green feed. If we solve the problem of green fodder at the expense of field fodder production, then it is possible to use part of the area allocated for mixed alfalfa and sweet clover crops for haylage, to use sweet clover crops for green fodder. This is one of the solutions to the problem of green fodder for the Aidarbayev farm due to field feed production. Perhaps the farm provides the full need for green fodder at the expense of natural forage lands, but our research included only field forage production.

In general, the feed base in the farm is sufficiently self-sufficient and there are all conditions to receive high-quality livestock products.

Conclusions

The farm "Aidarbayev" can provide the available livestock of animals in feed at the expense of feed grown on arable land, with the exception of green feed. But this problem can be solved by redistributing the structure of sown areas and increasing the area for crops grown for green fodder due to areas where other types of feed are provided in excess, as well as by increasing yields, using modern agrotechnologies of cultivation of fodder crops. Also, the need for green fodder can be compensated by natural forage lands.

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INFORMATION ABOUT THE AUTHORS:

Syrlybayev Golym Omarovich – Candidate of Agricultural Sciences, Associate Professor, Kazakh National Research Agrarian University, Kazakhstan, galim.syrlybayev@kaznaru.edu.kz , 87051800642;

Barlykova Nurlykhan Adilkhanovna – Master of Agricultural Sciences, Senior lecturer, Kazakh National Research Agrarian University, Kazakhstan, nurlykhan.barlykova@kaznaru.edu.kz;

Kulanbay Kalamkas Zhanabekkyzy – PhD, Associate Professor, Kazakh National Research Agrarian University, Kazakhstan, kalamkas.kulanbay@kaznaru.edu.kz

UDC 636.086.2

N.N. Lazarev, A. R. Tyazhkorob*

Russian State Agrarian University - Moscow Timiryazev Agricultural Academy
**ayrep-99@mail.ru*

THE YIELD CAPACITY OF CEREAL-LEGUME GRASS MIXTURES WITH TWO OR THREE TIMES MOWING

Abstract

The article is devoted to the research of botanical composition, plant density and yield capacity of single-species and mixed grasslands for the 25th year of use. The relevance of the topic in question was determined by the necessity of improvement domestic feed production for sustainable development of Russian animal husbandry. Nowadays it is of great importance to perform grassland management with the lowest costs. During the research following characteristics were determined: botanical diversity, plant density, yield of biomass. Moreover, the productive longevity of grasslands was estimated. According to the results of experimental data, the two times mowing management is recommended for old-age grasslands.

Keywords: mowing management, cereal and legume grasses, botanical composition, yield capacity, productive longevity, plant density.

Introduction

Nowadays, the issue of strengthening the feed base of animal husbandry is relevant for our country. At the same time, resource-saving technologies of feed production are of great interest, which make it possible to obtain high-quality feed with low cost. By resource-saving technologies we mean the cultivation of perennial herbage containing cereal and legume components. Each of them performs its function in the grass mixture: legumes accumulate nitrogen, making it available to cereals, and cereals produce a significant amount of green mass and, accordingly, dry matter. Thanks to this symbiotic interaction of the components, we get a sufficient amount of cheap, protein-rich feed. In addition, do not forget about the soil-protecting and soil-improving abilities of perennial grasses [4,5]. Resource conservation in meadow farming can be achieved through the widespread use of legumes in grass sowing and the extension of their productive longevity [1-3].

Methods and materials

In 2020, in a two-factor field experiment with two- and three-fold mowing (factor A), single-species and mixed crops of perennial grasses were studied: 1. White clover (Trifolium repens L.); 2. White clover (Trifolium repens L.) + cereals (Phleum pratense L. + Bromopsis inermis L.); 3. Alfalfa (Medicago varia Mart.) Selena varieties; 4. Red clover (Trifolium pratense L.) + cereals (Phleum pratense L. + Bromopsis inermis L.); 5. Red clover (Trifolium pratense L.); 6. Alfalfa (Medicago varia Mart.) Vega 87 varieties + cereals (Phleum pratense L. + Bromopsis inermis

L.); 7. Alfalfa (Medicago varia Mart.) Pastbishnaya 88 varieties; 8. Alfalfa (Medicago varia Mart.) Pastbishnaya 88 varieties + cereals (Phleum pratense L. + Bromopsis inermis L.); 9. Cereals + N_{90}; 10. Cereals without fertilizers (factor B).

The square of the experimental plot is 25 m^2, the repetition is fourfold, the placement of variants is by the method of organized repetitions. The experiment is located on medium-loamy sod-podzolic soil. The purpose of this study is to determine the yield of perennial herbage for the 25th year of life under different mowing regimes.

Results and discussion

The growing season of 2020 turned out to be favorable for the growth and development of perennial grasses. The temperature in general corresponded to the average annual values, and the amount of precipitation significantly exceeded the average annual norm. With two–mowing use, grasses were mown in the flowering phase of legumes and cereal components, and with three-mowing use, in the bud stage of legumes and the ear formation of cereals.

Analyzing the density of the herbage, we came to the conclusion that regardless of the mowing regimes, some leguminous grasses increase the number of shoots by 1 m^2 after the 1st mowing, and grass mixtures with a cereal component, in contrast, decrease with each subsequent mowing. The density of grass stands according to the variants of the experiment varied from 474 (10th var., 3rd mowing) to 941 (7th var., 2nd mowing) shoots per 1 m^2, also close to the maximum value was recorded in variant 4, 1st mowing, two-mowing use. The analysis of the data of the botanical composition showed a significant change in the composition of herbal mixtures for the 25th year of research compared with 1996, when the experiment was established. In variant 1, where there should be exclusively white clover (Trifolium repens L.), only 2.7 to 7.1% of it remained. In addition, it appeared in variant 10 in the amount of 9%, which may be explained by its vegetative reproduction. With three-mowing use, red clover practically disappears from the plant stand, the percentage of cocksfoot (Dactylis glomerata L.) and various grasses increases. The percentage of alfalfa with three-mowing use in variants 3 and 6 increases by almost 10%, which indicates a good yield of this crop. The analysis of the yield data shows that for the year the yield of dry matter in the two-mowing regime is significantly higher than in the three-mowing one by 60% (Table 1).

As for the types of grasses and grass mixtures, compared with the control (cereals without fertilizers, variant 10), all herb stands showed significantly higher yields, except for white clover (Trifolium repens L.) mixed with cereals.

The variant where the aftereffect of nitrogen fertilizers has been studied over the past three years (variant 9) also did not provide an increase in yield, that is, no aftereffect of nitrogen was detected.

Table 1 – Herbage yield capacity, t/ha of dry matter (two - /three – times mowing) (LSD_{05} particular differences – 0,31, LSD_{05} A – 0,22, LSD_{05} B – 0,10)

Variant	Mowing			Total	Average (B)
	1	2	3		
1 White clover (Trifolium repens L.)	2,06/1,98	3,89/0,6	1,02	5,95/3,6	4,78
2. White clover (Trifolium repens L.) + cereals (Phleum pratense L. + Bromopsis inermis L.)	1,99/1,95	3,28/0,47	0,77	5,27/3,19	4,23
3. Alfalfa (Medicago varia Mart.) Selena varieties	1,89/2,11	3,61/0,74	1,01	5,5/3,86	4,68
4. Red clover (Trifolium pratense L.) + cereals (Phleum pratense L. + Bromopsis inermis L.)	2,16/1,84	3,69/0,52	0,95	5,85/3,31	4,58
5. Red clover (Trifolium pratense L.)	2,13/1,95	3,37/0,52	0,95	5,5/3,42	4,46
6. Alfalfa (Medicago varia Mart.) Vega 87 varieties + cereals (Phleum pratense L. + Bromopsis inermis L.)	1,87/2,14	3,46/0,58	0,79	5,33/3,51	4,42
7. Alfalfa (Medicago varia Mart.) Pastbishnaya 88 varieties	1,97/1,66	3,26/0,56	0,95	5,23/3,67	4,45
8. Alfalfa (Medicago varia Mart.) Pastbishnaya 88 varieties + cereals (Phleum pratense L. + Bromopsis inermis L.)	2,39/1,66	3,25/0,56	0,81	5,64/3,03	4,34
9. Cereals + N_{90}	1,96/1,96	2,89/0,47	0,85	4,85/3,28	4,1
10. Cereals without fertilizers	1,95/1,79	3,28/0,5	0,79	5,23/3,08	4,16
Average (A)				5,44/3,4	

Conclusion

- Of the types of grasses sown in 1996, the following species have been preserved for the 25th year of use of herbage: Bromopsis inermis, Medicago varia, Trifolium repens and Trifolium pratense.
- The dominant species in the composition of all grass stands was the Dactylis glomerata. Its portion in the botanical composition varied from 30.8 to 56%.
- The highest yield of dry matter was provided by the cereal-legume herbage formed in the 25th year on the first variant of the experiment with single-species sowing of Trifolium repens – 4.78 t/ha.

- Nitrogen fertilizers did not have an aftereffect on the yield of herbage. In the variant with their introduction, the yield was 4.1 t /ha, and without the use of nitrogen 4.16 t/ha of dry matter.

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INFORMATION ABOUT THE AUTHORS:

Lazarev Nickolay – Doctor of Agricultural Sciences, Professor of the Department of Crop Production and Grassland Ecosystems, Russian State Agrarian University - Moscow Timiryazev Agricultural Academy, Russia, 123550, Moscow, Timiryazevskaya str., 49, e-mail: lazarevnick2012@gmail.com

Tyazhkorob Andrey – 1st year master degree student of Agronomy, agronomist of the Field Experimental Station of Russian State Agrarian University - Moscow Timiryazev Agricultural Academy, Russia, 123550, Moscow, Timiryazevskaya str., 49, e-mail: ayrep-99@mail.ru

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G.O. Syrlybayev[1]*, G.O. Bayadilova[1], R.S. Masonochich-Shotunova[2]

[1]Kazakh National Agrarian Research University, Almaty, Kazakhstan
[2]Kazakh Scientific Research Institute of Animal Husbandry and Feed Production
**galim.syrlybayev@kaznaru.edu.kz*

ECOLOGICAL ASPECTS OF ENVIRONMENTAL PROTECTION MEASURES AT NATURAL PASTURES IN KAZAKHSTAN

Abstract

The problems of conservation and improvement of pastures and hayfields in Kazakhstan occupy one of their main places in environmental problems. The article covers the main problems of rational use of natural forage lands, their conservation and restoration, reducing the impact of negative factors on them, including anthropogenic impact.

Keywords:: Ecological potential of pastures, anthropogenic impact, degraded pastures, downed pastures, agroecological system, pasture productivity

Preservation and improvement of pastures and hayfields in our country is one of the main ecological issues. Their deterioration or total degradation may result in a serious ecological problem – desertification of the territory.

Therefore, scientists have been assigned a task to develop a strategy of rational development and use of pasture resources to exclude erosion, degradation and other adverse impacts.

Ecological potential of pastures may be assessed by the efficiency of their major ecological functions: biological (plants, animals, microorganisms), natural and climatic, anthropogenic (produced/harvested fodder, livestock, animal products), scientific, social and economic, as well as tourism functions [1].

Ecological potential of a pasture territory is determined by its geographic location, human-induced impact, floristic and faunal composition and other factors. The ecological value of these natural forage lands for human lies in their natural and recreational capacities with sustainable use of forage, bee and medicinal plants. Furthermore distant mountain pastures can provide ecologically clean and healthy products. Remote location of pastures from developed industry, household and agricultural zones reduces the risk of accumulation of harmful pesticides and heavy metals in food products.

The process of primary biological product development in the pasture ecosystems runs in natural way, it is used for production of secondary biological products (breeding domestic animals which is reproduced under human control and provides source material for food and processing industry).

Human intervention with natural forage lands in order to ensure sustainable production process contributes to aggravation of the existing natural ecological problems and becomes a significant factor of environmental impact.

That's why any techniques aimed to improve and increase productivity of pastures and hayfields should be developed with due consideration of the system structural properties and functioning principles.

The pasture biocoenosis consists of plant and animal communities. Knowledge of the ecology of individual species of vegetation communities at hayfields and pastures and conditions required for their growth will help to design appropriate cultivation techniques and to use the natural forage lands properly and efficiently. For this purpose, the existing environmental factors influencing the pasture ecosystem should be carefully analyzed. Growth and development of grass stands at pastures and hayfields as well as their productivity depend on a number of natural and anthropogenic factors including two most important and closely connected factors - soil and climate.

One of the agriculture priorities in Kazakhstan is to increase the livestock production and export. To attain this goal the country needs solid fodder resources, which are not available in a sufficient quantity today. There are 182 mln ha of pastures and 5.1 mln ha of hayfields in Kazakhstan including 48 mln ha of degraded and 27 mln ha of overgrazed areas. Increase in the livestock is impossible without increase in fodder production.

The basic condition for preservation of pastures is to ensure adequate number of grazing animals on a specific area and to drive them to another area when necessary to restore vegetation using regrow capacity of plants, i.e. rotation grazing. The same goes for hayfields. If these rules are observed, there is no pasture trampling by animals, hayfields are not mowed clean, consequently the pastures and hayfields restore quickly. Animal manure is evenly distributed all over the pastures and contributes to improvement of soil fertility. For the purpose of comprehensive assessment of the natural and economical state of the natural grasslands through ecological monitoring it is necessary to identify ecological factors of the environment directly or indirectly influencing the state and productivity of the pasture ecosystems as main observation parameters, including factors of special importance such as climatic factors, soil fertility, soil moisture and sufficient content of nutrients, floristic and economical and botanical composition of vegetation, degree of human-induced impact.

Livestock grazing demonstrates a close correlation between the quality of forage and quality of animal products. Unlike hayfields, pastures are exposed to the impact of herds, an ecological factor affecting the soil, grass stand and other components of the natural complex [2].

Natural grasslands and pastures are heterogeneous. They differ in habitat conditions, species composition of grass stand and abundance of grasses, intake by different species and groups of animals, recovery ability, and crop yield produced from the unit of area of animal production, seasonal fluctuations, duration of use, etc.

To increase livestock production, natural forage lands are propelled as critical elements of the agricultural ecosystem. Grasslands should provide the cheapest feeds of the highest quality for livestock (pasture forage, hay and haylage). Given sufficient watering mineral fertilization of grasslands is cheaper than fertilizing any other crops, and enrichment with bean cultures can either replace nitrogen-based chemical fertilizers or reduce significantly their consumption in many cases. In grassland soils the mineralization process is less intensive than humification process, that is why there is no negative balance of organic substance and no need for animal manure as compared to cultivated soils. Grasslands along with forests should form an ecological frame of cultivated lands to stabilize biogeochemical cycles of primary nutrients (nitrogen, phosphorus, potassium), to prevent erosion, to absorb and neutralize fertilizers and pesticides washed from fields to exclude their penetration to water reservoirs. Green meadows of the landscape are beneficial for farm fields as animal manure contains solar energy accumulated by plants. Farm fields with eroded soil are usually withdrawn from agriculture and stocked down with meadow grasses. In that case the soil recovers effectively and lost fertility restores. Even inclusion of permanent grasses in crop allows improve the nutrient balance of the soil and compensate the fertility due to the depletion of nutrients by cereal crops [2].

Natural forage lands should be a depositary of biological diversity in agricultural ecosystems. This is a place where tens of species of important medicinal herbs and honey plants grow, rare and endangered species are preserved. Hundreds of useful insect species find shelter in grassland ecosystems. In recent decades, the artificial grasslands where most valuable plants of natural grasslands improved in course of selective breeding programs are sown gain traction in ecosystem preservation and production of feeds for cattle breeding. Artificial grassland, in its nature, is a transition from natural perennial grass communities to field crops. This type of planting combines productivity of field crops and persistency of natural grasslands.

Grasslands, both natural and artificial, are complex plant communities, and any human interference (cattle grazing, haymaking, fertilizing, watering) is interpreted through this type of system of relationships within the community. Without knowledge of principles of organization of these communities, they cannot be properly used or improved. Changes in grassland communities as a result of cattle grazing are called pasture degradation. The impact of cattle may vary depending on the type, quantity, grazing duration and regrazing frequency [2].

Cattle grazing works both ways: it has effect immediately on grass stand when plants are bitten off or broken by hooves, and indirectly through modification of the soil regime. Grazing usually leads to soil compaction which may result in salinization in southern areas due to intensified water rise through capillaries and evaporation from the surface. On wet soil, cattle grazing (e.g. sheep) may result in formation of bumps or specific tracks at dry slopes. On sandy soil, the greensward can be destroyed and result in worsening of wind erosion. Therefore, grazing causes changes in competitive relations in the communities, and beneficial species are not those with more active consumption of nutrient elements and water, but those less tasty for cattle and more resistant to grazing with low and appressed leaf rosettes and creeping

stems. Various thorns (thistle) feel well enough at pastures because cattle cannot eat them.

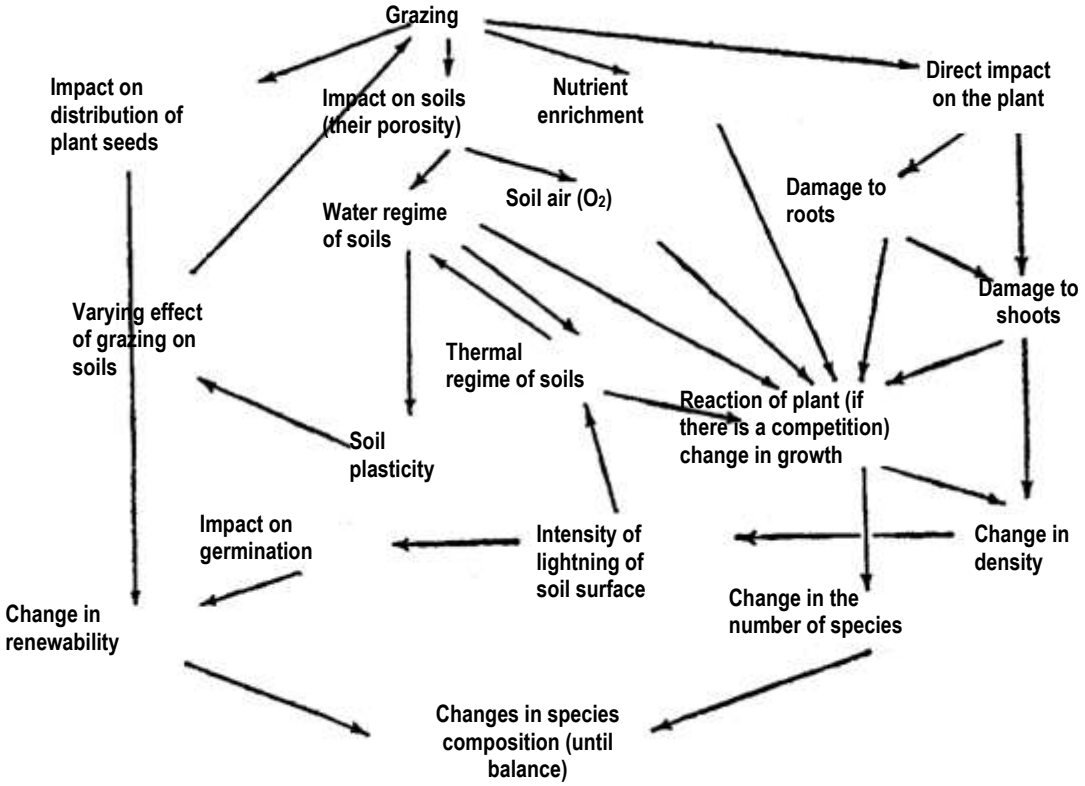

Fig.1 Mechanism of grazing factors (A. Ellenberger, 1963)

Moderate grazing is beneficial for most plants, there is even a certain adaptation between the grass stand and grazing cattle. Grass stand must be thick and 10 to 20 cm high so that the animals could get much herbage at a whack. Moderate grazing allows getting such grass stand convenient for feeding and occurs at most grassland types. If grazing is excessive, the “alliance” between the grass stand and animals impairs, grass “defends” from grazing by falling down onto the ground, where animals, especially big cattle, cannot easily eat it. To prevent such unfavorable consequences for grass stand regulated grazing is required, i.e. potential pasture production and recovery ability should be properly considered. By dividing a pasture into paddocks the farmer performs controlled (or rotational) grazing. Every year one of the paddocks is excluded from grazing and allowed to rest and recover. When a pasture is at rest, it is desirably to apply fertilizers and mow grass in late autumn to allow seeds falling into the vegetable layer. Then the seeds should be embedded by harrowing or in any other way which may include a light grazing to renew the grass stand.

In case of heavy grass stand impairment as a result of pasture degradation the grass stand must be restored. In most cases exclusion of the pasture from grazing for 3 to 5 years is enough to trigger autogenic succession, a so called post-grazing regeneration (recovery). The nature of changes in vegetation will become a mirror reflection of the changes which had place at pasture degradation: tall-growing plants

preferred by animals will become strong again. If grass stand is completely damaged with more than 50% of the ground uncovered and exposed, it is better to take reclamation measures and sow grass.

Changes in grassland communities with haymaking are not as obvious as pasture degradation. However, excessive growth of tall grass species in grass stand means that the meadow has not been mown-out for several years or it was mown-out too late. Mowing contributes to growth of graminaceous and leguminous plants.

If a meadow is not mown-out every year, a compacted layer of dead leaves forms at the ground surface, the temperature regimes changes, snow-melting delays, and mouse-like rodent appear who loosen soil and disrupt the grass stand uniformity which results in spots and then in introduction of trees and bushes [2]. The practice shows that alternation of early, middle and late mowing is optimal for meadows, that is why farmers organize a mowing rotation with alternating mowing schedules for different areas. This technique allows maintaining high species diversity and fertility of meadows.

Cattle grazing at pastures leads to origination of a close relationship between feeding quality and livestock production. Increasing content of ecotoxicants in the environment leads to their accumulation in plants. The total content of heavy metals in caw feeding ration during a pasture-grazing period exceeds that in the winter-stall feeding ration 2.2-times for plumbum. It has been established that in the soil contaminated with highly hazardous metals (e.g. cadmium (Cd), plumbum (Pb), zinc (Zn)) and moderately hazardous (e.g. cuprum (Cu)), there is increased mobility in the trophic chain and accumulation in livestock products [3].

In creation of new pastures or after restoration of degraded ones, it is necessary to perform a toxicological monitoring of pasture areas using biological testing methods in order to use the findings in ecological assessment of the territories.

Fertility and preservation of pastures depend on the loads. Excessive load on pastures results in their degradation or even total destruction – overgrazed pastures. The load should be controlled with due consideration of the number and types of animals, as well as type and productivity of plants. For instance, if the dry matter yield is 120-170 kg/ha, one sheep requires 3-3.5 ha of pastures [4].

To preserve fertility of the natural forage lands, seasonal pastures should be used. According to official data, Kazakhstan uses only 80 mln ha or 43% out of 188 mln ha of its natural forage lands [5], what leads to pasture degradation. Currently animals basically graze near populated settlements, where pasture lands are heavily overgrazed, vegetation grows scanty, productivity of forage lands decreases, and forage plants are gradually replaced by poisonous and harmful plants.

Deputies have considered these omissions in the draft law “On Pastures”. Many lands were recently purchased as private ownership, and not all of them are used for their intended purpose. Some people own lands but do not have animals while other people have animals but do not have enough land. Cultivated and pasture lands are used for construction of houses and other structures. Some lands have returned to forest. In recent time, authorities have started withdraw lands from people who does

not use them for their intended purpose, however this process is sluggish. All these can be attributed to antropogenic factors.

The main goal for cattle breeding in Kazakhstan is to restore degraded and heavily overgrazed pastures. There are special surface-level and basic soil improvement technologies. The only way to improve degraded pastures is reclamation, i.e. repeated plowing and sowing with new grasses. To reduce negative impact on soil and ecology in general, resource-saving technologies such as minimum soil processing (Mini-Till) and zero soil processing (No-Till) should be used.

Restoration of degraded pastures will take much time, but there is no alternative. Productivity of natural forage lands can only be restored through proper seasonal use of hayfields and pastures. i.e. rotational grazing, rational distribution of load between the pasture lands with due consideration of productivity, botanical composition and livestock population, as well as restoration of impaired natural forage lands and their use for intended purposes. Fulfillment of these conditions will help to preserve the forage lands in the country and increase their productivity, which will have a favorable ecological effect and lead to increase in the livestock products.

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INFORMATION ABOUT THE AUTHORS:

Syrlybayev G.O. - Candidate of Agricultural Sciences, Professor of the Department of "Agronomy" of the Kazakh National Agrarian Research University. Almaty, Kazakhstan, Abay Avenue 8, Email: galim.syrlybayev@kaznaru.edu.kz

Bayadilova G.O. - Candidate of Biological Sciences, Professor of the Department of "Genetics, Breeding and Biotechnology" of the Kazakh National Agrarian Research University. Almaty, Kazakhstan, Abay Avenue 8, Email: gulsun.bayadilova@kaznaru.edu.kz

Masonochich-Shotunova R.S. - Candidate of Biological Sciences, Kazakh Scientific Research Institute of Animal Husbandry and Feed Production Professor of the Department Feed Production Department of the Republic of Kazakhstan, Almaty 303 Baizakov St. **,** Email: rausana2010@mail.ru

School
ORGANIC HORTICULTURE AND PLANT PROTECTION

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A. Akmullayeva[1]*, K. Kulanbay[2], S. Mamanova

[1]Zhetysu University named after I. Zhansugurov, Taldykorgan, Kazakhstan
[2]Kazakh National Agrarian Research University, Almaty, Kazakhstan
**meirhan2009@mail.ru*

RESULTS OF TESTING BIOLOGICAL PREPARATIONS AGAINST LOCUSTS IN ALMATY REGION, ESKELDINSKY DISTRICT

Abstract

In the republic, 270 species and subspecies of locust insects have been identified, belonging to 75 genera, 5 families and 3 superfamilies. Notable damages to pastures, haymaking grounds and crops of agricultural crops are inflicted 112 species and subspecies of 54 genera, of which the most dangerous are 15-20 species.

Due to the locust location there were revealed 8 living forms, the dominating position among them take up cereals (19 types) and facultative (10 types) chortobionts. 4 types fall to eremobionts lot, specialized phytophills and gerpethobionts includes 2 types and petrobionts, subsoil geophills, chortobionts are presented by one type each.

Field tests of biological and chemical preparations were carried out against harmful locusts. Biological preparation *Nolo Bait*® was used at 0,001 l/ga. Calculations carried out in a 7-8 days have showed that the most part of locusts were paralyzed and on 14, 24 days biological effectiveness of preparations was 35,4-44,8%. As a standard was used dimilin – 48% s.c. which has showed a biological effectiveness – 77,8-97,6%.

Keywords. agriculture, genus, biotopes, fauna, locusts.

Introduction

Numerous scientists have studied the permanent and temporary foci of Calliptamus italicus locusts in the northern and northern (western and eastern) steppe regions [1p, 16].

Based on the analysis of the spread of this locust, it has been established that during the last 34 years in the republic the largest amount of anti-seizure measures against the Italian locust [2 p, 25]

The number of locusts in the fescue-wasteland (2117 units per 1-hour collection) was the priority. *Dociostaurus brevicollis, Calliptamus italicus, Oedaleus decorus, Chorthippus albomarginatus Deg. Stenobothrus fischeri* Home. often encountered

malignant species. And *Stauroderus scalaris, Podisma pedestris* L. species were somewhat different [3 p, 36].

During the massive increase of locusts, chemical processing of hundreds of thousands of hectares of land was carried out in Kachiry area of Pavlodar region for one year. 22 species of locusts are known to be among the most dangerous species in this region (Dublanajova 2001: 28), including the Italian grasshopper, black lane, cross, atbarsar, wingless, white lane, Submarine, Fisher and Siberian hordes.

In addition, from 1997 to 1998, there was a large number of malevolent Atbasar, Submersible, Siberian, Cross, White and Black winged locusts. The locusts have been particularly devastating in some years than the Italian locust. In this area 4553.6 hectares of land were examined and 1049.6 hectares of land were damaged by locusts [4 p, 13].

Locusts are widely known in the world as insects. They are dangerous for crops and pastures. They are also an unhealthy majority of the living world. In the present time, in Kazakhstan there are more than 270 species, from 10 to 12 species live in the suburban pheasant dungeons, pastures and pheasants.

Locusts are widely distributed in desert, steppe, forest-steppe regions of Kazakhstan. Harmful hillsides in these areas are locusts: *Arcyptera microptera* F.-W., *Aeropus sibiricus* L., *Oedaleus decorus* Germ., *Dociostaurus brevicollis*, *Chorthippus albomarginatus* Deg., *Stenobothrus fischeri*. and many other types.

The locusts have been proven in dozens of scientific publications in crop cultivation, hayfields and pastures, with dozens of square meters per square meter, and some of the harmful species during the drought years.

Object of research. Identification of the type of locusts in the Eskeldi district of Almaty region was mainly carried out on a route basis.

Methods and materials

Route surveys (interval 100-300 m) were performed. Determination of species of locusts. G. Bi-Bienko method, which was determined by calculating the collected volume of the collected amount of time collected from various plant biotopes by means of entomological tricks.

Due to the location and meeting of the locusts, N. Pravdin, M. E Chernyakhovsky divided into 4 groups according to the number of his / her performance: 1-person species (1-3 pcs in 1 hour collection); 2 rare species (4-10 pieces per 1 hour collection); 3-one normal type (11-20 pieces per 1 hour collection); The 4th most frequently encountered type (21-100 pieces per 1-hour collection) was determined by the type of locust found in the four oblasts.

The number of locusts per square meter was determined by counting the four-rectangular (frame), route-transect method and locust locks. The average number of locusts was determined by dividing their total number by calculations.

The size of the checked area is determined by the following formula:

$$P = \frac{a \times b \times c}{1000},$$

here *P*- the size of the tested area, hectare;

a - number of computing sites;

b - distance between computing sites m;

c - distance between routes m.

Four rectangular shapes have been calculated for the number of locusts 0.5 x 0.5 m (0.25 m 2) inside the rectangular shape. The calculations were conducted for 2 hours without interruptions. The average number of locusts per square meter was determined by dividing the total number of pests taken into account.

Locusts were calculated by the route-transect method. The plants in the seeds were classified and the rarest was 4 m, while the height of the plants (1-2 m) was 2-3 m.

Increase the extent of the explored space on the route.

The number of locusts in the area of 1 hectare is determined by the following equation::

$$D = \frac{A \times 10000}{B \times C},$$

here: *D*- average number of adult wood per hectare;

A- total number of pistachios along the route, pcs;

B- total length of the route, m;

C- route width, m.

The frequency of views was calculated in percentage:

$$P = \frac{n \times 100}{N},$$

here: *P*- frequency of meeting, %;

n - the number of samples that have been encountered;

N- total number of samples.

The types of locusts that dominate have been identified:

$$D = \frac{k \times 100}{K},$$

here**:** *D* – species priorities, %;

K – the types of tree predominance, pcs;

k – the advantage of one, pcs.

Results and discussion

The settlement of Eskeldinsky district is located in the crossroads of the Koksu depression and Zhetysu (Dzhungar) Alatau, which is mainly divided into two parts. The eastern part of the district is made up of the highest mountain ranges of snow and ice, with the highest altitude (4016m).

In the years when the climate was warm, the northern slopes of the Dzungarian Alatau kept cold. The average air temperature is 8.6-8.9 ° C. The average January temperature is 9,2-11,7 ° C, the average July temperature is + 24,4 ° C. A pleasant temperature range of 3950-4050 ° C, vegetation activity is 3650 (3-3.5 months). The highest temperature in summer is + 42 ° C. The frosty period lasted 160-170 days. Spring frost will return in the second half of April. In autumn frost falls in early October. Precipitation is 130-230 mm.

Figure 1. Map of Eskeldi District

Detection of locust species in the steppe zone of Almaty region was mainly carried out on a routine and route basis. From the typical 6 locust grabs, the number of locusts (grown-ups and adults) has reached 2,800. Of these, 2 families and 24 species of 18 relatives were identified.

24 locust locusts were identified in the Eskeldi district. Among these species are locusts: Siberian (*Aeropus sibiricus* L.), wingless (*Podisma pedestris* L.), White Lane (*Chorthippus albomarginatus* Deg.), Fisher Cheetah (*Stenobothrus fischeri* Ev.) And Subspecies (*Dociostaurus brevicollis* Ev.). At the same time, there were a number of species with a high-tech Italian chewing gum (*Calliptamus italicus* L.), a grasshopper (*Arcyptera microptera* F.- W.) and black winged locust (*Stauroderus scalaris* F.- W.) (1-Figure).

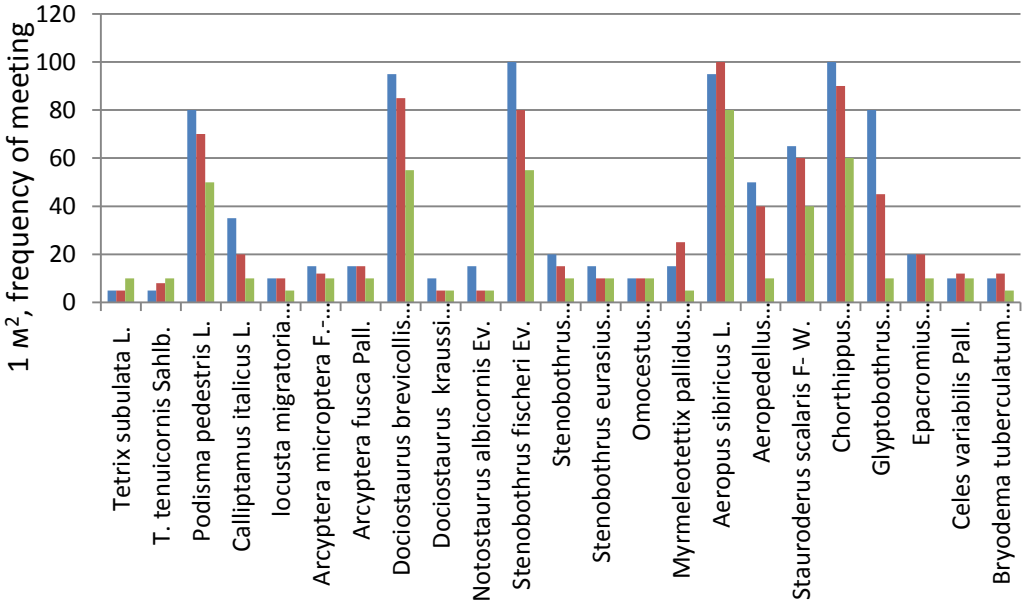

Figure 2. Type of locust and frequency of locusts

In different years, these anti-pest control measures were carried out in the agricultural land in the amount of 1-2 million hectares [5 p, 170].

Especially because of the massive increase and rapid development of the number of Italian leopards in 1996-2000, there were 7.5 mln. he resorted to safeguard measures (Jasanov 2003: 27).

In the Pavlodar region Irtysh region, 29 species of locusts have been identified from steppe pastures or untreated virgin lands. 9 of them are classified as economically significant pests [6 p, 634].

At the same time, the fauna of the residents is largely due to the average condition of the regions for each year and to the development of agricultural lands [7 p, 9].

In the Besköl district of the North Kazakhstan Oblast, the meadow biotope has been divided into seasonal periods, determining the quantity and productivity biomass. The most prevalent species of hay biotope were Chorthippus albomarginatus, Arcyptera microptera, Glyptobothrus biguttulus, Dociostaurus brevicollis, with an average area of 2,6-5,5 pcs / m2. In the beginning of June, the locust cultivation was 2.5 pc / m2, in mid-July it increased by 4 pcs / m2, in August it was 0.75-3.2 pcs / m2. Meanwhile, the average harvest yield was 1.4-2.5 kg / ha at the beginning of June, down to 6.6 kg / ha by the end of this month. (Kambulin, 1995: 634). One of the most dangerous species in the Akmola region is the Italian grasshoppin, and in 1999-2000, in all regions of the region. And mainly in the dry areas [8 p, 10].

Route surveys from the steppe regions of Abai, Zhetysu, Terekty, Syrymbet, Shimyr and Eshkiyolmes villages of Eskeldinsky district of Almaty region in 2016-2017 were conducted in june, july and august. Depending on the location of locusts, 6 typical biotopes have been studied: 1 - pasture (22 species, 10 harmful); 2-meadow (8 species, 3 harmful); 3-perennial herbs (14 species, 7 harmful); 4-meadow-wormwood-mixed herbs (15 species, 6 harmful); 5-field areas (12 species, 5 harmful); 6th place (10 species, 6 harmful); from biotopes. Among these species are *Dociostaurus brevicollis*, *Stenobothrus ficheri*, *St. eurasius* and *Chorthippus albomarginatus* have the advantage. The number of locusts has grown and grown in grain and wormwood. And Arcyptera microptera was dominated by fescue-mixed herbs. One of the most harmful species in the region was the Italian leopard, as well as the red winged, wingless and pigeon-go-round locusts in a fox-mixed herb. Frequently, the barabin, inhabited by grazing and hayfields, was rarely found on cereals-wormwood herbs (1-table).

Table-1. The growth of locusts in biotopes

№ p / s	Types of locusts	all, pcs	Percentage of locust meeting indicator, (%)					
			biotopes					
			1	2	3	4	5	6
1	*Tetrix subulata* L.	25	-	8,8	-	-	-	1,1
2	*Tetrix tenuicornis* Sahlb.	33	5,0	-	-	-	2,2	-
3	*Podisma pedestris* L.	220	4,0	-	4,0	-	-	12,7
4	*Calliptamus italicus* L.	93	3,0	-	5,5	-	3,2	-
5	*locusta migratoria migratoria L.*	25	2,0	6,0	-	3,2	-	-
6	*Arcyptera microptera* F.- W.	69	2,0	-	-	5,5	-	-

7	*Arcyptera fusca* Pall.	85	5,1	-	3,2	-	5,5	-
8	*Dociostaurus brevicollis* Ev.	390	18,2	16,3	13,2	13,2	13,2	3,7
9	*D. kraussi* Ingen.	58	2,0	-	6,8	6,8	6,8	-
10	*Notostaurus albicornis* Ev.	55	3,0	-	-	4,0	-	-
11	*Stenobothrus fischeri* Ev.	401	2,1	22,5	15,6	14,6	20,6	22,6
12	*Stenobothrus carbonarius* Ev.	28	1,6	-	3,2	3,2	4,2	-
13	*Stenobothrus eurasius* Zub.	68	1,1	12,0	6,4	6,4	-	-
14	*Omocestus haemorrhoidalis* Charp.	20	2,0	-	-	2,0	4,0	-
15	*Myrmeleotettix pallidus* Br.- W.	33	1,5	-	6,1	-	-	6,5
16	*Aeropus sibiricus* L.	35	1,1	-	5,0	5,0	-	-
17	*Aeropedellus baliolus*Mistsh.	62	1,3	-	-	6,1	6,1	-
18	*Stauroderus scalaris* F- W.	75	1,4	-	7,8	7,8	7,8	10,5
19	*Chorthippus albomarginatus* Deg.	415	22,0	22,0	15,0	15,0	22,0	6,8
20	*Glyptobothrus biguttulus* L.	203	10,1	12,6	-	-	5,0	10,8
21	*Epacromius pulverulentus* F.-W.	220	6,0	22,8	-	-	-	19,5
22	*Celes variabilis* Pall.	57	2,9	-	2,0	2,0	-	-
23	*Oedipoda miniata* Pall.	90	-	-	6,2	-	-	5,8
24	*Bryodema tuberculatum* Fab.	40	4,1	-	-	5,2	-	-
All:		**2800**	100	100	100	100	100	100

Note: 1 - pasture (22 species, 10 harmful); 2-meadow (8 species, 3 harmful); 3-perennial herbs (14 species, 7 harmful); 4-meadow-wormwood-mixed herbs (15 species, 6 harmful); 5-field areas (12 species, 5 harmful); Places 6 (10 species, 4 harmful)

Numerous scientists have studied the species composition, biology, ecology and economic peculiarities of locusts living in the regions of Kazakhstan. B. Lachininsky and many others (9 p, 387).

Dociostaurus brevicollis Ev., *Calliptamus italicus* L., *Oedaleus decorus* Germ. From the xerophytic species in february-biotic ecosystems of pasture. and mixed grasses on the fertilizing biotope *Myrmeleotettix pallidus* Br.-W. massive, as well as atasterism, and Fisher's locusts.

Dociostaurus kraussi in the desert region, *Notostaurus albicornis* House. species and species of *Asiotmethis, Melanotmethis* began to spring early spring, and most of the species were found in the late spring and early summer. In the last month of this summer in this region, the Asian Chewing gum and *Mizonocara, Egnatius apicalis*, were found to be more than just a few (10 p, 12).

In the laboratory case, there were no signs of locust damage during the spring wheat grazing in a dining room with 4 pc / m2. And from 8 to 12-16, the degree of damage to the plant increased, meaning the crust was hit by a snake of -58.2%, and a small snake was hit by a snake 55.2%.

Obtained in practice biopreparations based on Nosema locustae (0.001 l/ha) were used on the area of 1 ha, which were repeated 4 times. When counting the number of locusts within 7-8 days, most larvae were found to have hind limbs, some of which were destroyed, that is, most of them were semi-pubic. On the 14th-24th day there were cases of locusts. The biological effectiveness of the biopesticide Nosema locustae microscopia for 14 days had reached 35.8% of larvae in 24 days is

44.8%. Dimilin, inhibiting the development of chitin shell of larvae as a reference to the biological product, 48% of S. str. Received 0.02 l / ha, after treatment in the variants of experiments in the first days on 1 m2 area alive 0.6-0.2 PCs.locusts. In the last 24-day mortality of locusts accounted for 97.6%. As a standard, we offer a biopreparation of the Nosema locustae microscope, which inhibits the development of the chitin crust of larvae, with high efficiency. Because the impact of the biological product on locusts persists for many years. This biological product is now widely used in America, China.

Table-2. Nosema locustae against grasshoppers the biological effectiveness of a biological product

Experience options	Application size, l/ga	Средняя плотность личинок саранчи, шт/м^2			
		before treatment	biological effectiveness, %		
			date of calculation after processing		
			7	14	24
Nosema locustae	0,001	22,1 -	22,4 -	18,7 35,8	11,6 44,8
Dimilin, 48% s.k. (etolon)	0,02	22,8 -	4,4 77,8	0,6 96,0	0,2 97,6
Control (untreated)	-	22,5	22,7	18,9	12,2

Conclusion

In the biotope of pasture and perennial grasses, useful nests were collected by entomological traps in the places where treatment was carried out. According to the results of the analysis of the collected material, the development of the chitin crust of larvae is delayed (dimilin, 48% p.).p. 0.02 l/ha;) in the application of insecticides here – Coccinellidae (Coccinellidae), bedbugs (Nabidae, Anthocoridae), Alaska (Meloidae), Golden eyes (Chrysopidae), foals predatory (Carabidae), perpendicular (Hymenoptera), bee (Apoidae), there was no influence of ants (Formicidae) and spiders (order aranidtae). And during the first count in this place are birds (snow, Sparrow, etc.).b.) observed very good food, that is, there was a strong influence for the utility slot. pyrethroid group (citcor 25% k.e., marmalade tangerine slices V.C.) During the initial calculation application installed that 82-97% of the dying in the upper layer of plants; coccinellids, bone, gold Eyes, normal, and spiders. Compared with the observation, there was a decrease in the number of lamb, ant by 71-90%.

Thus, all chemical preparations showed high biological efficiency. But Adonis for a long time lasted 7.5 UMO toxicity.

In biological treatment with the use of the microscope Nosema locustae when counting the number of locusts for 7-8 days, it was noted that most larvae were destroyed hind limbs, some of which-half-coats. On the 14th-24th day there were

cases of locusts. As a reference to the biological product showed high efficiency dimilin, inhibiting the development of chitin shell larvae.

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INFORMATION ABOUT THE AUTHORS:

Akmullayeva Aizhan Seitkanovna – Candidate of Biological Sciences, Head of the Laboratory of Biotechnology Zhetysu University named after I. Zhansugurov Republic of Kazakhstan, 040009, Almaty region, Taldykorgan, I.Zhansugurova str. 187a, e-mail: meirhan2009@mail.ru

Kulanbay Kalamkas Zhanabekkyzy – PhD, Associate Professor, Kazakh National Research Agrarian University, Kazakhstan, kalamkas.kulanbay@kaznaru.edu.kz

School
VETERINARY MEDICINE IN BIOLOGICAL SAFETY

UDC 579.62

Denisenko Tatyana

"Moscow State Academy of Veterinary Medicine and Biotechnology - named after K.I. Skryabin", Moscow, Russia
Denisenkote@yandex.ru

INDICATION OF ANTIBIOTIC-RESISTANT MICROORGANISMS ISOLATED FROM WILD SPECIMENS OF POLAR BEAR AND ATLANTIC WALRUS

Abstract

This article presents the data of microbiological research of pathological material obtained from wild specimens of marine mammals of the Russian Arctic in order to monitor the species spectrum of opportunistic pathogenic microflora and its resistance to antibacterial drugs.

The study of sensitivity of isolated microorganisms to antibiotics revealed a high percentage of resistant microorganisms to antibacterial drugs used both in medicine and veterinary In this study, enterobacteriaceae (E.coli, Yersinia kristensenii, Morganella morgani, Serratia marcescens, Yersinia frederiksenii) showed resistance to the greatest number of drugs that may indicate their anthropogenic origin. Staphylococcus aureus resistance to drugs ranged from complete resistance to high sensitivity even within the same species of microorganisms.

Keywords: E.coli, Yersinia kristensenii, Morganella morgani, Serratia marcescens, Yersinia frederiksenii, antibiotic resistance, Atlantic walruses, polar bears.

Introduction

A significant environmental problem is the emergence and circulation of antibacterial-resistant microorganisms in nature. First of all, this is due to anthropogenic factors. Large marine mammals are the supreme betrayers of marine ecosystems. In the Arctic region of the Russian Federation, large marine predators are walrus and polar bear. It should be noted that the polar bear is one of the five mammal species included in the list of flora and fauna species that are indicators of the sustainable state of marine ecosystems of the Arctic Zone of the Russian Federation[1]. It is supposed that changes in the state of an indicator species in one way or another reflect the processes in the ecosystems of which the species is a part. Therefore, it becomes especially relevant to elaborate a detailed integrated approach to studying those parameters of the well-being of an indicator species that can ensure

the fulfillment of the tasks of monitoring the Arctic marine ecosystems. One of these parameters may be the state of the polar bear organism microflora[2].

It is the upper link in the trophic chain of marine ecosystems in a number of regions of the Russian Arctic, which allows it, as well as the polar bear, to be considered an indicator species of the ecological state of these ecobiotopes[3].

It is known that the end links of the trophic chain as a rule accumulate and concentrate xenobiotics and can also receive various pathogens from other food levels, the predator organism serves as an indicator of the ecological and epizootological state of the entire ecosystem. The microorganisms isolated from these animals, as part of the ecosystem, can serve as indicators of the sanitary state of the environment. Thus, when studying the resistance of isolated bacterial cultures to various antibacterial drugs used in veterinary and medicine, it is possible to judge the origin of this microflora[4]. The Arctic is a rather isolated region for the migration of microorganisms from domestic and farm animals as well as humans. Therefore, the detection of antibiotic-resistant strains in wild animals may indicate the contamination of this ecosystem with various pathogens that are not characteristic of this region[5].

Therefore, the detection of antimicrobial-resistant microorganisms in wild individuals of marine mammals of the Arctic region may indicate the level of contamination of the habitat of these animals not only by anthropogenic microflora, but also by various xenobiotics[6].

In view of the above, we set the following goal: microbiological studies of pathological material obtained from wild specimens of marine mammals of the Russian Arctic in order to monitor the species spectrum of opportunistic pathogenic microflora and its resistance to antibacterial agents[7].

Materials and methods

Collection of biological samples was carried out by the staff of the Marine Mammal Council ROO in 2014 - 2017 during Arctic expeditions in Russia. A total of 248 samples were taken from 32 polar bears and 24 Atlantic walruses. The animals were of different ages and sexes. Samples were taken according to GOST 9209-77. "Sampling and preparing them for laboratory tests." with observance of aseptic and antiseptic rules [9]. Sampling was performed intravital after immobilization of animals, assessment of their clinical condition and biometric parameters. Material was sampled with stool probes by washing off the mucous membranes of the oral cavity, nasal cavity, anus, and conjunctiva of the eye. For transportation, the stamptons with material were placed in tubes with Ames transport medium. Selected samples were not subjected to freezing, transported and stored at +40 ◌̊C.

Bacteriological examination of biological material was carried out at the Department of Microbiology, K.I. Skryabin Moscow State Medical Academy of Veterinary Medicine and Biology. Bacteriological and mycological examination of the material was carried out according to standard methods. Initial inoculations were performed on MDA, blood MDA, saline MDA, and Endo and Saburo media. The cultures were cultured at 37 ◌̊C and 24 ◌̊C for 48 to 240 hours, depending on the biological properties of the microorganisms. In order to study the sensitivity of

isolated microorganisms to antibacterial agents, a disc diffusion method was used. In the process, we were guided by the following methodological recommendations: MUK 4.2.1890-04; EUCAST, Antimicrobial susceptibility testing, disk diffusion method, VET01-A4 Performance Standards for Antimicrobial Disk and Dilution Susceptibility Tests for Bacteria Isolated From Animals, Approved Standard - Fourth Edition. For this study, antibiotics of the critical groups of penicillin, tetracycline, cephalosporin series (all generations), polymyxin, macrolides, quinolones, nitrafurans, glycopeptides, and lincosamides were used. Based on the quantitative data obtained (diameter of the antibiotic growth suppression zone), microorganisms were divided into susceptible (S), moderately resistant (I) and resistant (R). To distinguish between these three categories of sensitivity (or resistance), the so-called breakpoint concentrations of the antibiotic (or borderline values of the diameter of the zone of growth suppression of the microorganism) were used.

Results

As a result of the studies, 347 bacterial isolates were isolated and identified. The isolated microorganisms were mainly represented by genera: *Staphylococcus, Streptococcus, Micrococcus, Escherichia, Morganella, Yersinia, Serratia, Ochrobactrum, Pseudomonas,* etc. Microorganism species composition of cultures differed in each sample. We isolated most frequently and in higher numbers microorganisms of the genus *Staphylococcus (S. intermedius, S. epidermidis, S. kloosii, S. pseudointermedius, S. cohnii ssp. urealyticum, S. sciuri) (Figures 1,2,3,4).*

We isolated bacteria of this genus in 31 of the 32 polar bear individuals studied and in 22 of the 24 walrus individuals. Gram-negative microorganisms were represented mainly by *Enterobacteriaceae* and *pseudomonads.*

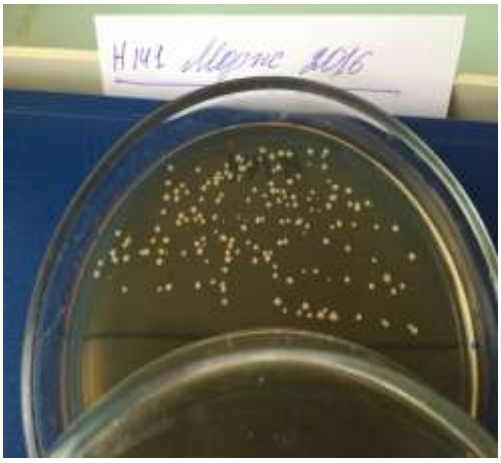

Figure 1 - Primary seeding on salt agar from walrus.

Figure 2 - Primary seeding from polar bear on salt agar.

A high percentage of resistant microorganisms to antibiotics used both in medicine and in veterinary medicine was found when studying the sensitivity of isolated microorganisms to antibiotics. In this study, enterobacteria (*E.coli, Yersinia kristensenii, Morganella morgani, Serratia marcescens, Yersinia frederiksenii*)

showed the greatest amount of resistance to the drugs, which may indicate their anthropogenic origin.

Figure 3 - Primary seeding on blood agar from polar bears.

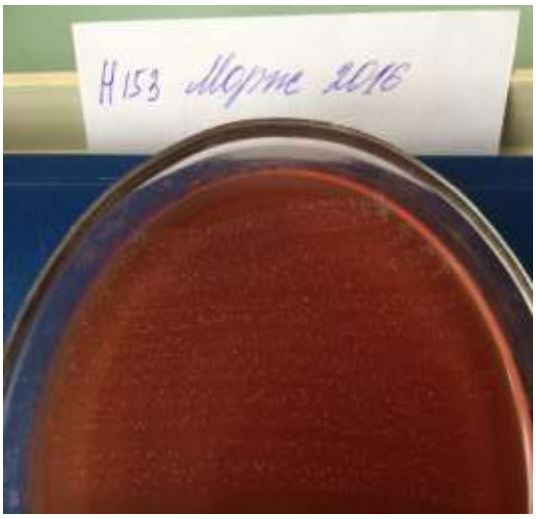

Figure 4 - Primary seeding on blood agar from walruses.

The resistance of staphylococci to drugs ranged from complete resistance to high sensitivity even within the same species of microorganisms. However, there was a tendency for all the cocci microorganisms obtained in this study to be more resistant with respect to drugs actively used in veterinary medicine, while enterobacteriaceae were more resistant with respect to medical drugs.

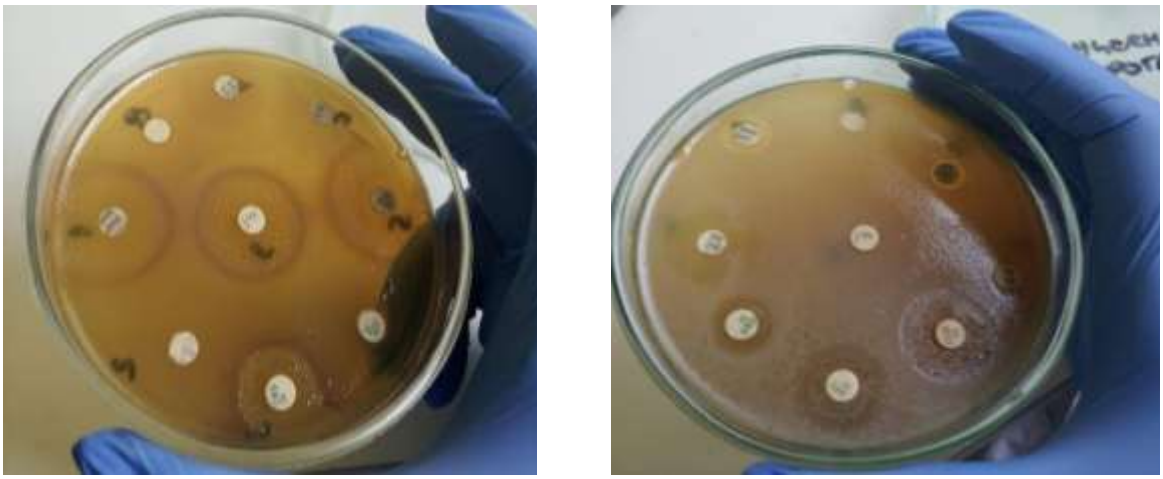

Figure 5 - Results of antibiotic resistance of isolated cultures from polar bears and walruses.

When analyzing the proportion of resistant isolates in relation to different drugs, the following results were obtained. The greatest number of isolated cultures of microorganisms showed resistance to tylosin (76%), cefazolin (52%), penicillin (62%), levomycin (46%), at that natural resistance of gram-negative microflora to penicillin was taken into account (Figure 5). Moderate resistance was shown to

tetracycline (58%) and gentamicin (48%). Sensitivity was shown to ciprofloxacin (56%) and enrofloxacin (44%).

Conclusion

As the results of this work show, microorganisms with polyresistance to a number of antibacterial drugs for medical and veterinary purposes are found in the populations of marine mammals of the Russian Arctic. Due to the sufficiently isolated nature of the study region, such data suggest a high prevalence of microorganisms with moderate and high resistance to antibiotics and the ability of such microflora to circulate in marine ecosystems [10,11]. In addition, most cultures of isolated microorganisms are conditionally pathogenic and can, under certain conditions, play an etiological role in various pathologies of both domestic and wild animals. Given the clinical relevance of these microorganisms to humans as well, the discovery of antibiotic-resistant strains in marine ecosystems raises questions about the extent of this problem.

Conclusions:

1. In the microbiological study of biomaterial from polar bear and Atlantic walrus individuals, 347 bacterial isolates belonging to 9 genera were isolated.

2. The study of the sensitivity of isolated microflora to antibiotics showed that Gram-negative microorganisms are resistant to the greatest number of drugs.

3. The largest number of both gram positive and gram negative microflora isolates were resistant to tylosin, penicillin, cefazolin, and levomecitin.

4. Moderate resistance was shown to tetracycline and gentamicin.

5. About half of isolates were sensitive to ciprofloxacin and enrofloxacin.

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INFORMATION ABOUT THE AUTHOR:

Tatyana Denisenko - PhD, associate professor of Moscow State Academy of Veterinary Medicine and Biotechnology named after K.I. Skryabin, Russia,109472, Moscow, st. Academician Scriabin, 23. e-mail: Denisenkote@yandex.ru

School
AGRIBUSINESS

UDC 332.1: 332.3

Ziyoydin Israilov[1]*, Jahongir Baratov[2]
[1]Andizhan machine-building institute, Uzbekistan
[2]Tashkent Institute of Architecture and Construction, Uzbekistan
**zisrailov269@gmail.com*

FEATURES OF THE ESTABLISHMENT AND OPTIMIZATION OF LAND PLOTS OF FARMS IN UZBEKISTAN

Abstract

This article discusses issues related to the reform of agriculture in the Republic of Uzbekistan through structural changes. The main purpose of the article is to study the causes of structural changes by explaining the features of the establishment and optimization of farms in Uzbekistan.

Keywords: agriculture, shirkat, structural changes, farms, optimization, pricing policy, production efficiency, agro-cluster.

Problem statement

At the beginning of economic reforms, more precisely in 1993, there were about 1,100 "state farms"(Sovxoz) and another 900 "collective farms"(Kolxoz) in Uzbekistan, which at that time were the main form of organizing production in agriculture. If collective farms were established in the 1930s as a result of the dispossession of rural landowners, state farms began to appear in the 1950s as state agricultural enterprises. The above forms of economic management made it possible to specialize the economy of Uzbekistan as a supplier of primary raw materials to the central republics of the former Soviet Union. Over time, this led to the emergence of such negative phenomena as the "cotton monoculture", and various kinds of socio-economic and environmental problems. Realizing this situation, the country's leadership at that time chose the path of gradual development of market relations in all spheres of the economy. At the same time, the country's government, based on long-term development goals and the needs of the economy, reserved the right to determine to price, distribution of financial and commodity resources, consumption, and the basic principles of export policy. Although these measures were perceived as temporary, in practice they were in effect for 25 years and had a serious impact on the results of agricultural development. If we compare the statistical data of Uzbekistan and the Netherlands, we can see the following differences: 16 million people live in the Netherlands, 1.038 million hectares of cultivated land, and 131 billion US dollars of agricultural production. And in Uzbekistan, the population is 34.7 million people, the sown area is 4.4 million hectares, and the volume of production is 13.2 billion US

dollars. In 1998, that is, in the first years of agrarian reforms, the law "About farms" was adopted to form a concrete idea of farms. Article 5 of this law stated that farms would be created in areas and territories where there is no surplus labor force. For farms specializing in crop production, the minimum size of the allocated area was set at 10 hectares for cotton and wheat, and for farms for growing fruits, grapes, melons, and other types of products, 1 hectare.

Main body

Farms specializing in cattle breeding could be established if there were at least 30 conditional heads of cows. And the amount of land allocated for farming varied from 0.3 hectares in the regions of the Ferghana Valley, as well as Tashkent, Samarkand, and Khorezm regions. But, in other regions and the Republic of Karakalpakstan 0.45 ha, and non-irrigated areas at least 2 hectares. These requirements determined the features of the establishment of farms in Uzbekistan at the beginning of the transition period to a market economy. In addition, the organization of farms in Uzbekistan was carried out in the following two orders:

- in regions without surplus labor:
- based on "shirkat" farms, in which the level of profitability over the past three years has been the lowest.

In both cases, the farm is established by the head of the future farm. He had to show his property, as the economic basis of the farm was his property. And the following could be included in the property: a house, available equipment, livestock, financial resources, fruit-bearing trees, intellectual abilities, and others. Based on the charter of the farm, its business plan is drawn up, after which the head proceeded to receive the allocated land. In the first case, based on the location of the zone, the head of the farm applied for the head of the shirkat, and he applied for the chairman of the tender commission. Applications were considered within the prescribed time limit. The commission considered the future leader from all sides: work experience, education, and money, and available equipment, ability to do business, outlook, and other qualities. A person who meets the requirements of the commission received land from 30 to 50 years for rent. After that, the farm duly passed state registration, and it became a full-fledged legal entity.

The first stage of the creation of farms covered 1993-1998, and they were created in those regions where there was a shortage of labor. The basis was the decrees of the heads of shirkat farms and allocated land at the expense of the balance of the economy. In general, "during this period, 21,000 farms functioned in the country, and the total area allocated for them amounted to 498,000 hectares, or each farm had an average of 19.6 hectares of land. However, in some cases, cotton and wheat farms had from 1 to 3 hectares of land". In this period, the creation of economic and organizational, and legal foundations for the activities of farms was the main task of the time. For this reason, the second stage of the development of farms was the period of creating the economic and organizational, and legal foundations for the activities of farms. On April 30, 1998, the "Land Code" was adopted, as well as laws on: "Agricultural cooperatives", "Farms", and "Peasant farms". Based on these legal acts, the regulatory framework for the functioning of agricultural enterprises

and the implementation of reforms in agriculture was created. According to the decision of the Cabinet of Ministers during 1999-2001, more than 4 thousand farms were created based on 68 unprofitable shirkat farms [6].

The third stage was a period of accelerated development of farms in Uzbekistan. During this period, based on the decision of the Cabinet of Ministers of January 5, 2002 "About the transformation of agricultural enterprises into farms", in the Yozyovon, Mirzaobod, and Mekhnatobod districts, 83 unprofitable shirkat farms were completely turned into farms". Thus, since 2004, active propaganda and promotion of farms have been launched in Uzbekistan. From 2004-to 2007, in all regions of the Republic of Uzbekistan, shirkat farms were completely disbanded and turned into farms. In their place, 215 thousand farms were created.

If we analyze the activities of farms, despite the measures taken, there were still some unresolved problems that were relevant and required serious attention from the state. Some problems such as inefficient use of land resources, systematic deterioration of the financial and economic condition, and insufficient provision of material and technical resources, besides, such factors in the process of allocating land as soil and climatic conditions of the land, the population density of the region not taking into account. In addition, it became obvious that it is necessary to take into account the production specialization of farms in the allocation of land. The Decree of the President of the Republic of Uzbekistan dated October 6, 2008 “On measures to optimize land plots at the disposal of farms” was designed to solve the above problems. To ensure the implementation of this decree of the President of the country, the number of farms was reduced from 215,776 to 107,381, or by 51%. At the same time, the average land area of farms increased from 27.4 ha to 47.5 ha [6].

According to the Ministry of Agriculture of the Republic of Uzbekistan, as a result of optimizing the land plots of farms in 2009, working capital increased, and the provision of material and technical means improved. The volume of growing agricultural products increased, including grain by 385 thousand tons, fruits, melons, and potatoes by 800 thousand tons, and the growth rate of production also increased. According to Table 1, in the period 2010-2013, the number of farms in Uzbekistan was reduced, and land plots were expanded. However, this process in the context of the regions did not occur in the same way. For example, the largest reduction in the number of farms was observed in the regions of the Fergana Valley, Tashkent, Samarkand, and Kashkadarya regions. In these areas, the reduction rate is over 1000. In other regions, this figure is less than 1000, and the Republic of Karakalpakstan accounted for the smallest reduction. However, according to the main indicator of optimization of land plots of farms, the Andijan region is in the last place, that is, the smallest size of land plots per farm [6].

That is, as a result of optimization, the average area of farms increased by only 5 hectares. In other areas, this figure is much higher. Only in Samarkand, Khorezm, and Fergana regions, this indicator is less than 10 hectares, and in the rest, it is more. This situation can be explained by differences in the total area of the regions and the Republic of Karakalpakstan, as well as the total number of farms. If we take the indicator "average area per farm" as the main indicator of optimization, we can

conclude that farms in the Andijan region were the least affected by optimization, and those in the Bukhara region were the most affected.

Table 1. Change in the size of land plots of farms in the Republic of Karakalpakstan and regions of Uzbekistan as a result of optimization in 2010-2013

Name of regions	As of October 1, 2010			As of January 1, 2013			Difference (+ -)		
	Total number of farms	Total territory ()th ha	Average land space of farms	Total number of farms	Total territory ()th ha	Average land space of farms	Total number of farms	Total territory ()th ha га.	Average land space of farms
Karakalpakstan	3879	457	118	3354	426	127	-525	-31	9
Andijan	7296	224	31	6175	224	36	-1121	0	6
Buhkara	4841	730	151	3953	730	185	-888	0	34
Djizzak	5560	469	84	4735	487	103	-825	18	18
Kashkadarya	8599	726	84	7139	726	102	-1460	0	17
Navoi	2383	223	94	1801	216	120	-581	-8	26
Namangan	6245	228	37	4515	230	51	-1730	2	14
Samarkand	8804	496	56	7723	497	64	-1081	1	8
Surkhandarya	5527	605	109	4951	606	122	-576	1	13
Sirdarya	4241	232	55	3319	238	72	-992	6	17
Tashkent	7449	423	57	6051	422	70	-1398	-1	13
Fergana	10131	286	28	7737	286	37	-2394	0	9
Khorezm	5760	206	36	4681	206	44	-1079	0	8
Total	80714	5306	66	66134	5295	80	-14580	-12	14

source: Kh.Khuzhakulov, N.Askarov and Kh.Khuzhakulov. Some features of the development of diversified farms. Scientific electronic journal “Iktisodiyot va innovation tekhnologiyalar”. No. 3, May-June, 2016.

From October to December 2015, the next stage of optimization of land plots of farms in Uzbekistan was carried out. The results of the new stage are fundamentally different from the results of the previous stages, that is, they are opposite. This time, the optimization of land plots was carried out by reducing, and their number increased. The indicators of this process are reflected in Table 2. In general, the number of farms increased by 21%, or 1756. The land area of farms in the Republic of Karakalpakstan and Tashkent region was reduced by more than 20 hectares, and in Navoi and Jizzakh regions by about 12 hectares. In other regions, this figure is less than 10 hectares, and the lowest figure is in the Syrdarya region, that is, 2.5 hectares, in the Khorezm region 3.5 hectares, and in the Andijan region 4.2 hectares. In other areas, this figure varied between 5 and 10 hectares. The reasons for the optimization of land plots of farms in 2015 have not yet been studied and the answer to the question has not been found - why the optimization of farms in 2015 was carried out in the opposite direction to the optimization results of 2008-2010 [6].

From the data in Table 2 below, it can be seen that structural changes in agriculture in Uzbekistan were carried out on a phased basis, the goals achieved did not always justify themselves. For this reason, the question arises - why the implemented changes could not have a serious impact on the growth of agricultural production and economic efficiency? To find an answer to this question, we will pay attention to some features of the ongoing reforms in agriculture in Uzbekistan and comment on them from the point of view of scientific logic.

Table 2. Change in the size of land plots of farms in the Republic of Karakalpakstan and regions of Uzbekistan as a result of optimization in 2015

Name of regions	As of 01.10. 2015		As of 12/01/2015		Difference (+, -)			
	Total number farms	Average land plot farm	Total number farms	Average land plot farm	Total number of farms		Average land plots of farms	
					Unit (+,-)	%	Hectare	%
Karakalpakstan	3691	80,6	4 802	58,7	1 111	30,1	-21,9	-27,2
Andijan	7251	29,8	8538	25,6	1 287	17,7	- 4,2	-14,2
Buhkara	4632	44,4	5 273	39,0	641	13,8	-5,4	-14,2
Djizzak	7787	55,7	10 073	43,2	2 289	29,4	-12,6	-22,6
Kashkadarya	10756	51,2	12 373	44,8	1 617	15,0	-6,4	-12,4
Navoi	1814	48,3	2 519	35,6	705	38,9	-12,7	-26,2
Namangan	5523	35,7	7 397	26,9	1874	33,9	-8.9	-24,8
Samarkand	10952	36,9	12 641	32,1	1 689	15,4	-4,8	-13,1
Surkhandarya	5447	45,5	6108	41,2	661	12,1	-4.4	-9,6
Sirdarya	5097	48,6	5459	46,1	362	7,1	-2,5	-5,2
Tashkent	6272	53,3	9418	29,6	3146	50,2	-23,7	-44,4
Fergana	8805	31,3	10420	26,1	1615	18,3	-5,2	-16,6
Khorezm	5490	36,9	6049	33,8	559	10,2	-3,1	-8,4
Total	83514	43,9	101070	36,1	17556	21,0	-7,8	-17,8

source: Kh.Khuzhakulov, N.Askarov and Kh.Khuzhakulov. Some features of the development of diversified farms. Scientific electronic journal “Iktisodiyot va innovation tekhnologiyalar”. No. 3, May-June, 2016.

In the first period of reforms, that is, from 1993 to 1998, the name of the former collective farms and state farms were renamed "shirkat farms", but the type of farming did not change. In this regard, the question arises - what was the reason for maintaining centralized production in agriculture and how did it meet the requirements of that period?

Beginning in 1993, the government of Uzbekistan began to carry out market reforms, and at that time the main problem was to stop the decline in production, ensure macroeconomic stability, and implement structural changes. In our opinion, the preservation of collective farms and state farms in the form of "shirkat farms" was caused by the desire to maintain the stability of production, since, in the case of an accelerated introduction of farms, the process of adaptation to the conditions of a market economy and formation could be delayed. The result of such a situation would be a shortage of food, a lack of raw materials for industry, and a loss of foreign

exchange earnings from exports for the country's budget. It can be assumed that the solution to the above tasks was directly related to agriculture, and the preservation of state control was of long-term strategic importance.

In 2009, Israeli University professors Hebru J. Lerman and D. Sediq noted that "in the Central Asian region, the reforms implemented in agriculture, including the establishment of small farms and peasant farms instead of collective farms and state farms, simply mean a return to traditional forms of farming market economy. In the Soviet Union, collective farms and state farms were an ideological response to farming in a market economy. At the same time, collective farms and state farms were considered an alternative, which would allow achieving economies of scale in production by increasing the mechanization of agriculture [4]. We think that the reason for linking production to the Soviet ideology is that the elimination of private ownership of land and the development of the public sector were seen as a further development of the planned economy. However, it would be wrong to consider that in the conditions of Uzbekistan, little attention to the development of farming until 2008 was the unwillingness of the country's government to develop a private property and free enterprise in the agricultural sector. It would be more plausible to say that the use of shirkat farms made it possible to reliably ensure the balance of state and public interests at a very difficult time for the country.

Main findings

The experience of Uzbekistan in the development of farming through optimization after 2015 showed that there are still problems related to improving the economic efficiency of production in agriculture. The main problems concerned two aspects of market reforms in agriculture: pricing policy and financial stability. An analysis of the activities of farms in the regions and the results of land optimization showed that farms are still in a state of financial dependence on commercial banks. Commercial bank loans cover only the costs of working capital but do not allow the accumulation of capital for the renewal of fixed capital and the development of new technologies, wage increases, etc. That is, the low level of profitability did not allow the accumulation of capital for the renewal of production; or loans.

Kh.Khuzhakulov and N. Askarov, after studying the experience of optimizing the land areas of farms, came to the following conclusion: "the optimization of land plots of farms in the short term by applying administrative methods causes dissatisfaction, and in the future, this process should be carried out in an evolutionary form". Farmers were dissatisfied with the fact that the state took away their property under the pretext of the need to optimize land to increase production efficiency. For many farmers, this was an unexpected shock, the farmers could not prevent this turn of events. Kh.Khuzhakulov and N.Askarov openly left the question - what does the evolutionary method of optimizing the land plots of farms mean [1].

At the meeting of the President of the country on September 12, 2018, the task was set to fully process the cotton grown in the country by 2020 with the establishment of cotton-textile clusters. The issue of expanding the organization of cotton and textile clusters was raised at the meeting. In the same year, cotton was harvested in clusters on an area of 164,000 hectares in 20 districts. In 2019, it is

planned to produce cotton in 51% of the total sown area in 61 clusters. At the same time, 78% of domestically produced cotton fiber is processed at our local textile enterprises. The share of finished products will increase from 40% to 60%. In 2017, the first cotton-textile clusters were established in Bukhara and Syrdarya regions, with the first positive results.

Resolution of the Cabinet of Ministers of the Republic of Uzbekistan dated January 26, 2018 No 53 "On measures to introduce modern forms of organization of cotton and textile production." To establish market relations between farms, other agricultural producers, and textile enterprises, to ensure the production of competitive high-value-added products based on the introduction of modern forms of organization of cotton and textile production, textile enterprises, as well as the Ministers of the Republic of Karakalpakstan Taking into account the testing of the Council and regional authorities in the framework of the 2018 harvest of raw cotton, it is planned to organize 13 cotton and textile production in the relevant regions. It was noted that the organization of this production is based on the conclusion of a direct contract between the enterprises of the textile industry and farms for the production and supply of raw cotton. The resolution stipulates that the organizers of cotton and textile production will promote the efficient and rational use of land, water, and other resources, increase productivity and timely collection of raw cotton, as well as its deep processing and production of high value-added products. provides reproduction. In 2019, it was decided to establish 48 cotton-textile clusters to increase cluster cotton production to at least 52%. In 2018, clustering was launched in the agriculture of Uzbekistan. What does this mean by clustering in agriculture? Private investors invest in the creation of a network of enterprises in agriculture, which can establish a technological cycle of production from growing plants to the final production of finished products.

Table-3. Established agro-clusters in Uzbekistan

Territory	Number of the clusters	Cotton planting area	
		Total	Average area per cluster
On the republic	73	701426,6	9 352,4
Karakalpakstan	3	28 161	9 387,0
Andijan	9	60 126	6 680,7
Buhkara	8	112 329	14 041,1
Djizzak	4	28 068	7 017,0
Kashkadarya	6	70 200	11 700,0
Navoi	2	32 600	16 300,0
Namangan	6	55 182	9 197,0
Samarkand	8	75 580	9,447,5
Surkhandarya	5	49 846	9 969,2
Sirdarya	4	42 606,6	10 651,7
Tashkent	6	54 600	9 100,0
Fergana	8	50 330	6 291,3
Khorezm	6	41 798	6 966,3

Source: https://www.agro.uz.

Conclusions

At the same time, the private investor assumes two obligations: financing the working capital of farms and providing them with agricultural machinery. In this method, the state relieves itself of the obligation to finance farms, but the order for some products and price controls remain. The owner of the cluster makes a profit as a result of the production of finished products, that is, by increasing the added value. In this case, the role of farms decreases significantly, they become a supplier of labor for growing plants and obtaining the primary raw product.

If optimization is done in a free competitive manner using a market mechanism, it may be the most satisfactory path. However, this approach also requires limiting government intervention in the agricultural sector and paving the way for the maximum implementation of the market mechanism. Based on the above, we can conclude that to raise agricultural production in Uzbekistan to a qualitatively new level, it is necessary to open the way for the implementation of the principles of a market economy.

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INFORMATION ABOUT THE AUTHORS:

Ziyoydin Israilov – Ph.D. (Economics). Deputy Professor of the department «Industrial production organization» of the Andizhan machine-building institute. Uzbekistan. zisrailov269@gmail.com

Jahongir Baratov – 1st year student of the Tashkent Institute of Architecture and Construction. Economics specialty, Faculty of Construction Management.

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M. Yusupova[1], A. Mamazhonov[2]*
[1]Andijan Machine-Building Institute, Uzbekistan
[2]Andijan Institute of Agriculture and Agrotechnologie, Uzbekistan
**mat69@mail.ru*

OPPORTUNITIES AND CHALLENGES OF USING INTERNATIONAL FINANCIAL REPORTING STANDARDS

Abstract

This article discusses the possibilities of international accounting standards and their importance in the context of globalization. The article is written about the accounting problems that led to the emergence of international standards. Analyzed positive developments using international standards. solutions to accounting problems are considered on the basis of the basic principles of accounting

Keywords: International financial reporting standards, interpretation of standards, accrual principle, compliance principle

Introduction

The international practice of accounting and reporting, determined by the standards, is heterogeneous and multifaceted. All currently existing accounting standards can be conditionally divided into the following groups, the division into which is made on the basis of the level of accounting standardization:

1. National standards of different countries, the application of which is mandatory within a particular country.
2. Regional standards, the application of which is mandatory for countries belonging to certain regions.
3. International financial reporting standards developed for countries around the world.

National accounting and reporting standards are developed by countries independently. In different countries, national accounting and reporting standards are called differently, in addition, different bodies are involved in their development: in some countries this is the prerogative of state bodies, in others - professional organizations. Such questions find their solution in the theory and methodology of international accounting. Each country has certain differences due to national characteristics and development factors, in this regard, each country has its own national accounting system.

Methods and materials

International Financial Reporting Standards are rules that establish requirements for the recognition, measurement and disclosure of financial and business transactions for the preparation of financial statements of companies around the world. Standards ensure the comparability of accounting documentation between companies on a global scale, and are also a condition for the availability of

accounting information for external users. IFRS are a set of compromise and fairly general accounting options, they are advisory in nature; on their basis, national accounting systems can develop national standards with more detailed regulation of accounting for certain objects.

Each standard contains information on the following mandatory items:

- Accounting object - definition of the accounting object and the basic concepts associated with this object;
- recognition of the object of accounting - a description of the criteria for attributing objects of accounting to various reporting elements;
- assessment of the object of accounting - recommendations on the use of assessment methods and requirements for the assessment of various reporting elements;
- reflection in financial statements - disclosure of information about the object of accounting in various forms of financial statements.

Results and discussion

The application of International Financial Reporting Standards is based on two fundamental accounting principles: going concern and accrual, which determine the general approach to the preparation and presentation of financial statements for the comparability of the activities of companies in all countries of the world.

The going concern principle assumes that a business entity is operating, and will continue to operate in the foreseeable future, has neither the intention nor the need to eliminate or reduce the scale of its activities. Therefore, the assets of an economic entity are reflected at their original cost, excluding liquidation expenses. If there is such an intention or need, then the financial statements should state this fact in the following order:

- reflect the assessment of property at salvage value;
- write off assets that cannot be collected in full;
- accrue liabilities in connection with the termination of contracts and economic sanctions.

The accrual principle is based on the fact that the income and expenses of an economic entity are recorded as they arise, and not as cash or cash equivalents are actually received or paid. Thus, this principle implies:

- recognition of the result of the transaction as it is completed;
- reflection of operations in the reporting of the period in which they were carried out;
- formation of information about obligations to pay and obligations to receive, and not only about actually made and received payments.

International Financial Reporting Standards take on a special role in achieving, harmonizing and expanding the possibilities of financial reporting around the world. International practice, in particular the practice of the CIS countries, shows that they are used for the following purposes:

- they serve as the basis of national accounting and reporting requirements in many countries of the world;

- used as a benchmark for individual countries developing their own accounting and reporting requirements;
- ensure compliance of financial statements with the requirements of stock exchanges and international regulatory bodies;
- are used by national bodies developing standards for capital markets;
- used even in countries where IFRS is not required due to the increase in the number of companies.

The above circumstances cause the increasing recognition and application of IFRS. This is dictated not only by the requirements of international organizations that regulate capital and securities markets, but also by the following:

- standards cover a part of the accounting requirements representing a wide-ranging accounting basis;
- high quality standards, high contrast, contrast, as well as their full reflection;
- the ability to use standards through interpretations that are published periodically.

Thus, in modern conditions of globalization, the use of international standards brings a high effect to the international community.

It is known that the development and implementation of IFRS is the result of the globalization of the world economy, followed by the process of internationalization of accounting and reporting, which are caused by a number of practical problems of accounting and reporting in transnational corporations.

Solutions to these problems find their solution in the theory and methodology of international accounting. The national accounting and reporting system really wants to become full-fledged and respected by the international economic communities.

Global changes in the world economy, as noted above, require additional procedures for the preparation and evaluation of financial statements, preparation for the application of qualitatively new accounting and reporting standards. All this requires a certain amount of time and effort to ensure that users of information are protected from unreasonable economic decisions.

Conclusion

Scholars and practitioners in the field of accounting and audit have repeatedly emphasized that the introduction of IFRS requires the implementation of a global program that covers the organizational, methodological, and psychological aspects of the reform. This means creating a holistic system of financial infrastructure, covering not only standards, but also new legislation, education and professional growth.

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INFORMATION ABOUT THE AUTHORS:

Mamazhonov Akhramjon- doctor of philosophy (PhD), docent, Andijan Institute of Agriculture and Agrotechnologies, Uzbekistan, Andican, st. “Oliygoh ko’chasi”, house 1, mat69@mail.ru

Malikaxon Yusupova- doctor of philosophy (PhD), docent, Andijan Institute of Mechanical Engineering, Uzbekistan, Andican, st. “Bobur shoh”, house 56, mat69@mail.ru

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A. Khurramov[1]*, I.M. Ganiev[2], Mevlüt GÜL[3], A. Nasrullaev[1]

Tashkent State University of Economics, Uzbekistan
[2]Samarkand Branch of Tashkent State University of Economics, Uzbekistan
[3]Isparta University of Applied Sciences, Turkey
* *azizbek_khurramov@sbtsue.uz*

THE USE OF EFFECTIVE RISK MANAGEMENT TECHNIQUES AND THE ROLE OF DIGITAL TECHNOLOGIES

Abstract

For the first time, the concept of “risk management" in relation to the business sector of human activity was formed in the insurance business, and later in the stock market. Management as a management science has brought to the field new knowledge insights into how the risk management process should be organized. The concept of "risk" is vaguely defined and often depends on the context in which it is used. In its most general form, risk can be defined as a potential risk.

Keywords: Risk assessment, successful trading, management, production risk, external risks, credit relations, specific industries.

Introduction

Risk management processes. Risk management involves four main processes: identification, analysis, planning, and risk management. Risk identification is the first step in the risk management process. This step identifies and describes the risks that may occur during project implementation and the relationship between the risks.

Identified risks are divided into groups (financial, technological, political, professional, force majeure, etc.). At the analysis stage, a risk assessment is performed. It calculates the probability of risks and the damage they can cause and sets risk limits. After that, the risks are grouped according to their importance and the most important of them are highlighted, which are carefully monitored throughout the life of the project [1].

After identifying and analyzing the risks at the planning stage, measures will be developed to prevent and mitigate their consequences if they occur. Relevant documents include a description of the actions to be taken to respond to the occurrence of each potential problem and a list of persons responsible for taking appropriate action to neutralize them. The task of the control phase is to monitor the identified risks.

Based on such monitoring data, the response is if a problematic situation is identified. Properly organized control over the implementation of the project provides quality and timely information to the company's management to make decisions on risk prevention.

During the project process, new risks may be identified or the extent of their impact on the project may change. Risk management is therefore a closed cycle in which control is again the identification phase and thus continues until the end of the project. Risk management is an important part of successful trading. Effective risk management requires not only careful monitoring of the amount of risk but also a strategy to minimize losses.

Use certain methods to manage risks. Appropriate organizational and technological measures will be developed to reduce production risk (for example, non-fulfilment of planned indicators on product volume and quality), including current and operational planning system, quality management system and other similar measures in the enterprise aimed at creating a system that excludes execution timely and appropriate product quality of the planned targets.

Adequate measures are being developed to reduce other risks, the main criterion of which is their effectiveness, the ratio of the result (decrease in loss or increase in profit) to the cost of their implementation. The main problem of risk management in the foreign economic activity of the enterprise is the management of external risks, the occurrence of which does not depend on the efforts of enterprises.

The following groups of methods can be distinguished to reduce the losses that may occur as a result of these risks: insurance, hedging as a method of using futures contracts and options traded on the stock exchange.

Applying various forms and methods of settlement and credit relations, minimizing the risk of non-payment for goods delivered or non-acceptance of goods against payment. For example, a certified documentary letter of credit, various bank guarantees, avalanches, collateral, etc. Insurance plays an important role in risk management methods in foreign economic activity.

Insurance, by its very nature, is a form of pre-reserve of resources designed to cover losses in the expected form of various risks. In this case, the party at financial risk is the insurance company. The purpose of ensuring the business entity is to protect it from financial consequences (property damage) due to adverse events. In addition to insurance, other risk management methods are also used [7].

Various hedging methods are widely used to manage the risks associated with falling commodity prices, stock prices and unfavourable exchange rate depreciation. The advantage of hedging is the ability to make quick decisions, a relatively low price. Disadvantages include a narrow range of actions (only the price parameters, stock values and currency of commodity transactions), the complexity of the methods used, the high level of expertise of specialists.

Methods

An imperfect view of risk management in capital markets is discussed in Smith and Stulz (1985) and further developed in Froot, Scharfstein and Stein. According to Froot et al., The firm's production function is concave and outside financing is expensive; these assumptions guarantee that fluctuations in internal funds destroy the value of the firm.

It is assumed that a negative shock to domestic funds cannot be compensated without cost by an increase in external financing and thus leads to a decrease in

investment; this has a large impact on the firm's profits because the marginal product of investment is high when the investment is low.

The spirit of Smith and Stulz is similar: hedging reduces the likelihood of financial distress, which increases the value of the firm because of the external fixed costs of bankruptcy.

Empirical work to test these ideas usually focuses on the use of derivatives by firms. Some papers analyze broad cross-sections of non-financial companies, while others analyze specific industries (such as gold mining or banking) in which the use of derivatives is especially common.

The table below summarizes the results of a representative sample of documents on the relationship between the use of derivatives and measures of financial friction or cash flows relative to investment opportunities.

Results

Risk is a very broad concept that encompasses everything from product innovation risk to market risk, supply chain risk to reputation risk. A key component of enterprise risk management is strategic risk management, and it is a concept that affects an organization’s risk levels and strategic decision-making processes.

Strategic risk management underlies the processes of strategy setting and strategy implementation. Strategic risk management is important for a business because it manages risks that significantly affect the company’s strategy and ability to achieve business goals.

In general, in the process of corporate risk management, many company management form various risk committees. These risk committees unite an interdisciplinary group to monitor and review risks throughout the company and to promote the practice of risk awareness and risk management in the company.

The structure and composition of these committees vary significantly between businesses. But the key is that it works for the business and should take into account the complexity of the business, the enterprise risk management processes, and the business structure [6].

Strategic risks are risks that significantly affect an enterprise’s strategy and ability to achieve business goals. Consequently, these risks are risks that affect the value of the company and the sustainability of the business.

Risk strategic management requires planning that defines the relationship between all important areas of enterprise activity, risks, and processes designed to reduce risks across the enterprise. Company management should protect and question strategic risk management. Sometimes risks can also be a business opportunity for a business.

The main strategic risk management services provided by our organization:

- Strategic risk
- Influential risk
- Risk of regulation
- Financial risk
- Financial risk
- Market risk

- Credit risk
- Liquidity risk
- Operational risk
- Cyber threat
- Global risk management
- Risk perception
- Security in the digital world
- Non-financial risks
- Risk in information technology
- Artificial intelligence and risk management

Developing an effective risk management plan can prevent small problems from developing into large ones. Different types of risk management plans can deal with calculating the probability of an event, its impact on you, what risks constitute speculation, and how to minimize the problems associated with those risks. Planning can help you overcome and prevent difficult situations that may or may not occur [2].

As you know, all market prices are variable. You should not be afraid of mistakes in market activities, because none of them is safe, most importantly, do not repeat the mistakes, always adjust the system of actions in terms of maximum benefit. Historical experience shows that the risk of not getting the intended results, especially the generality of commodity-money relations, is reflected in the competition between the participants in the economic cycle.

Therefore, with the emergence and development of capitalist relations, various risk theories emerge, and the classics of economic theory place great emphasis on the study of risk problems in economic activity. The manager is designed to create additional opportunities to mitigate sharp fluctuations in the market. The main goal of management, especially in today's Russia, is that in the worst-case scenario, we can only talk about a slight decrease in profits, but in no case does the question of bankruptcy arise.

Therefore, special attention will be paid to risk management and continuous improvement of risk management. Risk management reflects the system of risk assessment, risk management and financial relationships that arise in the business process.

The level and magnitude of risk can be influenced by the financial mechanism implemented through strategy and financial management methods. This type of risk management mechanism is risk management. The basis of risk management is the organization of work to identify and reduce the risk [3].

Risk can be managed through a variety of measures that allow to predict of the occurrence of a certain level of risk and take timely measures to reduce the level of risk. The problem is that the uncertainty of the economic situation, the uncertainty of the conditions, the change in the political and economic situation and the prospects make the entrepreneur take the risk of these conditions.

The greater the uncertainty of the economic situation in decision-making, the higher the level of risk. It follows that the urgency of the problem is that changes in the external and internal environment of any organization, regardless of the stability

of the socio-political and economic situation, lead to the emergence of risks that need to be managed to achieve goals.

Figure 1. Risks Management Structures

Discussion

The main characteristics of risk are incompatibility, alternative and uncertainty. A feature such as risk mismatch leads to a conflict of objectively existing dangerous actions with their subjective assessments. There are initiatives, innovative ideas, the introduction of new promising activities, as well as conservatism, dogmatism, subjectivism and others, which accelerate the development of technology and affect public opinion and the spiritual environment of society.

Alternative means the need to choose one of two or more possible options for decisions, directions, actions. If there is no choice, then no dangerous situation arises and as a result, there is no danger. Uncertainty is the incompleteness or inaccuracy of information about the conditions of implementation of the project (solution).

The presence of risk is directly related to the presence of uncertainty that is heterogeneous in form and content. According to the source of occurrence, the risk is classified as an economic activity that is related to a person's personality and is influenced by natural factors.

As mentioned above, all operations in the market and, above all, investments are in some way related to risk, and market participants must always take on a variety of risks: loss of property, financial or losses, declining incomes, lost profits. It is therefore necessary to take into account different types of risks in each specific case [1].

This means that the effectiveness of risk management largely depends on the type that requires a science-based classification. Risk classification allows you to clearly define the place of each type of risk in their overall system and use the most effective methods and techniques appropriate to that type to manage it. Depending on the possible economic outcome of the decision, the risks can be divided into two

groups: pure and speculative. Pure risks mean the possibility of a negative (damage, loss) or zero results. This category of risks includes some of the natural, environmental, political, transport and commercial risks - manufacturing and trade.

Speculative risks are expressed in terms of the possibility of obtaining negative and positive (benefits, benefits) results. These include another part of commercial risk - financial. Depending on the underlying cause, the risks are divided into natural, environmental, political, transportation, and commercial.

- Natural hazards include the risk of losses as a result of the actions of natural forces of nature, such as economic damage as a result of earthquakes, floods, hurricanes, epidemics, and so on.
- Environmental risk - the possibility of loss or additional costs associated with environmental pollution.
- Political risk - the risk of property (financial) loss due to changes in the political system, the balance of political forces in society and political instability. Political risks are related to the socio-political situation in the country and the activities of the state and do not depend on the economic entity. These include the possibility of loss due to revolution, riots, nationalization of enterprises, confiscation of property, the imposition of embargoes, abandonment of previous obligations of the new government, and so on. Risks in this category may also include the risk of changes in legislation, ie. significant changes in regulatory documents governing economic activity, such as tax legislation, currency regulation legislation, and so on [2].
- Transport risk. The probability of loss associated with the carriage of goods by different modes of transport: road, rail, sea, air, etc.
- Commercial risks represent the probability of losses as a result of the business activities of business entities. According to the main types of business activities, this risk group is divided into production, trade and financial risks.
- Production risk - the possibility of losses or additional costs associated with the failure or cessation of production processes, violation of the technology of operations, low quality of raw materials or the work of personnel, etc.
- Trade risk - the risk of loss or loss of income due to non-performance of obligations by one of the parties, for example, non-delivery or late delivery of goods, delays in payments, etc.
- Financial risks are related to the possibility of losing financial resources (cash). They are divided into two types: risks associated with the purchasing power of money and risks associated with the capital investment (investment risks). Risks associated with the purchasing power of money include inflation and currency risks.
- Inflation risk - The risk of resulting gains
- Currency risk is associated with significant losses due to exchange rate fluctuations. This type of risk is particularly important and requires assessment when conducting export-import transactions and transactions with foreign exchange values.

Most economic evaluation and management decisions are probabilistic, multi-variable in nature. Therefore, errors and miscalculations are common, even if they are unpleasant. However, the manager should always strive to take into account the

potential risk and take certain measures to reduce its level and cover possible losses. This is, in fact, the essence of risk management (risk management).

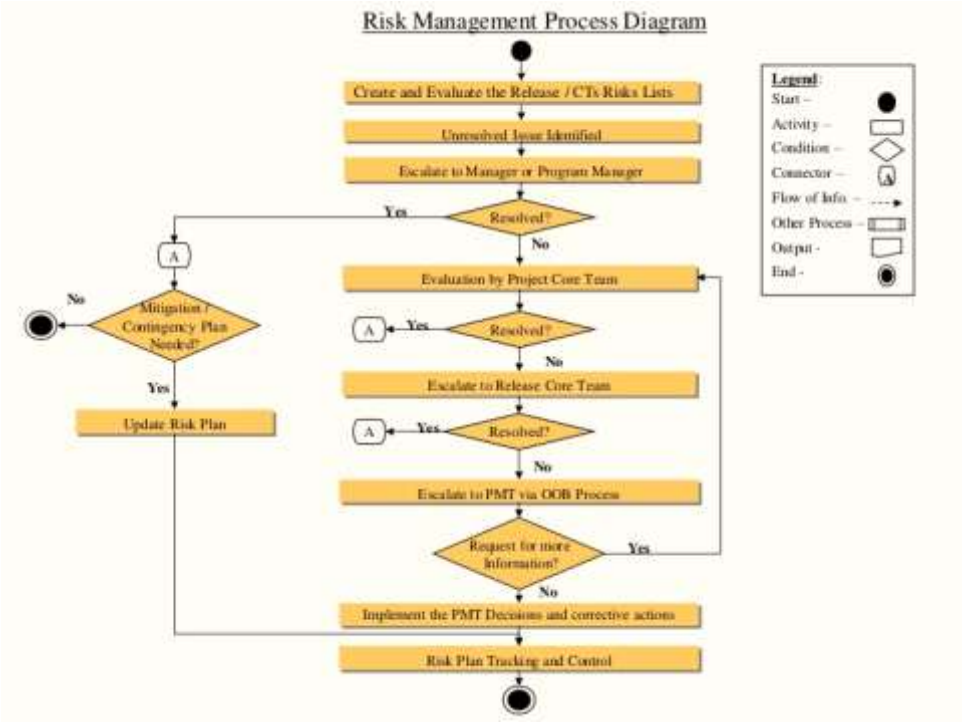

Figure 2. Risk Management Process Diagram

The main purpose of risk management (especially in the conditions of modern Russia) In the worst case, we can talk about the lack of profit, not about the bankruptcy of the organization. International business experience shows that most bankruptcies are caused by gross errors in management and miscalculations. Therefore, entrepreneurs and managers should pay special attention to effective risk management [4].

Quantitative measurement of risk can be determined by the absolute or relative degree of loss. In the absolute sense, the risk can be determined by the number of possible losses in physical (natural-material) or value (paid) form, in relative terms - the ratio of the number of potential losses to some base, for example, capital, total costs or benefits. In practice, the implementation of a particular management decision is, as a rule, complicated by the need to take into account not one but several types of risks.

In this regard, the overall level of risk determined by the risks of specific r. In this case, the specific risk can be determined by increasing or decreasing the minimum level of the relevant risk type (r 0 i) defined by a certain norm. In this case, it is important to determine the level of risk that could lead to bankruptcy. For this purpose, a loss ratio is calculated, which represents the ratio of the maximum possible loss and the amount of the investor's own funds.

TO r \ u003d U / S

loss of risk management

where *Tr* is the risk coefficient;

U is the maximum possible amount of losses;

S is the number of own funds.

Empirical studies show that the optimal risk coefficient is 0.3 and the critical level (leading to bankruptcy) is 0.7[6].

Conclusion

Risk management is a relatively new and rapidly evolving field of professional management in modern management. Special positions will be created for risk managers in commercial organizations to analyze, justify and make risk decisions.

Creating a risk management system in the organization involves:

- creating an effective system for evaluating and monitoring the decisions made;
- separation of a special unit or employee engaged in risk management;
- allocation of funds and formation of special reserves to insure against risk and cover possible losses.

The modern business world is developing rapidly. In the context of market contraction and the weakness of the ruble, enterprises are forced to comprehensively shape and develop their export potential, which requires additional restructuring of management.

In this regard, the risk management system that must be created by enterprises in one way or another can become a source of attractiveness for investors and a factor of success in foreign and domestic markets.

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INFORMATION ABOUT THE AUTHORS:

Azizbek Khurramov - Researcher of Samarkand Branch of Tashkent State University of Economics., Uzbekistan., E-mail: azizbek_khurramov@sbtsue.uz

Ibragim Mamadievich Ganiev - Scientific advisor, PhD, Associate Professor of Samarkand Branch of Tashkent State University of Economics., Uzbekistan., E-mail: ganievim@yandex.com

Mevlüt GÜL - Associate Professor of Isparta University of Applied Sciences., Faculty of Agriculture Department of Agriculture Economics., Turkey., E-mail: mevlutgul@isparta.edu.tr

Azamkhon Nasrullaev - Researcher of Samarkand Branch of Tashkent State University of Economics., Uzbekistan., E-mail: azamkhon_nasrullaev@sbtsue.uz

School
SOIL SCIENCE, AGROCHEMISTRY AND ECOLOGY

UDC 635-05

Baratova Mokhidil Rakhimovna
Andijan branch of Tashkent state Agrarian University, Uzbekistan
mbaratova1975@gmail.com

EFFICIENCY OF THE TECHNOLOGY OF GROWING ECOLOGICALLY POOR PUMPKIN WITH USING BIO STIMULATORS

Abstract

An improving of the technology of product growing is basic factor for increasing product volume in order to ameliorate of ensuring world people with food staffs. Using of bio stimulator in the conditions of grey pasture soil as an untraditional organic fertilizer had justified yourself from point of view economic efficiency. In the conditions of poster soil using bio stimulator as a untraditional fertilizer allows to increase a volume of humus in the structure earth.

Keywords: pumpkin, bio-stimulator, productivity, economic efficiency, seed-growing, humus, organic fertilizer.

Topicality of the problem

Improving of the technology of product growing is basic factor for increasing product volume in order to ameliorate of ensuring world people with food staffs. A pumpkin fruit has very important significance for satisfying population demand for food staff and industry with- in row material, so increasing its' productivity is one of the urgent problems in developing countries. It is scientifically justified that a pumpkin should be eaten by man during year systematically that is in constant volume. But, in order to achieve this goal available cultivated land should be used rationally and productivity has to increase intensively [10, p.212–216]. Cultivating sorts of the pumpkin had origin from America continent. If a pumpkin with big fruit originated from South America, but hard bark pumpkin from Northern America and Muscat pumpkin appeared in Central America and Southern Mexico. Results of the archaeological digs in America continent herald us that cultivated sorts of the pumpkin were known to humankind in the 3century BC. A pumpkin got Europe and Asia from America and it was wide spread in many countries of these continents. A pumpkin was sown in Portugal, Spain and France first of all. Pumpkins were brought to England in the beginning of XVIII century, but in the south part of Russia it begun to sow from XIX century. This culture was very wide spread in Kazakhstan and Central Asia region at that time [5, p.10–13].

A reason of necessity of growing pumpkin in huge volume is linked its' consumption and treatment peculiarities. That is pumpkin tree is a keeper of health of

human. A carbon water, oils and carbohydrates are additional food for man's health. A pump- kin structure has more than 50 useful biological active materials. Besides, pumpkin is reach for mineral salts' units, carbon waters, different oils, acrobatically acid, retinolum, thiamine, hepatoflavin, nicotine acid and vitamins. If C vitamin is missing in the human body it may cause such diseases zinc and anemia, if a vitamin is missing a body growth is slowdown and eye vision may get turbid. Vitamin B1 and Vitamin B2 enter ferments which are participating in the ex- change of oils and carbohydrates. In order to ensure an organism with vitamins A, B1 and B2 2–3,5 milligram necessarily to eat vitamin C50–120 мg and PP 15–25 мg during a day.

Growing ecologic poor product with using bio- simulators is advanced in such countries as France, Ukraine, Russia and Netherlands. For instance, in Sol province of Netherland organized growing poor potato without chemical drugs and fertilizers. That is, a potato is feeding with only organic fertilizers and fighting against diseases and insects are conduct by sing technical methods. 1 kg of this potato sell on the world market 8 euro per kg nevertheless consumers' potato grown with using mineral fertilizers sells on the world market 2 or 3 euro per kg.

However, it is worthy to underline that while significant steps had done in the world for growing ecological poor product, cultivating food products without using chemical drugs and by using bio stimulators is one of the very urgent tasks. First of all, this method ecological poor and secondly, very economical from point of view of production expenses. It means that conducting new scientific studies in this field is very actual problem of the society and science in Uzbekistan.

Uzbekistan is a developing country and reforms in agriculture sphere intended onto improving food supply of the population. 2007 year vegetables were sown on 159,8 hectare land, and received yield 4669,9 ton total crop, but in 2010 year a total volume of the crop was 6346,4 ton and per person product had been increased till 192 kg. This indicator was equal to 145 thousand ton in 2018 year. Vegetables and melon growing are one of the significant branches of the agriculture sphere in Uzbekistan, because on the available 3.5 mln arable land 213 hectar or 4,9 percent uses for growing vegetables melon growing and potato. Local experts underline that every per- son who lives in Central Asia region should eat 63,9 kg potato, 113 kg vegetables and 98 kg melon growing products per year. In order to satisfy claims of the health care organizations, 5–5,5 mln ton vegetables, 1,5 consumable potato, and 2,3–2,4 mln ton melon growing products should be cultivated for full satisfaction a demand of the Uzbekistans' population. Plant feeding is very significant for pumpkin growing especially for pumpkin's seed. Increasing productivity with additional feeding is very important and this information is obvious for many people [7, p.7–8] in the book "Vegetables and melon growing products seeds" pointed out to main key situations of the pump- kin's growing agriculture technics and very useful recommendations. They had gave very large recommendations about sowing chart: they outlined pumpkin sowing chart as **(330 × 70) × 100/2**. In this chart it is possible receiving 6600 seedlings per hectare. It was underlined that in this chart it is possible to receive 25–30 ton harvest from each hectare from pumpkin sorts Spanish-73 and Palov Kadu [7, p.8–12]. Three type of pumpkin growing in Uzbeksitan: maxima,

mascata and pepo. Spainish-73 is belongs to pumpkin with big fruit, “Palov Kadu” and “Qashqar” to mascat, and Kabachka and Patisson to hard bark sort.

It was conducted field experiment in Andijan region of Uzbekistan with an aim for increasing pump- kin productivity by applying bio stimulators technology, to select prospective sorts of pumpkin, to work out seed growing agriculture technology, developing recommendation to farm facilities for cultivation selected sorts on the fields. The next tasks were done during two years:

– to sow on the 0.5 hectar field of Andijan experimental scientific station the pumpkin Spanish-73 sort, 0.5 hectare of the experimental field of “Naynavo oqshomi” farm pumpkin sort “Palov Kadu – 268”;

– to learn an effect of the bio stimulators of “Verva”, “Uchqun”, “Super uchqun”, “Gossiprin” on pumpkin productivity and augment seeds;

– conducting phenologic observations in each variance;

– conducting bio metric measurements (length of the plant and its lateral leafs, number of the twigs);

– valuing of the seed fruits coming of morphological signs (heigth, width, diametr, color, cobweb, width of womb, epidermis thickness;

– defining productivity (fruit and seed);

– estimating economic effiency.

A methods of research

Methods of the conducting field experients, methods of conducting field researches on vegetables, melon growing and statistical data observations.

Places of field experiemnt, soil and climate conditions

Experiments conducted on the 0.5 hectare of experiemntal fields of the Andijan scientific experiemntal station of growing potatom vegetables and melon growing, and Andijan region “Shaxrixon” district “Naynavo” farm field in the 2018–2019 years. A weither of experiemntal fields seems similar because of they situated in one region and looks like identical with other farms specialized in growing vegetables on the plain lands of Uzbekistan. A temperature of the places very varyable, rainy, annual volume of precipitations is 200–225 мм. Relative humidity of the weither’s in summer season is averaged 35–40%. Winter season is cold and dew drop. The most cold month is January (–15,–18 grade). The most hot month is July. (+35, +44 grade).

Results of the field experiment

A). Preparing seeds to sow and growing them. Before sowing seeds were observed and defected ones had been separated by hand and planned to use 5 kg/he seed. Pumpkin’s sort Spanish-73 and Palov Kadu-268 were processed with bio stimulators of Verva, Uchqun, Super Uchqun and Gossiprin and then sown directly into earth. Sowing process was organized in this way: one day before sowing seeds had put into Verva, Uchqun, Super Uchqun and Gossiprin bio stimulators tincture in the proportion 200 ml/kg for infusion and then drying. Because of Uchqun and Super uchqun bio stimulators has liquid shape, Gossiprin one is powdery and Verva resinous, first of all they were weighted, then prepared tincture. As soon as seeds had grew out from earth they were processed within pitchblende fodder prepared with using 2 litr plant oil, 2 kg Clorophos chemical preparation and 40 kg oilcake per

hectare against such insects as rootworm, shortwire maggot and calfhead and etc. By means this method it was possible to save all seedlings:

1. For the 0,5 ga field spent 2,5 kg seed of pumpkin sort of Spanish-73.
2. For the 0,5 ga field spent 2,5 kg seed of pumpkin sort Palov Kadu 268.
3. For ensuring seeds growing up on time and smooth a soil humidity had been kept on the level 85–90%.
4. Using pitchblende fodder for saving seedlings from harmful insects gave positive results.

A field of increasing pumpkins' seeds. Seeds of the pumpkin were sown on the experimental fields on 10th April of 2018 year after processing with bio stimulators. Accordance of seed-growing methods, an isolated zone had been created in the size 1000 meter around experimental field. All agro technic tasks were carrying out strictly of claims of method of seed-growing.

Results of the phenological observation of field experiment

A time of grow out of seeds: seeds processed with bio stimulators were sown on 10th April of 2019 accordance of field design and satisfactorily watered. On the day of sowing a grade of air was observed +20 +22 oC and soil grade by

+18 +20 oC. As a result seeds grow out in the next time vary.

Table 1.– Andijan scientific experimental station field

Sort name	**Years**	**Time of sowing**	**1-v**	**2-v**	**3-v**	**4-v**	**5-v**
Spanish-73	2018	20.04	29.04	28.04	26.04	25.04	27.04
Spanish-73	2019	10.04	16.04	16.04	15.04	14.04	16.04

As it seeing above illustrated variables of table, day of grows out have some differences among variances on the Andijan scientific experimental station field. In first variance difference consists 6 days, in second variance 6 days, in third variance 5 days, in fourth variance 4 days and in fifth variance 6 days. But, in 2018 year in 1 variance 8.8 days, in 2 variance 8 days, in 3 variance 6.2 days, in 4 variance 5.2 days and in 5 variance 7.4 days.

Table 2.– Andijan branch of TSAU field

Sort name	**Years**	**Time sow**	**1-v**	**2-v**	**3-v**	**4-v**	**5-v**
Spanish-73	2018	20.04	29.04	28.04	26.04	25.04	27.04
Spanish-73	2019	10.04	16.04	16.04	15.04	14.04	16.04

As seen in the table above, grow-out of seed on the field of Andijan branch of TSAU in 2019 year in all variances had some differences: 1 day in 1 variance, 2 day in 2 variance, 5 day in 3 variance, 4 day in 4 variance, and 6 day in 5 variance. But, in 2018 year these variances had next differences: 1 variance 8.8 days, 2 variance 8 days, 3 variance 6.2 days, 4 variance 5.2 days, and in 5 variance 7.4 days.

Table 3.– "Naynavo oqshomi" farm filed

Sort name	**Years**	**Time of sow**	**1-v**	**2-v**	**3-v**	**4-v**	**5-v**
Palov Kadu- 268	2018	20.04	29.04	28.04	26.04	25.04	29.04
Palov Kadu – 268	2019	10.04	17.04	16.04	16.04	15.04	16.04

Grow-out of seed on the field of "Naynavo oqshomi" farm filed in 2019 year in all variances had some differences: 7 day in 1 variance, 6 day in 2 variance, 6 day in 3 variance, 5 day in 4 variance, and 6 day in 5 variance. But, in 2018 year these variances had next differences: in 1-variance 9 days, in 2-variance 8 days, in 3 variance 6.4 days, in 4 variance 5.2 days, and in 5 variance 7.8 days. Thus, during 2018 and 2019 years was observed that in the 3 and 4 variances seed grow out time was shortest than in other variances. A seed grow out in shortest time have the next positive sides: firstly – a time of plant growing shortening (fruit got ripe quickly), secondly – a level of decay and getting harmful from ground thrust decreased comparing with control variance in spring season of year.

Agro technique actions (fertilize, watering, chop) carry out had been organized coming of the recommendations of the textbook "Seed-growing of vegetables and melon growing" of R. A. Rakhimov,

A. S. Khakimov and A. A. Toshmuhammedov [3]. Although in all variances agriculture technology tasks were carry out similarly depends on the bio stimulators feed quantity it was observed differences in the phases of plant growing and evolvement.

A time of budding phase

Table 4.– Andijan scientific experimental station field (Spanish-73 sort)

Years	**1-v**	**2-v**	**3-v**	**4-v**	**5-v**
2018	10.06	07.06	06.06	04.06	08.06
2019	24.05	22.05	21.05	19.05	23.05

If to compare phase of plants budding of 2019 and 2018 years, a time gap between grow out and total budding consisted 42 days in 1 variance, 40 days in 2 variance, 41 days in 3 variance, 40 days in 4 variance and 42 days in 5 variance in 2018 year. In 2019 these variables were: 38 days in 1 variance, 36 days in 2 variance, 36 days in 3 variance, 35 days in 4 variance and 37 days in 5 variance.

Table 5.– "Naynavo oqshomi" farm (Palov Kadu –268 sort):

Years	**1-v**	**2-v**	**3-v**	**4-v**	**5-v**
2018	08.06	07.06	04.06	03.06	06.06
2019	26.05	25.05	23.05	21.05	26.05

Comparing budding phase results in 2018 year had the next values from time grow out and total budding 40 days in 1-variance, 40 days in 2-variance, 39 days in

3-variance, 39 days in 4-variance, 38 days in 5-variance. In 2019 these variables were: 39 days in 1 variance, 39 days in 2 variance, 37 days in 3 variance, 36 days in 4 variance and 40 days in 5 variance. Shortening time of grow brought about to early flourishing of plants.

If to compare a phase of flourishing plant by sowing variances of 2018 year, there are next time disparities 1-variance 51 day, 2-variance 49 day, 3-variance 49 day, 4-variance 48 day and in variance 51 days but in 2019 year the next variables observed: 1-variance 49 day, 2-variance 45 day, 3-variance 43 day, 4-variance 43 day and 5-variance 46 days accordingly.

If to compare a phase of flourishing plant by sowing variances of 2018 year, there are next time disparities 1-variance 51 day, 2-variance 49 day, 3-variance 49 day, 4-variance 48 day and in variance 51 days and in 2019 year the next variables observed: 1-variance 49 day, 2-variance 45 day, 3-variance 43 day, 4-variance 43 day and 5-variance 46 days accordingly.

Flourishing phase of plants on the field “Naynavo” farm in 2018 year has the next time disparities by variances: 1-variance 51 day, 2-variance 50 day, 3-variance 51 day, 4-variance 51 day, 5-variance 48 days. In 2019 year these variables has next values: 1-variance 48 day, 2-variance 47 day, 3-variance 45 day, 4-variance 45 day, 5-variance 49 days. Besides, flourishing phase in 3 and 4 variances were early and when were used bio stimulators “Uchqun” and “Super uchqun” time of flourishing shortened. It allowed to enter the plants into phase of procreate earlier.

According of the above illustrated table data, in 3 and 4 variances lenth of leafs and and latter twigs number has similar values all experimental field of “Andijan scientific – experiment station”, and “Naynavo oqshomi” farm. This results’ allowed grow up qualitative and big fruits besides growing additional fruits on the latter twigs. As it seen above table calculated variables about phase of procreate on the all experimental fields in 3 and 4 variances began little bit early. If period of flourishing and procreating may match with beginning of hot days of summer season it is possible to observe falling of flovers and fruit elements. Accordance of the received results of from experiments in that variances when seeds were processed with bio stimulators “Uchqun” and “Super uchqun” phase of flourishing and procreating begins early. It allows to crease productivity and to improve quality of fruit. Pumpkin growth agro technics were carry out accordance of the methodical guide of the scientific research institute of vegetables, melon grown and potato studies.

Economic efficiency

Coming of the results about increasing productivity that a number of 6600 plant unit per hectare it was registered the next variables values:

Andijan scientific experimental station field. **Spanish-73 sort**

1- variance: control one, and total expenses not exceeded from indicated criterion indicated in the methodical guide. This was recognized as a zero expense. Productivity consisted 25,9 ton per hectare.

2- variance: 200 gram Gossiprin bio stimulator purchased for 20000 Uzbek soum and after processing seeds 5 kg were sown per 1 hectare. Exceeded expense was 20000 Uzbek soum for purchase bio stimulator Gossiprin. Yielded additional

crop was equal to 2300 kg pumpkin in the 2 variance. Taking into count that fact that market price for 1 кg pumpkin was 1000 Uzbek soum per kg, total profit consisted 2.3 million Uzbek soum. But, additional net profit consisted 2.280 million Uzbek soum that is "2300000–20000 =2280000".

3- variance: 200 gram Uchqun bio stimulator purchased for 20000 Uzbek soum and after processing 5 kg seeds were sown per 1hectare. Exceeded expense was 20000 Uzbek soum. Yielded additional crop was equal to 4300 kg in 3 variance. If to take into count that fact market price of 1 кg pumpkin was 1000 Uzbek soum, total profit consisted 4.3 million Uzbek soum. Additional net profit was equal to 4.280 million Uzbek soum that is "4300000–20000 = 4280000.

4- variance: 200 gram bio stimulator "Super- uchqun" purchased for 20000 Uzbek soum and after processing 5 kg seeds were sown per 1 hectare. Exceeded expense was 20000 Uzbek soum. Yielded additional crop in the 4 variance was equal to 6100 kg and if take into count market price 1000 Uzbek soum for 1 kg pumpkin, total profit consisted 6.1 million Uzbek soum. But, additional net profit was equal to 6100000–20000=6080000 Uzbek soum.

5- variance: 200 gram bio stimulator Verva purchased for 10000 Uzbek soum and after processing 5 kg seeds were sown per 1 kg. Exceeded expense was 10000 Uzbek soum. Yielded additional crop in the 5 variance was equal to 900 kg. Taking into count market price 1000 Uzbek soum per kg, total profit consisted 900000 Uzbek soum. Additional net profit was equal to 900000–10000=890000.

Table 6.– "Naynavo oqshomi" farm field. Palov Kadu –268 sort:

Variances	**Number fruits per plants**		**Weigh of fruit(кg)**		**Productivity (c/he)**	
	2018	**2019**	**2018**	**2019**	**2018**	**2019**
1	1.2	1.3	2.7	2.72	213	233
2	1.6	1.3	2.22	2.74	234	235
3	1.8	1.4	2.33	2.8	277	258
4	1.7	1.5	2.73	3.0	306	29.7
5	1.5	1.4	2.46	2.6	243	240

1 variance: control one, and total expenses not exceeded from indicated criterion indicated in the methodical guide. This was recognized as a zero expense. Productivity consisted 23,3 ton per hectare.

2- variance: 200 gram Gossiprin bio stimulator purchased for 20000 Uzbek soum and after processing seeds 5 kg were sown per 1 hectare. Exceeded expense was 20000 Uzbek soum for purchased bio stimulator Gossiprin. Yielded additional crop was equal to 200 kg pumpkin in the 2 variance. Taking into count that fact that market price for 1 кg pumpkin was 1000 Uzbek soum per kg, total profit consisted 200000 Uzbek soum. But, additional net profit consisted 198000 million Uzbek soum that is "2000000–20000 =198000".

3- variance: 200 gram Uchqun bio stimulator pur- chased for 20000 Uzbek soum and after processing 5 kg seeds were sown per 1hectare. Exceeded expense was

20000 Uzbek soum. Yielded additional crop was equal to 2500 kg in 3 variance. If to take into count that fact market price of 1 кg pumpkin was 1000 Uzbek soum, total profit consisted 2.5 million Uzbek soum. Additional net profit was equal to 2.5 million Uzbek soum that is "2500000–20000 =2480000.

4- variance: 200 gram bio stimulator "Super- uchqun" purchased for 20000 Uzbek soum and after processing 5 kg seeds were sown per 1 hectare. Exceeded expense was 20000 Uzbek soum. Yielded additional crop in the 4 variance was equal to 6400 kg and if take into count market price 1000 Uzbek soum for 1 kg pumpkin, total profit consisted 6.4 million Uzbek soum. But, additional net profit was equal to 6400000–20000=6380000 Uzbek soum.

5- variance: 200 gram bio stimulator Verva purchased for 10000 Uzbek soum and after processing 5 kg seeds were sown per 1 kg. Exceeded expense was 10000 Uzbek soum. Yielded additional crop in the 5 variance was equal to 700 kg. Taking into count market price 1000 Uzbek soum per kg, total profit consisted 700000 Uzbek soum. Additional net profit was equal to 700000–10000=690000.

Conclusion

1. Using of bio stimulator in the conditions of grey pasture soil as a untraditional organic fertilizer had justified yourself from point of view economic efficiency. Coming of above mentioned facts recommend to farm heads to use bio stimulator as the best organic fertilize for increasing pumpkin plants productivity.
2. In the conditions of poster soil using bio stimulator as a untraditional fertilizer allows to increase a volume of humus in the structure earth. Though humus had splatted during period of plant growing in the variances of experiment with comparing con- trol was observed exceeded volume on 0, 06–0, 05%.
3. During the period of growing mobile food elements in the field of experiment not changed. (in the beginning growing period, in the period of flourishing and in the end of harvesting).
4. Because of increased level of feeding elements in the variances 3 and 4 they affected on pumpkin's growth and evelvement positively. As a result it was observed high rates of height, crop elements and collected harvest on the field of experiment.
5. Coming of the results, Spanish-73 sort in the variances 3 and 4 productivity were high comparing with control one. In the control variance yielded per hectare 25,2 ton fruit, 136 of its seed of fruit, in the 2 variance 27,5 ton fruit and 157 kg seed, in the 3 variance 29.5 ton fruit and 175 kg seed, in the 4 variance 31.3 ton fruit and 209 kg seed, in the variance 26,1 ton fruit and 149 seed. A main result is that it was created gene pool of qualitative seed.
6. Using bio stimulators for growing pumpkin justify themselfes as a organic fertilizer from economic point of view. As showed in results of economic efficiency, in the 2 variance received 180000, in the 3-variance 2480000, 4-variance 6380000 and in the 5-variance 690000 Uzbek soum profit earned.

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INFORMATION ABOUT THE AUTHORS:

Baratova Mokhidil Rakhimovna – Teacher, Ph D. (Chemistry). Deputy Professor, Andijan branch of Tashkent state Agrarian University, Uzbekistan. E-mail: mbaratova1975@gmail.com

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Tajimuratov Bekpolat

Karakalpakstan institute of Agroculture and Agrotechnology,
Nukus, Republic of Uzbekistan
j.bahit2019@gmail.com

CULTIVATION CULTURAL PLANTS BY USING ATMOSPHERIC MOISTURE IN SANDY DESERT

Abstract

Introduction: In sandy desert soils, the cultivation of crops using rainwater is very important. This is because the demand for water in agriculture is growing from year to year. I think it is very important to plant crops in the sandy desert soil using rainwater in the early spring. biomass is a food chain for the various living creatures that live in it.Barley (Hordeum) is a family of annual and perennial herbaceous plants belonging to the cereal family. About 30 species are known in Eurasia and America. In agriculture, A. has been cultivated in Central Asia (Turkmenistan) since the 12th-10th millennia BC. Homeland Old Asia. Ekma A. (N. sativum) is grown in many countries around the world. According to their biological characteristics, A. is divided into spring and autumn species. A. The root set is poppy-like: the main root develops in the driving layer. Stems straw-like, 4-6 joints, height 30-35 cm to 130-134 cm. The leaf consists of a leaf blade, leaf sheath, tongue and ears, and is wider than the leaves of other cereals.

Keywords: Sandy desert soil, barley, millet, rainwater, cultivation, atmosphere moisture, Hydrogel, nitrogen, phosphorus, potassium, agrochemical property.

Introduction

Almostmmm 70% of the country's land area is located in the desert zone. Currently, almost 83% (more than half) of the area occupied by agriculture in the country is covered by arid areas (deserts, hills). Currently, the number of water sources is increasing from year to year due to the increase in water demand in the agricultural sector.

Methods and materials

It is known that in almost all countries in the arid zone there is a growing shortage of water from year to year. As a result, crop yields are declining due to unsatisfactory water demand, and lands are being abandoned due to water shortages. Therefore, it is necessary to make effective use of any water resources provided by people close to one person today [1 p.19.20].

Selection of three types of cultivated plants in desert conditions We first take into account the average conditions of plant cultivation in one line with the number of plant species in the center of the repair structure of cultivated plants. In the deserts, the most cultivated crops were tori, barley, corn, ayg abag ar, and soybean. These plants were planted in the first decade of March. Phenological control works were

carried out in April and May. In this case, the depth of repair along the wire and the composition of the sandy soils and humus were determined. In sandy soils, the Tori o plant is a water-tolerant plant that requires less water than other plants [2 p.7-10].

In the course of the research, the sandy deserts were experimentally fertilized using soil conditions, taking into account the fact that the height of barley from agricultural crops is less dependent on water. Initially, the experimental area was selected and the weight of 1000 barley elevations was measured on an analytical balance. (Average 37, 10 g obikor variety.) Field experiments to increase the height of in sandy deserts were carried out on the basis of the methodological manual " dala tajribalarini o'tkazish uslublari" In this case, the field experiment was conducted in a systematic (orderly) manner with 5 options and 3 iterations. (Figure 2). The experimental site is located in the area of open lakes (Round 2) in the city of Nukus. Nitrogen, phosphorus and hydrogel were planted at a depth of 4-5 cm in the sandy desert soil on January 16 accompanied by barley seed seeds.

Table - Agrochemical composition of sandy desert soils.) (Mg / kg)

Soil layer depth(sm)			
agrochemical composition **(mg/kg)**	**0-15 cm**	**15-30 cm**	**30-50 cm**
Humus	0,2	0,5	0.34
Nitrogen	0,03	0,08	0,05
Generally phosphorus	0,03	0,05	0,04
Potassium	1,2	1,6	1,4
Variable potassium	241	155	238.0
Variable potassium	26.4	29.0	24
Ph	6,88	7,11	6,8g
Phosphate	5,4	5,85	3,6
Sulfate	14,4	4,8	2.16
Zinc	11.1	3,08	1.33
Manganese	0,38	0,36	0,29

Results and discussion

In order to study the agrochemical composition of the soil of sandy deserts in the laboratory, it was brought from the field by envelope (at a depth of 0-15, 15-30, 30 - 50 cm) (nitrogen, phosphorus, potassium, manganese, phosphate, copper, zinc, dry residues, chromium, sulphate and pH balance), another chemical composition was determined in the laboratory. (List 1). Elements of sandy desert soils are obtained in relation to the interior of desert sands. The content of humus in sandy desert soils is 0, 2-0, 5, nitrogen 0, 01-0, 03, total phosphorus 0, 03-0, 05 and potassium 1, 2-2, 0%. active phosphorus 26, 0, exchangeable potassium 241, 0 mg / kgdi. The amount of trace element manganese (Mn) in sandy desert soils was determined from each layer of the soil. It would be known that 0, 38 mg / kg at a depth of 0-15 cm, 0, 36 mg / kg

at a depth of 15-30 cm, and 0.29 mg / kg at a depth of 30 -50 cm. It would be known that sandy desert soils have a relatively high nutrient content in the top soil.

Cultivation of barley 1.picture green barley by rain water.2.picture

Barley and millet ripened in sandy desert soil. 3.4-pictures
Figure 1

Conclusion

The following is a summary of the findings of the study.

1.Using rainwater, the crops sprouted and ripened in early spring. They got good results from barley and millet. The reason is that this year there was more rain and snow than last year.

1. Barley, millet, maize and corn were planted using atmospheric moisture , and by the end of may they were all green.

2. The height of barley began to sprout on April 30, and by the end of May it had reached 55 cm. (Figure 1). It has been proved that in the conditions of sandy deserts it is possible to plant crops using atmospheric activity.

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INFORMATION ABOUT THE AUTHORS

Tajimuratov Bekpolat Dastan uli – Doctoral student, field of agrochemical,Karakalpakstan institute of Agroculture and Agrotechnology, Nukus, Republic of Uzbekistan, j.bahit2019@gmail.com.

CONTENT

School
PROBLEMS OF ASSESSMENT AND MANAGEMENT OF NATURAL RESOURCES

School
GREEN ECONOMY

School
INNOVATIVE TECHNOLOGIES AND TECHNICAL MEANS IN AGRICULTURE

School
LAND AND FOREST MANAGEMENT

School
PLANT PRODUCTION MANAGEMENT

School
ORGANIC HORTICULTURE AND PLANT PROTECTION

School
VETERINARY MEDICINE IN BIOLOGICAL SAFETY

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