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N. Sh. Suleimenova[1], E. M. Kuandykova[1], M. Filipova[2]

[1]Kazakh National Agrarian University, Almaty, Kazakhstan,
[2]Angel Kanchev University of Ruse, Bulgaria.
E-mail: naziya44@gmail.com, 9Elnara@gmail.com e-mail, mfilipova@uni-ruse.bg

INNOVATIVE TECHNOLOGIES OF SOYBEAN CULTIVATION

Abstract. The effectiveness of innovative soybean technology solutions in solving ecological problems of the agroecosystem is reduced, which reduces the environmental burden on the environment in the scale of the cultivated crop. The ecological aspects of the application of mineral fertilizers in combination with the inoculation of soybean seeds, taking into account their biological characteristics, are described as one of the techniques of resource-saving technology aimed at maintaining the stability of the agroecosystem and increasing the productivity of soy. The possibility of replacing the main dump cultivation with fine planing (Mini-till), which provides a reliable restoration and preservation of the fertility of the soil resource, has been revealed. The obtained results indicate that mineral fertilizers contribute directly to the maximum height of soybean standing and the accumulation of dry matter. The introduction of mineral fertilizers in a dose of $P_{60}K_{30}$ provides an increase in linear growth of plants by 11-16% and with an increase in the dose to $N_{30}R_{60}K_{30}$ – by 21%. Rational use of the bioenergetic resource and biological potential of the culture studied, due to the ability of nitrogen fixation to bind atmospheric nitrogen, as a result of which the dose of nitrogen fertilizers used decreases, the norm of nitrogen fertilizer can be reduced, which contributes to the protection of the environment and the resource saving of the agroecosystem.

Keywords: agroecosystem, soybean, innovative technology, inoculation, Mini-till, recovery, productivity.

Introduction. In certain ecosystems its interaction with environment causes many negative consequences, changes in parameters, non-balancing of biogeochemical cycles, elements and level of soil fertility [1]. This refers to the agrarian sphere since agriculture takes a special place in ensuring balanced conditions for ecosystem's normal existence [2, 3]. According to Rattan Lal (2007), world agriculture has never met with such serious problems as in the first decades of the 21st century [4, 5]. These problems are caused by 7.6 billion population in 2017 and its expected increase from 9.6 to 13.2 billion by 2050 [6].

The constant and unceasing growth of the world's population creates an increasing need for food. To meet this demand, agrarians need to develop and implement more advanced and sophisticated innovative farming technologies that allow to obtain more yields per unit of area [7]. The role of agricultural production in providing the country with food, increasing employment and economic development of the republic unambiguously dominates [8, 9].

Therefore, agro-industrial complex faces an important current agroecological problem, connected with achieving goal of the industrial program for development of agro-industrial complex (AIC) of the Republic of Kazakhstan until 2020 [10, 11]. The tasks should be aimed at increasing the yield, acreage, introduction of techniques for intensive crop cultivation. But, at the moment, as a result of increasing frequency and re-occurrence of droughts and increasing aridity on territories of a number of agricultural zones of the republic, productivity of this production will probably decrease sharply. In regard to this, new innovative technologies in agriculture and diversification of crop production are needed to solve these problems.

It should be noted that development of innovative environmental technologies is one of the key conditions for sustainable economic growth, ensuring the competitiveness of its products on world markets. Also it's one of the most pressing issues currently being discussed in the world community. With

innovative new technology, production costs are reduced, it is possible to achieve great success in obtaining economic profit [12, 13]. That is why scientists are so interested in issues of continuous modernization and introduction of new perspective and innovative technologies. In context of our study, under environmentalization of agroecosystem's environment, the priority of scientific research is towards ensuring sustainable production of high-quality biological products, effective use of natural bioenergetic potential of cultivated crop and restoration of soil and energy resources.

According to the results of our research, this technology reduces ecological burden on the environment within the scope of cultivated crop, which is especially beneficial (from the economic point of view) for the agricultural enterprises themselves. The less fuel, energy, fertilizers, seeds, man-hours and other resources are expended on the production of a single unit, the lower its cost and the higher the profit from its sale.

Therefore, when developing techniques of innovative soybean technology, resource-saving optimal parameters for application of mineral fertilizers were identified, taking into account the biological characteristics of soybean. We studied the influence of $P_{60}K_{30}$ and $N_{30}P_{60}K_{30}$ aimed at improving environmental situation, maintaining the stability of agroecosystem and increasing productivity of soy.

This article highlights the effectiveness of innovative soybean technology - use of mineral fertilizers in combination with soybean seeds inoculation taking into account their biological characteristics. The possibility of replacing the main dump moldboard tillage with fine flat-cut tillage (Mini-till) can provide: firstly, the restoration of agrophysical indices of soil fertility, and secondly cost reduction of total energy (fuel consumption) by 21.8-28.4%, and production cost when applying resource-saving techniques of innovative technology in foothill zone conditions of southeast of Kazakhstan.

Methods and objects of research. The object of research is a unique leguminous crop – soybean (Eureka variety), short-rotational crop tillage. The traditional technology of soybean cultivation was used as a control in experiments, in accordance with recommendations of the System of Agriculture of Almaty oblast [14]. The classical techniques of field observations and experiments have been used [15, 16]. Field experiments were made in training and experimental farm "Agrouniversitet" in foothill zone conditions of southeast of Kazakhstan.

The experimental field's soil is resembled as onion-chestnut type of heavy mechanical composition. The humus content in the plow horizon is 4.3%, which gradually decreases with depth. The content of total nitrogen and total phosphorus is high - 0.258 and 0.211%, respectively [17]. The climate of the region is characterized as sharply continental with low humidity, plenty of sunlight, short, but cold winter.

Results of the research and discussions. The effectiveness of innovative methods of soybean technology, such as use of mineral fertilizers in combination with soybean seeds inoculation has been studied taking into account their biological characteristics. Various methods of cultivation technology such as the timing of sowing, depth and methods of seeding, inoculation of seeds, basic and presowing soil formation, etc. have a tremendous impact on activity of microorganisms, soil aeration and crop quality. And this, in turn, affects speed of nitrogen fixation.

During the study of resource-saving techniques of innovative technology, we tested two options for application of mineral fertilizers - $P_{60}K_{30}$ and - $N_{30}P_{60}K_{30}$ when treating seeds with nitragin and without treatment. To determine the influence and dosage of the studied variants and mineral fertilizers and study inoculation on activity of nodule formation and determining the optimum seeding rate, we studied 3 seeding rates of 400, 600 and 800 thousand pcs / ha with a row spacing of 30 cm.

In order to make a comparative evaluation of the studied norms of mineral fertilizers, inoculation and the rate of seeding we took as control - St soybean seeding without fertilizers with traditional technology.

To determine the influence of studied variants of mineral fertilizers' norms and inoculation on the activity of forming nodules, we studied 3 seeding rates of 400, 600 and 800 thousand pieces / ha. Studied variants of techniques have impact on growth and development of soybeans along with the aboveground part and the underground part of the culture. The main indicator of the effectiveness of symbiosis of plants and nodule bacteria is their number and mass.

Observations and calculations of the amount of formed nodules and their mass under traditional technology in studied seeding rate variants without inoculation showed that very few nodules of 9.7- 12.4 pieces per plant were formed on the roots of soy. Their number increases in case of seed inoculation with nitragin. In variants with nitragin inoculation but without fertilizers, the number of nodules increases

depending on the seeding rate from 16.2 pcs. up to 21.0 pieces on one plant. When $N_{60}P_{180}K_{90}$ mineral fertilizers were applied in recommended dose on the control variant of traditional technology, the formation of nitrogen-fixing nodules increases up to 27.7 and 29.5 pc/plant, while the weight of dry nodules is 124.6-137.1 mg/plant.

Under resource-saving technology seed inoculation with nitragin has a significant positive effect on formation of nodules where the number of nodules increases to 24.5-29.1 pcs/plant, depending on the seed sowing rate. When applying $P_{60}K_{30}$ – 35.1-38.0, when applying $N_{30}P_{60}K_{30}$ fertilizers this pattern of dependence of nodule formation is maintained and makes 39.4-47.6 pcs/plant (in case of resource-saving Mini-tillage on depth of 16-18 cm). And, the mass of nodules increases in the same sequence as the number of nodules in the variants. The increase of these indicators proves the rational use of bioenergetic resource and the biological potential of studied culture, due to the ability of nitrogen fixation to bind atmospheric nitrogen, which decreases the dose of used nitrogen fertilizers (thereby reducing the nitrogen fertilizer rate by 25-50%), which contributes to environmental protection and resource saving agro-ecosystem.

In interpreting obtained experimental data, we noted that advantages of resource-saving methods of innovative technologies are: - a reduction in the number of technological operations for soil processing, - restoring, maintaining and increasing soil fertility, - improving the ecology of the ecosystem and reducing current costs.

In existing traditional system, which is adopted for the control variant, a number of tillage methods are performed in a certain sequence. As a result, environmental problems arise, such as excessive soil spraying and drying, deterioration of soil resources indicators, increase in financial and energy costs. The share of tillage accounts for 30-40 percent of all costs. Therefore, it is necessary to focus on effective and environmentally friendly innovative methods of cultivation technologies, such as minimal tillage.

The results of soil fertility monitoring in studying the effect of minimal soil cultivation on soil resources (soil fertility) made it possible to give a comparative assessment of the arable layer and soil composition and structure comparing to traditional and resource-saving technologies. In traditional technologies system of dump moldboard tillage processing, the arable layer is characterized by a more loose composition with a high total porosity and degree of aeration, which is not desirable.

According to many researches the density leaves an imprint on the whole complex of soil's physical conditions, on its hydro, aerial, thermal regimes and, consequently, on conditions of agroecosystem's biological activity. When soy is cultivated, optimal aeration of the upper soil layer is very important, in which the root system of plants and nodule nitrogen-fixing bacteria normally function. Therefore, at present, both domestic and foreign scientists study the soil treatment system in terms of regulating soil density.

Under the conditions of our research, composition of arable layer of soil has been studied in dynamics over the phases of soybean development. During the initial period of plant development, soil density under traditional cultivation technology is much lower. In period of soybean sowing associated with the preparation of soil for sowing, the bulk mass of the soil is within the limits of 0.89 and 0.95 g/cm^3. The arable layer has a loose constitution with a large porosity, which causes an accelerated physical evaporation of soil moisture, after that the water regime of the root-forming layer of nodule formation decreases.

In this variant of traditional technology, the bulk mass of the soil increases in the developmental phases from 0.95 to 1.19 g/cm^3. The average density of soil during the vegetation period of soy is 1.06 g/cm^3.

With application of minimal tillage variants, the soil density becomes 1.14-1.15 g/cm^3. During the vegetative period, the regularity in structure of arable layer of soil is characterized by minimal tillage variant of study. During the periods of growth and development of soybean, the density of the soil is characterized by the bulk increase of mass with flat-cut soil tillage for the depth of 16-18 cm from 1.16 g/cm^3 (sprouting phase) to 1.24 g/cm^3 (ripening), where average density in vegetation is 1.20 g/cm^3.

In case of a minimal flat-cut tillage for the depth of 12-14 cm, composition of arable layer has a more dense build-up, the bulk mass of the soil increases from 1.17 g/cm^3 (sprouting phase) to 1.27 g/cm^3 (ripening), where the average density for vegetation is 1.22 g/cm^3.

It should be noted that under resource-saving technology, minimization of soil cultivation has resulted in a reliable preservation and restoration of soil fertility indicators due to changes of arable soil

layer's composition. In variants with minimal (Mini-Till) technology of tillage, the soil density is optimized in comparison with the traditional treatment, the volume mass of the arable layer increases by 0.14-0.16 g/cm^3, optimal density approaches the equilibrium of 1.20-1.22 g/cm^3 of soil, where develop favorable environmental conditions for growth and development of soybean plants (table 1).

Table 1 – The influence of the mini-till technology on the structure of the arable layer and the structural properties of soil in terms of density, g/cm^3 (average over 2015-2017)

Tech-nology	Variants of mini-tillage	Structural properties of the arable (0-20 cm) soil layer									
		Soil density over the phases of soya development, g/cm^3							Macro-struc-tured-ness, %	Σ of water stable soil aggregates, %	Coef-ficient of structu-redness
		Sow-ing	Shoo-ting	Bran-ching	Flowe-ring	Bean formation	Ripe-ning	Ave-rage			
Tradi-tional	Plowing to the depth of 20-22 cm	0.89	0.95	1.02	1.08	1.12	1.19	1.06	32.1	23.5	0.63
Resource-saving	Tilling the soil to the depth of 16-18 cm without ploughing	1.14	1.16	1.19	1.20	1.22	1.24	1.20	43.2	38.1	0.84
	Tilling the soil to the depth of 12-14 cm without ploughing	1.15	1.17	1.20	1.21	1.25	1.27	1.22	51.7	39.2	0.89

Along with optimization of arable soil layer's structure the techniques of resource-saving technology have a significant effect on aggregate composition and structure of soil. As can be seen from the table, in comparison to traditional technology with dump plowing, the sum of macroaggregates of the arable layer of soil is 32.1%, and the sum of water-resistant aggregates is 23.5%, with a structural coefficient only 0.63. The results of agrophysical indices of this technology characterize the deterioration of the soil structure. Decrease in these indicators greatly reduces the most important processes occurring in the soil, primarily aerial, hydro and thermo regimes, and this leads to a decrease in growth and development of soy. It is especially important to ensure optimum parameters of soil porosity during the flowering phase - the bean formation, when the symbiotic soybean apparatus reaches its maximum development and the lack of air during this period can lead to low nitrogen uptake and, as a consequence, shortage of harvest. Minimal tillage of the soil resulted in a reliable preservation and increase of agrophysical indicators of soil fertility. Comparing to resource-saving technology, flat-cut minimal-tillage (Mini-Till) showed that the sum of soil macroaggregates rises from 32.1% to 43.2 - 51.7%, and the sum of water-resistant aggregates from 23.5%, to 38.1 – 39.2% and the structural coefficient from 0.63 to 0.84 - 0.89.

Decreasing the number of mechanical influences by 2 times with the minimum (Mini-Till) technology of soil cultivation provides an increase of aggregates' water resistance which is especially important in soybeans cultivation in irrigation conditions. Since the symbiotrophic process is aerobic, the optimization of air regime in the active root layer has particular importance

The aggregate composition improves, soil structure restores and air regime of agroecosystem becomes optimized in cases where large nodules of nitrogen-fixing bacteria are formed on soybean roots.

Based on the results obtained, it is proved that the application of minimal (Mini-Till) soil cultivation increases the stability of soil's ecological condition, ensures stabilization of arable soil structure for optimal growth and development of soybean in southeast of Kazakhstan.

The obtained results indicate that mineral fertilizers contribute directly to the maximum height of soybean standing and accumulation of dry matter. The introduction of mineral fertilizers in a dose of $P_{60}K_{30}$ provide an increase in linear growth of plants by 11-16%, and dose increase to $N_{30}R_{60}K_{30}$ - by 21% and accumulation of solids increases at appropriate doses within 9% and 12%, which is associated with improved supply of food elements with nutrients. The height of plants during the years of research varied between 47.3 and 70.7. It grew with increasing seeding rate.

In regular soybean sowing with a width of 30 cm, the smallest plant height of 40.3 cm was noted in the variants with the lowest seeding rate, and with an increase of up to 800 thousand pieces/ha, it reached 63.5 cm. This is due to the fact that light regime improvement stimulates an increase in plant height. The height of lower beans' attachment directly depended on the height of the plants and changed with it. The average number of grains in soya beans varied from 1.6 to 2.5 per year, the weight of 1000 seeds varied from 104.8 to 142.4 g.

The use of nitragin has a symbiotic effect, increases the number and weight of nodules on the roots of soybean plants, which improve the nitrogen nutrition of crops, with the subsequent increase in the productivity of the crop (table 2).

Table 2 – Productivity of soybean depending on use of mineral fertilizers with inoculation during the years of research, centner/ha

Technology	Variants of using fertilizers	Yield during years of research, c/ha			Average yield, c/ha	Increase in	
		2015	2016	2017		c/ha	%
Traditional	W/t fertilizers	18.1	20.0	21.2	19.8	St	–
	Nitragin	18.9	23.1	23.8	21.9	2.1	10.6
	$N_{60}P_{180}K_{90}$	23.0	26.8	28.2	26.0	6.2	31.3
Resourse- saving flat-cut tillage for depth of 16-18 cm	Nitragin	22.0	22.4	23.7	22.7	2.9	14.6
	$P_{60}K_{30}$	22.7	27.7	26.1	25.5	5.7	28.7
	$N_{30}P_{60}K_{30}$	24.3	28.9	27.5	26.9	7.1	35.8
Resourse- saving flat-cut tillage for depth of 12-14 cm	Nitragin	23.5	24.6	23.9	24.0	4.2	21.2
	$P_{60}K_{30}$	25.8	25.1	26.2	25.7	5.9	29.7
	$N_{30}P_{60}K_{30}$	27.2	24.3	27.4	26.3	6.5	32.8
HCP_{05}, centners/ha =		1.85	2.15	2.3			
S_x, % =		2.75	3.06	3.87			

Under resource-saving technology on the background of phosphate-potassium fertilizer ($P_{60}K_{30}$), the yield of soybeans rises to 25.5 c/ha, which is 28.7%, providing an increase in yield of 5.7 c/ha and full fertilization ($N_{30}R_{60}K_{30}$) provides 26.9 c/ha (35.8%) and an additional yield of up to 7.1 c/ha.

A comparative assessment of soybean responsiveness to the level of mineral nutrition showed that, due to its physiological characteristics, the soybean reacts distinctly to changes in the nutrient regime of soil. Introduction of phosphorus and potassium fertilizers against the background of seed treatment with nitragin increases the yield of soybeans to 25.7 c/ha ($P_{60}K_{30}$) and to 26.3 c/ha ($N_{30}R_{60}K_{30}$).

The yield of soybean grain showed a higher yield increase from using mineral fertilizers with inoculation: 6.5 - 7.1 c/ha compared to the control harvest.

Under traditional technology, seed inoculation provides a yield increase of 2.1 c/ha, while in case of resource-saving technology this difference is 5.7-5.9 c/ha (at a dose of $P_{60}K_{30}$) and 6.5-7.1 c/ha (at a dose of $N_{30}R_{60}K_{30}$). Joint application of mineral fertilizers and inoculation with resource-saving technology creates favorable conditions for the synthesis and accumulation of biomass. Moreover, a higher effect of inoculation was observed in variants without fertilizers and with application of mineral fertilizers $P_{60}K_{30}$.

Thus, it was revealed that in conditions of southeast of Kazakhstan primary scientifically justified methods of increasing soil fertility and soybean yield are the application of optimal dose of mineral fertilizers and inoculation of soybean seeds with use of resource-saving techniques of innovative technologies that allow to quickly monitor agroecosystem's ecological situation. Thus, they are among the main methods for stabilizing soil, biological resources, providing energy and maintaining agroecosystem's resource saving.

Conclusion. The norms for introduction of mineral fertilizers ($P_{60}K_{30}$) in combination with inoculation of soybean seeds, by taking into account biological characteristics, are optimal, as one of the methods of resource-saving technology and are aimed toards improving ecological situation, maintaining

stability of agroecosystem (soil structure and water resistance of the aggregates are restored) and increasing productivity (additional yield up to 7.1 centner/ha.) of soybeans.

The possibility of replacing the basic dump cultivation with fine flat-cut (Mini-till) tillage, where:

- firstly, the aggregate composition improves, the soil structure restores and the air regime of the agroecosystem becomes optimized in case where large nodules of nitrogen-fixing bacteria are formed on soybean roots;

- Secondly, it reduces the costs of aggregate energy (fuel consumption) by 21.8-28.4% and raises yields while using resource-saving techniques of innovative technology in foothill zone of the southeast of Kazakhstan.

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Н. Ш. Сулейменова[1], Э. М. Куандыкова[1], М. Филипова[2]

[1]Казахский национальный аграрный университет, Алматы, Казахстан,
[2]Русенский университет им. Ангел Кънчева, Русе, Болгария

ИННОВАЦИОННЫЕ ТЕХНОЛОГИИ ВОЗДЕЛЫВАНИЯ СОИ

Аннотация. Освящена эффективность приемов инновационной технологии сои в решении экологических проблем агроэкосистемы, которые снижают экологическую нагрузку на окружающую среду в масштабах возделываемой культуры. Изложены экологические аспекты применения минеральных удобрений в сочетании с инокуляцией семян сои с учетом их биологических особенностей, как один из приемов ресурсосберегающей технологии направленные на поддержание стабильности агроэкосистемы и повышение продуктивности сои. Выявлено возможность замены основной отвальной обработки почвы с мелкой плоскорезной обработкой (Mini-till), обеспечивающие достоверное восстановление и сохранение плодородия почвенного ресурса. Полученные результаты свидетельствует о том, что минеральные удобрения непосредственно способствуют достижению наибольшей высоты стояния сои и накоплению сухого вещества. Внесение минеральных удобрений в дозе $P_{60}K_{30}$ обеспечивает увеличение линейного роста растений на 11-16% и при увеличении дозы до $N_{30}P_{60}K_{30}$ – на 21%.

Рациональное использование биоэнергетического ресурса и биологического потенциала самой изучаемой культуры, благодаря способности азотфиксации связывать атмосферный азот, вследствие чего снижается доза применяемых азотных удобрений позволяет уменьшить норму азотного удобрения, что способствует защите окружающей среды и ресурсосбережения агроэкосистемы.

Ключевые слова: агроэкосистема, соя, инновационная технология, инокуляция, Mini-till, восстановление, урожайность.

Н. Ш. Сулейменова[1], Э. М. Куандыкова[1], М. Филипова[2]

[1]Қазақ ұлттық аграрлық университеті, Алматы, Қазақстан,
[2]Ангел Кънчев атындағы Русе университеті, Русе, Болгария

МАЙБҰРШАҚ ӨСІРУДІҢ ИННОВАЦИЯЛЫҚ ТЕХНОЛОГИЯЛАРЫ

Аннотация. Мақалада агроэкожүйенің экологиялық мәселелерін шешуде майбұршақ дақылын өсірудің инновациялық технологиясының тиімділігі баяндалады, бұл егістік өнімділігіне және қоршаған ортаға экологиялық жағдайын жақсартуға, ресурстарды үнемдеуге ықпал етеді. Минералды тыңайтқыштарды қолданудың экологиялық аспектілері олардың биологиялық сипаттамалары ескеріліп, майбұршақ дәндерінің егуімен ұштастыра отырып, агроэкожүйенің тұрақтылығын сақтауға және майбұршақ өнімділігін арттыруға бағытталған ресурс үнемдеу технологиясының әдісі ретінде қарастырылады. Топырақты минималды шығынмен сыдыра жырту (Mini-till) әдісімен ауыстырудың маңыздылығын дәлелдеуде, агроэкожүйенің тиімді экологиялық жағдайын қамтамасыз ететін, топырақ ресурстарының құнарлығын қалпына келтіреді және сақтап қалады. Алынған нәтижелер бойынша минералды тыңайтқыштардың әсері майбұршақтың биіктігіне және құрғақ заттардың жинақталуына тікелей әсер ететіні айқындалды. $P_{60}K_{30}$ мөлшерінде минералды тыңайтқыштарды қолдану өсімдіктің өсуін 11-16%-ға және $N_{30}P_{60}K_{30}$ мөлшерде 21%-ға дейін арттыруға мүмкіндік береді. Зерттелініп отырған майбұршақ дақылында агроэкожүйесінің өнімділігін арттыру мақсатында биоэнергетикалық ресурсты және биологиялық потенциалды рационалды пайдалану, азотфиксация қабілетіне байланысты – атмосфералық азотты байланыстырады, соның салдарынан қолданбалы азотты тыңайтқыштардың дозасы азаяды, бұл қоршаған ортаны қорғауға және агроэкожүйенің ресурстық үнемдеуіне ықпал етеді.

Түйін сөздер: агроэкожүйе, майбұршақ, инновациялық технологиялар, инокуляция, Mini-till, қалпына келтіру, өнімділік.

Information about authors:

Suleimenova Nazia Shukenovna – doctor of agricultural sciences, professor, Kazakh National Agrarian University, Almaty, Kazakhstan; naziya44@gmail.com; ORCID 0000-0002-3458-3799

Kuandykova Elnara Marzakeevna – PhD, Kazakh National Agrarian University, Almaty, Kazakhstan; 9Elnara@gmail.com e-mail; ORCID 0000-0001-8768-086X

Filipova Margaritka – PhD Associate Professor, Angel Kanchev University of Ruse, Bulgaria; mfilipova@uni-ruse.bg

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K. Zh. Tagayev[1], A. I. Morgounov[2], M. A. Yessimbekova[3], A. I. Abugalieya[3], G. O. Bayadilova[1]

[1]Kazakh National Agrarian University, Almaty, Kazakhstan,
[2]International Maize and Wheat Improvement Center (CIMMYT), Ankara, Turkey,
[3]Kazakh Research Institute of Agriculture and Plant Growing, Almalybak village, Almaty region, Kazakhstan

EFFECT OF COMMON BUNT INFECTION ON AGRONOMIC TRAITS AND RESISTANCE IN WINTER WHEAT LINES

Abstract. Common bunt (*Tilletia caries*) is a seed transmitted fungal disease in wheat. The resistance cultivars and lines of wheat should use to control this type of diseases in organic farming. A set of 75 wheat cultivars and lines from IWWIP of Turkey used. During the period 2016-2017, an experiment was carried out at the Kazakh Research Institute of Agriculture and Growing in an artificially inoculated nursery. The susceptible check, GEREK 79, had a high level of susceptibility to common bunt with 59.7% infected heads. The high mean disease incidence in the nursery was 74.4%. The sixteen genotypes were resistant to disease under artificial inoculation. The forty-two wheat genotypes (56% of all genotypes) expressed moderate resistance, which infected around 2.0-27.3% of ears. The wheat lines had different levels of agronomic traits under artificial inoculation of common bunt. The productivity of wheat genotypes under artificial infection ranged from 1.13 to 7.29 t/ha. The expected strong positive correlation was detected between the grain number and grain weight (r = 0.7), between the grain weight and TKW (r = 0.75) and the grain weight and total grain weight (r = 0.79). The negative correlation was found between the bunted ears and all agronomic traits. Identified resistance genotypes will be useful for breeding programs to forming resistance cultivars to common bunt in Kazakhstan.

Keywords: wheat, wheat cultivars, wheat lines, common bunt, resistance, productivity.

The Kazakhstan is one of the major wheat producers in the world. The climatic conditions on the north are very favorable to cultivate cereals crops. The total area planted to wheat in the country represents over 85% of total cereal production. Currently Kazakhstan produces 18-20 million tons of wheat grain, but output is highly dependent on weather and in recent years has fluctuated between 10 and 17 million tons. Kazakhstan is a major exporter of wheat and plays an important role in the food security of Central Asia [1]. However, diseases and pests also play an important role in yield reduction in Kazakhstan. Common bunt, caused by *Tilletiatritici* (Bjerk.) G. Wint. *In* Rabenh. [syn. *T. caries* (DC.) Tul. & C. Tul.) and *T. laevis* Kuhn *in* Rabenh. (syn. *T. foetida* (Wallr.) Liro.], has occurred in all wheat-growing countries of the world [2, 3]. The diseaseis largely spread in all wheat-growing regions [4]. The spores which are left on the surface of the contaminated seeds are systematically developing and multiplying, year by year, inside the growing wheat plants, when the plant reaches maturity, they transform the core of the wheat kernels into toxic fungus spores. In case of heavy incidence it is not possible to use the seed as food or feed. It causes yield loss in common wheat [5, 6] and reduces grain quality [7]. Already low doses of the spores represent a problem for seed sales and multiplication. The spores contain trimethylamine causing an unpleasant odour. Although chemical seed treatments can effectively control these diseases, especially common bunt, resistant cultivars remain desirable for bunt management in developing countries [8], for organic production of wheat, and as a lower-cost alternative to chemical treatment [9]. Although the chemical treatment of wheat seed for the control of common bunt is widely used, genetic resistance of wheat is an important part of the bunt control in many countries, especially on organic farms. Resistant varieties may reduce the losses due to bunt infection [10]. The most economic and effective way of

controlling common bunt of wheat is using bunt resistance cultivars [11-13]. It is important to identify sources of wheat resistance to common bunt in order to use resistant varieties and to develop resistant cultivars through breeding effort. Testing for resistance to *Tilletia spp*. and identification of new sources of resistance are necessary especially under organic farming conditions [14]. Estimating the level of common bunt resistance is time consuming due to the need to wait until the symptoms are expressed. Symptoms happen when the grain filling period is nearly complete. The symptoms sometimes are only expressed on the last spikes formed, and the symptoms often are only expressed in a few of the florets [11]. So, understanding the effect of the common bunt on earlier agronomic traits would help in identifying the trait associated with the resistance and hence the ability to select resistant genotypes earlier rather than waiting until plant maturity. For example, it was reported that common bunt has an effect on plant height, number of heads and root length of heads [15].

Our aim of this study was to evaluate agronomic traits and resistance of wheat cultivars and lines to common bunt under artificial infection. The approach of this study was to study the effect of common bunt infection on some easily measured agronomic traits in a set of seventy-five International common bunt nursery's winter wheat genotypes. Also identification resistant and susceptiblegenotypes to know if there are differences in the response of theagronomic traits to the disease in order to determine if we can use anagronomic trait as an indicator for the level of resistance to common bunt.

Materials and methods. A set of 75 winter wheat lines from Common Bunt Resistant Nursery (CBUNT- RN 2015-2016) were used to study effect of common bunt on some important agronomic traits. This nursery was performed and distributed by the International Winter Wheat Improvement Program of Turkey and combined different type of germplasm resistant to common bunt (75 wheat genotypes from 7 countries –Turkey, Iran, Kazakhstan, Mexico, Romania, Russia, and USA). The experiments of artificial inoculation with spores of common bunt were organized in the field, in the agricultural research blocks of Kazakh Research Institute of Agriculture and Growing, Almalybak, Almaty region, Kazakhstan, in the period 2016-2017. The experiments were carried out in randomized complete blocks with three repetitions. After inoculation, approximately 150 seeds have sown from each germplasm. Artificial inoculation of the seeds with spores has done by methods A.I. Borrgardt-Anpilogova [16], using a mixture of isolates of southeast part of Kazakhstan. The spores were obtained sampling natural infected plants from the field, from Scientific Research Institute for Biological Safety Problems, Otar, Kazakhstan. The doses of spores used for inoculation vary a lot [17]. In order to provide a total infection, the wheat cultivars and lines were treated separately with a higher inoculation dose of 0.08 g spores/150 seeds [18]. A winter wheat resistant (MUFITBEY and NACIBEY) and susceptible checks (GEREK79) were included to confirm the effectiveness of the common bunt inoculation protocol. The seeds were sown in the autumn and in the next year, at the heading stage, the disease could be detected in the field. The specific symptoms were evaluated at the heading stage by the visual inspection of the spikes in the month of June, when we could observe, at the infected plants, the dark coloured spikes, the spreading of the glumes and, at the maturity, the grains content transformed into a mass of dark coloured spores. The evaluation tests provided by scale Krivchenko, level of percent (%) of infected ears [19]. The resistance evaluation have done by reporting the number of susceptible plants to the total number of plants. The plant height was measured during ripening stage as the height of the plant from the ground to the tip of the plant. The length of the head was measured from the base of the head to the tip after the plants completely emerged. Number of spike was measured by counting of all spikes in one plant. The number of grain per spike was measured by counting all the grains in one general spike. The grain weight per spike, 1000 kernel weight and total grain weight were measured on mature plants that had not been watered for seven days as the average grain weight, weight of 1000 grains and weight of all grains, respectively. Statistical and correlation analysis were provided using Excel 2010.

Results and discussion. Resistance to common bunt. A mixture of common bunt teliospores from races for field in southeast part of Kazakhstan induced a different reaction on wheat lines of International CBUNT Nursery. The winter susceptible check, GEREK 79, had a high level of susceptibility to common bunt with 59.7% infected heads (table). This high level of infection in the susceptible check on cultivar GEREK 79 confirmed that the common bunt infection was successful. Goates (1996) [3] suggested that common bunt resistance evaluation should be considered valid when a susceptible check had more than 50% infected heads. The two resistance winter genotypes, MUFITBEY and NACIBEY, had similar

degrees of resistance with 10.1 and 2.0% infected heads, respectively. The high mean disease incidencein the nursery was 74.4%. Among 75 lines tested genotypes from CBUNT International nursery, 16 genotypes were resistant to disease under artificial inoculation:

PBW343*2/KUKUNA//ATAY/CALVEZ/3/ATAY/GALVEZ87, ORKINOS-1/SUNR23//SONMEZ, ATAY/GALVEZ87/6/TAST/SPRW/4/ROM-TAST/BON/3/DIDO//SU92/CI13645/5/F130L.12, MADSEN/MALCOLM//ZARGANA-9/3/BURBOT-6, RINA-6/ORKINOS-7, DE9//MERGAN-2, ORKINOS-1*2/3/AUS GS50AT34/SUNCO//CUNNINGHAM, KS902709-B-5-1/BURBOT-4, RANA96/GANSU-3, RINA-6/BEZ/NAD//KZM(ES85.24)/3/F900K, ALMT*3/7/VEE/CMH77A.917//VEE/6/CMH79A.955/4/AGA/3/SN64*4/CNO67//INIA66/5/NAC, BEZOSTAYA/AE.CYLINDRICA, BEZOSTAYA/TR.MILITINAE//TR.MILITINAE-6, BEZOSTAYA/TR.MILITINAE// TR.MILITINAE-4,CV.RODINA/AE/SPELTOIDES(10 KR) and OSTROV. It is 21.3% of all studied wheat genotypes. The other 42 wheat genotypes (56% of all genotypes) expressed moderate resistance, which infected around 2.0-27.3% of ears. Ten wheat lines were susceptible (31.4-48.2% infected ears) and seven lines were very susceptible(up to 50% infected ears) to common bunt infection.

Common bunt resistance and agronomic traits of wheat genotypes

#	Name of wheat lines	Plant height, Cm	Head length, Cm	Spike number	Grain number/ Spike	Grain weight/ spike, g	1000 kernel weight, g	Total grain weight, g	% buntedears	Grain yield, t/ha
1	2	3	4	5	6	7	8	9	10	11
1	MUFITBEY (resistant check)	120,0	12,0	25,0	83,0	3,8	45,7	30,5	10.1	6.08
2	NACIBEY (resistant check)	105,0	10,0	19,0	61,0	1,8	29,5	16,6	2,0	2,17
3	GEREK79 (susceptible check)	116,0	9,0	19,0	47,0	0,7	14,8	12,7	39,7	2,63
4	PBW343*2/KUKUNA//ATAY/CALVEZ /3/ATAY/GALVEZ87	85,0	11,0	21,0	56,0	1,0	17,8	14,3	0,0	3,68
5	87-461 a 63-555//SAULESKU#26/ PARUS/3/AGRI/NAC//ATTILA	85,0	11,0	25,0	80,0	2,7	33,7	18,5	57,2	4,44
6	ORKINOS-1/SUNR23//SONMEZ	115,0	13,0	23,0	79,0	3,5	44,3	22,2	0,0	4,50
7	ATAY/GALVEZ87/6/TAST/SPRW/4/ROM-TAST/BON/3/DIDO//SU92/ CI13645/5/F130L.12	125,0	14,0	23,0	79,0	3,7	46,8	28,7	0,0	3,35
8	MADSEN/MALCOLM//ZARGANA-9/3/BURBOT-6	130,0	12,0	21,0	52,0	2,0	38,4	12,5	0,0	4,17
9	RINA-6/ORKINOS-7	115,0	12,0	25,0	64,0	2,4	37,5	15,0	0,0	2,58
10	SAULESKU#44/TR810200//GRISET-4	100,1	12,0	21,0	73,0	2,2	30,1	20,0	57,2	7,29
11	ATTILA/BABAX//PASTOR/4/TAST/SPRW//ZAR/3/ATAY/GALVEZ87	90,1	12,0	23,0	78,0	2,9	37,1	22,0	47,8	2,77
12	BURBOT-4/3/OMBUL/ALAMO//MV11	100,1	12,0	23,0	71,0	2,4	33,8	19,0	6,1	2,12
13	FRTL//AGRI//NAC/3/BONITO-36/4/ERIT58-87//KS82W409/SPN/3/ KRC66/SERI	105,1	10,0	19,0	50,0	1,7	34,0	10,2	11,9	1,92
14	GUN91/MNCH*2//T-2003	105,1	11,0	21,0	67,0	2,6	39,0	21,0	15,4	3,63
15	KRASNODAR/FRTL/6/NGDA146/4/YMN/TOB//MCD/3/LIRA/5/F130L.12	120,1	11,0	25,0	84,0	3,5	41,6	25,6	11,1	6,24
16	TJB368-251/BUC//SMUT1590-165/3/KS7866-15/ORS8425/4/ NE87U119/CHAM//1D13.1/MKT	125,1	13,0	23,0	71,0	3,2	45,0	24,5	4,6	1,80
17	SHARK/F44105W2.1//AUS4930.7/2*PASTOR/3/ORKINOS-1	100,1	10,0	21,0	78,0	2,3	29,4	19,1	26,5	6,08
18	GANSU-1/3/AUS GS50AT34/SUNCO// CUNNINGHAM/4/ORKINOS-1	95,1	12,0	21,0	63,0	2,8	44,4	27,2	4,2	4,83
19	BURBOT-4/3/OMBUL/ALAMO//MV11	95,1	11,0	21,0	60,0	1,5	25,0	17,0	9,3	4,81
20	KUPAVA/BURBOT-4//PYN/2*BAU	90,2	12,0	21,0	57,0	2,2	38,5	16,0	54,8	3,05
21	DE9//MERGAN-2	125,2	14,0	21,0	59,0	2,5	42,3	21,0	0,0	2,12

Continuation of table

1	2	3	4	5	6	7	8	9	10	11
22	KRASNODAR/FRTL/6/NGDA146/4/YMN/TOB//MCD/3/LIRA/5/F130L.12	125,2	12,0	23,0	70,0	2,8	40,0	21,8	8,6	6,17
23	362K2.111//TX71A1039.VI*3/AMI/3/ES14/130L1.12//MNCH	120,2	11,0	21,0	74,0	2,0	27,0	18,6	10,0	5,20
24	SELYNKA/MERGAN-1	125,2	10,0	19,0	50,0	1,8	36,0	15,2	23,1	1,70
25	91-142 A 61/KATIA1//GRIZET-4	120,2	11,0	21,0	65,0	2,6	40,0	18,2	10,0	4,70
26	KUPAVA/BURBOT-4//PYN/2*BAU	100,2	11,0	19,0	50,0	1,3	26,0	16,5	31,4	5,67
27	KRASNODAR/FRTL/6/NGDA146/4/YMN/TOB//MCD/3/LIRA/5/F130L.12	115,2	11,0	23,0	65,0	2,7	41,5	16,0	34,5	4,25
28	ORKINOS-1*2/3/AUS GS50AT34/SUNCO//CUNNINGHAM	135,2	12,0	23,0	57,0	2,4	42,1	19,2	0,0	4,35
29	87-461 a 63-555/4/ERIT58-87//KS82W409//SPN/3/KRC66/SERI	110,2	13,0	23,0	57,0	2,5	43,8	19,3	32,5	1,55
30	SAULESKU#44/TR810200//ZGI	115,3	12,0	21,0	57,0	2,1	36,8	19,5	50,0	4,50
31	KRASNODAR/FRTL/6/NGDA146/4/YMN/TOB//MCD/3/LIRA/5/F130L.12	115,3	12,0	25,0	63,0	2,7	42,8	21,5	15,4	5,50
32	TAM200/KAUZ/4/CHAM6//1D13.1/MLT/3/SHI4414/CROW	80,3	13,0	23,0	80,0	3,3	41,2	18,8	21,2	2,80
33	SHARK/F44105W2.1//CHARA/3/MERGAN-1	100,3	10,0	21,0	65,0	2,4	37,0	17,6	15,6	3,98
34	ALPU/VR5053(WA#FM/201/23*2/GS50A)	105,3	12,0	23,0	62,0	2,0	32,2	16,4	25,0	3,73
35	KS902709-B-5-1/BURBOT-4	110,3	11,0	21,0	55,0	2,1	38,1	18,8	0,0	5,55
36	JCAM/EMU//DOVE/3/JGR/4/THK/5/BOEMA	95,3	11,0	21,0	80,0	2,2	27,5	18,0	12,9	3,20
37	BATERA//KEA/TOW/3/TAM200/4/494J6.11/TRAP#1/BOW/5/TX96V2427	105,3	10,0	21,0	55,0	1,6	29,0	12,8	6,1	2,70
38	BATERA//KEA/TOW/3/TAM200/4/494J6.11/TRAP#1/BOW/5/TX96V2427	95,3	12,0	21,0	63,0	2,0	31,7	15,1	5,9	5,27
39	ORKINOS-1/4/JING411//PLK70/LIRA/3/GUN91	125,3	14,0	25,0	76,0	3,1	40,7	25,8	15,4	2,12
40	GRIZET-4/3/ID#840335//PIN39/PEW/4/LILIA BG/GT	120,4	13,0	23,0	90,0	2,8	31,1	17,8	17,9	4,55
41	KAMBARA1/ZANDER-17	95,4	14,0	25,0	72,0	2,1	29,1	18,7	27,3	2,20
42	ADMIS/5/SMB/HN4//SPN/3/WTS//YMH/HYS/4/SAB	100,4	11,0	21,0	66,0	2,3	34,8	20,8	17,7	6,45
43	RANA96/GANSU-3	125,4	12,0	23,0	74,0	3,1	41,8	21,2	0,0	5,05
44	RINA-6/BEZ/NAD//KZM(ES85.24)/3/F900K	110,4	11,0	22,0	49,0	2,1	42,8	14,3	0,0	5,35
45	VORONA/3/TOB*2/7C//BUC/4/CHAM6//1D13.1/MLT/3/SHI4414/CROW	110,4	9,0	21,0	58,0	2,0	34,4	15,0	5,3	4,83
46	Son64/4/Wr51/mida//Nt.h/K117/5/Anza/3/Pi//Nor/Hys/4/ Sefid	120,4	11,0	19,0	58,0	2,8	48,2	23,4	20,0	5,24
47	ALD/SNB//ZARRIN/3/YACO/2*PARUS	70,4	9,0	19,0	72,0	2,8	38,8	18,7	33,3	1,93
48	SPN/MCD//CAMA/3/NZR/4/ALD/SNB*2/5/GASCOGNE	75,4	11,0	21,0	61,0	1,3	21,3	7,8	6,5	2,78
49	SPN/MCD//CAMA/3/NZR/4/ALD/SNB*2/5/GASCOGNE	65,4	10,0	20,0	55,0	1,3	23,6	11,5	5,9	2,58
50	CMH79A.955/4/AGA/3/4*SN64/CNO67//INIA66/5/NAC/6/CMH83.25//RSH/8/ZRN	80,5	11,0	23,0	72,0	2,2	27,7	18,1	21,7	2,85
51	CMH79A.955/4/AGA/3/4*SN64/CNO67//INIA66/5/NAC/6/CMH83.25//RSH/8/ZRN	90,5	12,0	23,0	83,0	2,5	30,1	18,0	13,9	2,78
52	CMH79A.955/4/AGA/3/4*SN64/CNO67//INIA66/5/NAC/6/CMH83.25//RSH/8/ZRN	85,5	12,0	21,0	64,0	1,8	28,1	16,0	17,5	2,65

Continuation of table

1	2	3	4	5	6	7	8	9	10	11
53	QUDS*3/MV17	95,5	11,0	21,0	67,0	2,0	28,3	16,2	48,2	2,63
54	ALMT*3/7/VEE/CMH77A.917//VEE/6/ CMH79A.955/4/AGA/3/SN64*4/CNO67 //INIA66/5/NAC	80,6	10,0	21,0	53,0	1,8	34,0	14,0	0,0	4,83
55	CROC_1/AE.SQUARROSA(224)/OPAT A	80,5	12,0	19,0	52,0	1,8	35,7	14,7	20,6	3,50
56	SANZAR-8/KKTS	90,5	11,0	21,0	72,0	2,0	30,5	16,7	41,9	3,68
57	INTENSIVNAYA//PBW343*2// TUKURU	90,5	12,0	19,0	64,0	2,0	29,6	14,5	23,4	2,83
58	TSAPKI/FARMEC	90,5	11,0	21,0	71,0	2,0	26,7	20,1	57,2	6,47
59	AMCEL/KS970274/3/KS91048L-2-1/ CM112793(CHL)/2*STAR)/HWK1064-6	95,5	12,0	19,0	56,0	2,3	41,0	19,2	2,2	2,53
60	DORADE-5/KS980512	100,6	12,0	23,0	92,0	3,5	38,0	21,0	23,8	6,35
61	OR 943576/KS920709	95,6	13,0	23,0	85,0	1,8	21,1	17,0	5,9	3,47
62	MRS/CI14482//YMH/HYS/3/RONDEZV OUS/4/ABI 86*3414X84W063-9939-2//KARL92	90,6	13,0	21,0	60,0	1,8	30,0	20,0	44,5	4,15
63	KS92WGRC-25	110,6	11,0	19,0	49,0	1,5	30,6	13,0	38,5	4,73
64	BEZOSTAYA/AE.CYLINDRICA	120,6	14,0	29,0	81,0	3,0	37,0	25,3	0,0	4,51
65	BEZOSTAYA/TR.MILITINAE//TR.MIL ITINAE-6	140,6	16,0	24,0	97,0	3,0	30,0	20,5	0,0	1,55
66	BEZOSTAYA/TR.MILITINAE//TR.MIL ITINAE-4	140,5	14,0	24,0	49,0	1,8	36,7	20,7	0,0	3,68
67	CV.RODINA/AE/SPELTOIDES(10 KR)/S.CEREALE(1.OKR)	140,4	14,0	24,0	62,0	1,8	29,0	16,8	20,0	3,60
68	CV.RODINA/AE/SPELTOIDES(10 KR)/S.CEREALE(1.OKR)	140,0	14,0	24,0	59,0	2,0	33,8	18,7	5,4	4,37
69	CV.RODINA/AE/SPELTOIDES(10 KR)	140,7	14,0	24,0	71,0	2,6	36,6	20,2	0,0	5,68
70	F06393GP10	70,7	10,0	22,0	63,0	1,8	28,5	16,7	25,8	0,87
71	F08034G1	75,7	10,0	22,0	62,0	2,2	35,4	17,3	34,5	4,43
72	F08347G8	75,8	11,0	22,0	74,0	3,0	39,1	19,0	8,9	1,13
73	OSTROV	75,7	11,0	20,0	79,0	2,7	34,1	17,0	0,0	2,32
74	F07270G2	100,9	10,0	18,0	44,0	1,8	41,0	16,3	74,4	4,17
75	F00628G34-1	80,7	10,0	18,0	80,0	3,1	38,7	24,1	4,9	3,53

Agronomic evaluation. In the present work 9 traits were assessed on 75 winter wheat lines through 2 years grown under artificial infection of common bunt. The wheat lines had different levels of agronomic traits under artificial inoculation of common bunt. The plant and spike height were 70.4-140.7 cm and 9.0-14.0 cm, respectively. The number of spike per plant ranged from 18 to 25 spikes. The grain weight per spike was 0.7-3.8 gram. The 1000 kernel weight and total grain weight were showed different level of productivity, 14.8-48.2 gram and 7.8-30.5 gram, respectively. The productivity of wheat genotypes under artificial infection ranged from 1.13 to 7.29 t/ha.

Correlation analysis. The correlations among the nine traits were mostly similar, but in some cases, the strength of the correlations was different. The correlation coefficients were found to be highly significant at the 0.05 probability level. The moderately positive correlation was detected between the plant height and head length ($r = 0.51$), between the head length and number of spike ($r = 0.62$). Also, moderately positive correlation was found between grain number and total grain weight ($r = 0.53$). The expected strong positive correlation was detected between the grain number and grain weight ($r = 0.7$), between the grain weight and TKW ($r = 0.75$) (figures 1, 2).

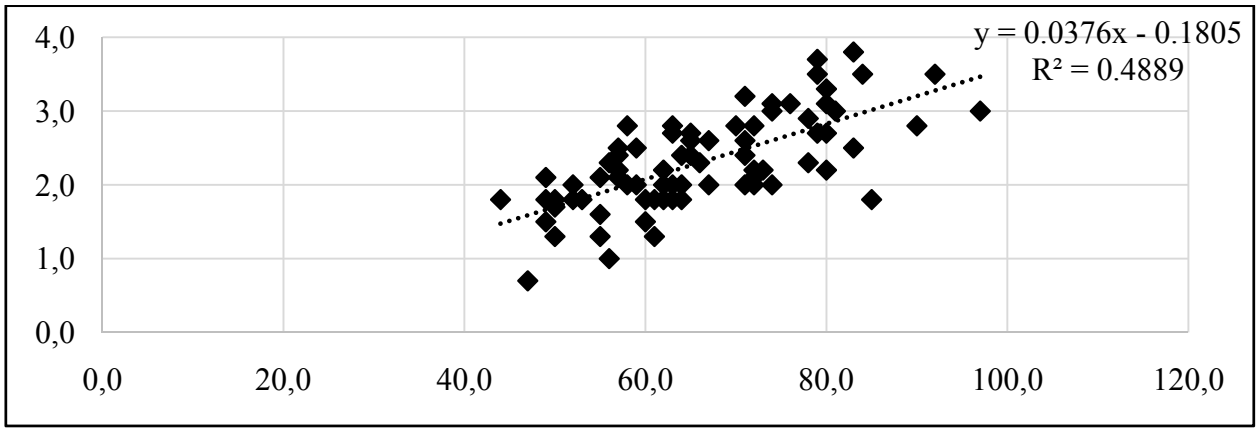

Figure 1 – The correlation coefficient of the between grain number and grain weight per spike

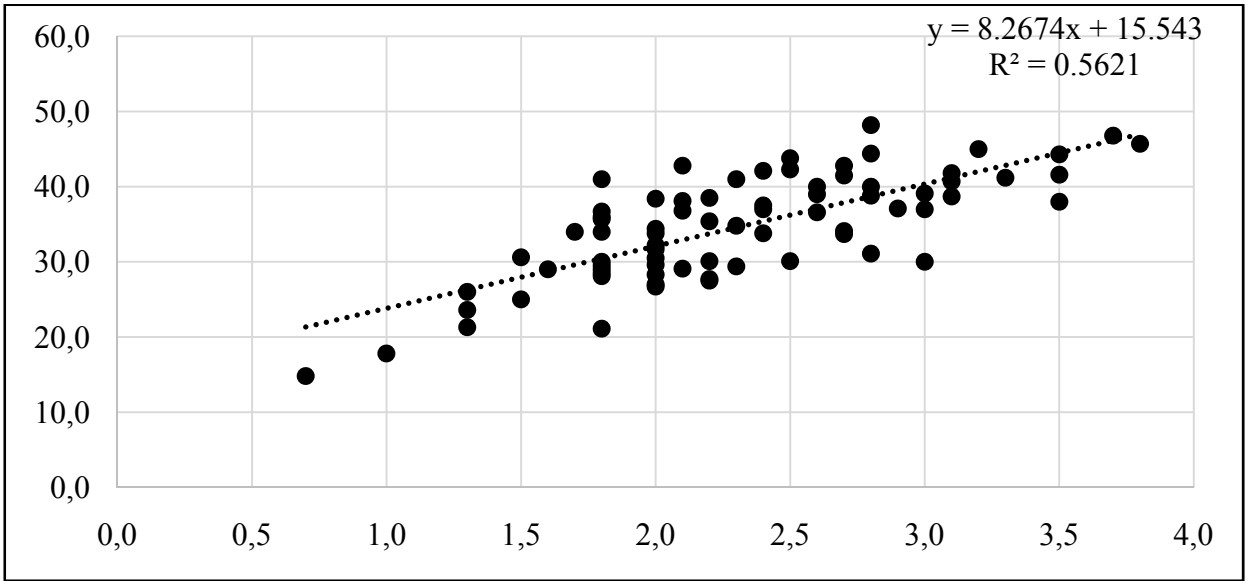

Figure 2 – The correlation coefficient of the between grain weight per spike and TKW

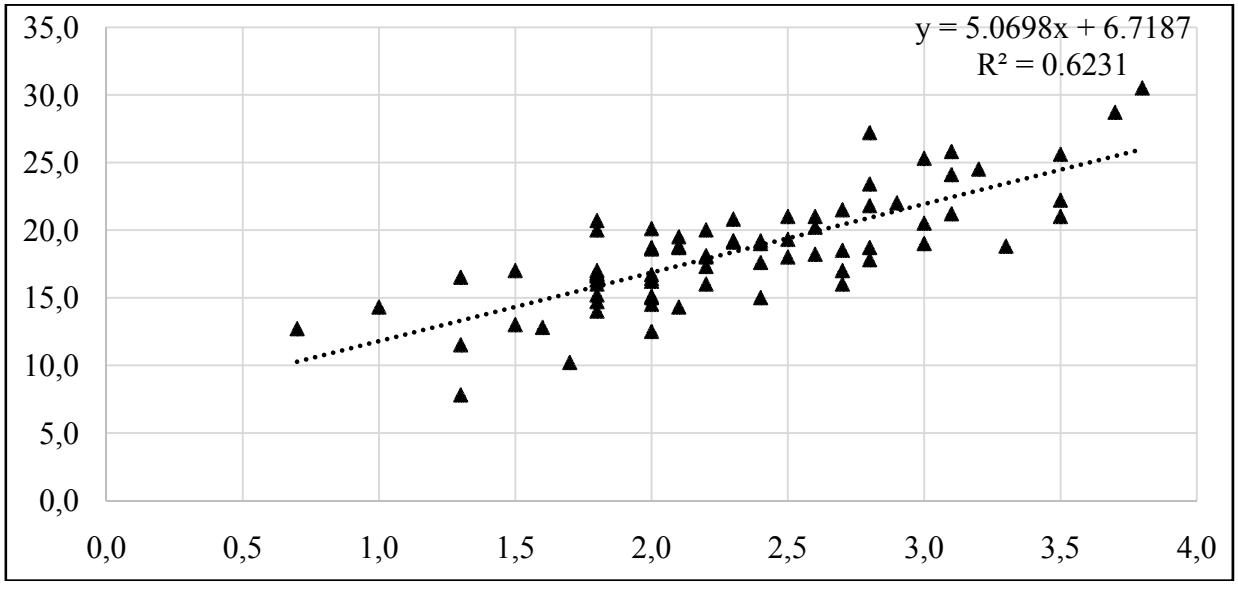

Figure 3 – The correlation coefficient of the between grain weight per spike and total grain weight per plant

Also, strong positive correlation was found between grain weight and total grain weight (r = 0.79) (figure 3). The negative correlation was found between the bunted ears and all agronomic traits, but these correlations were no so high, from r = 0.1 to r + 0.29.

Conclusion. In conclusion, the common bunt infection was found to decrease the productivity and biological yield in the tested genotypes. Artificial inoculation tests for common bunt resistance showed that a large number of resistance genotypes is available in disease condition of southeast part of Kazakhstan. On base this study sixteen genotypes from the CBUNT Nursery of IWWIP can be considered as valuable resistance sources to common bunt. Identified resistance genotypes will be useful for breeding programs to forming resistance cultivars to common bunt in Kazakhstan.

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К. Ж. Тағаев[1], А. И. Моргунов[2], М. А. Есимбекова[3], А. И. Абугалиева[3], Г. О. Баядилова [1]

[1]Қазақ ұлттық аграрлық университеті, Алматы, Қазақстан,
[2]Жүгері мен бидайды жақсарту халықаралық орталығы (СИММИТ), Анкара, Түркия,
[3]Қазақ егіншілік және өсімдік шаруашылығы ғылыми-зерттеу институты,
Алмалыбақ, Алматы облысы, Қазақстан

ҚАТТЫ ҚАРАКҮЙЕ АУРУЫНЫҢ КҮЗДІК БИДАЙ ЛИНИЯЛАРЫНЫҢ АГРОНОМИЯЛЫҚ БЕЛГІЛЕРІМЕН ТӨЗІМДІЛІГІНЕ ӘСЕРІ

Аннотация. Қатты қаракүйе (*Tilletia caries*) тұқым арқылы берілетін бидайдың саңырауқұлақ ауруларының бірі. Органикалық ауылшаруашылығында аурудың алдын алу үшін ауруға төзімді бидай» сорттары мен линияларын өсіру қажет. Зерттеу жұмысында Түркияның «Күздік бидайды жақсарту бойынша халықаралық орталық»(IWWIP) құрған халықаралық қатты қаракүйе тәлімбағының 75 бидай линиялар жиынтығы

қолданылды. Зерттеу жұмысы 2016-2017 жылдары Қазақ егіншілік және өсімдік шаруашылығы ҒЗИ-ның жасанды инфекциялық тәлімбағында жүргізілді. Сезімтал бақылау нұсқасы GEREK 79 генотипі 59,7% масақ қатты қаракүйемен ауырып, сезімталдылықтың жоғары деңгейіне ие болды. Он алты генотип жасанды инфекция аясында ауруға төзімділік танытты. Аурудың ең жоғары деңгейі 59,7%-ға дейін масақтары залалданған бидай линиясында тіркелді. 42 бидай генотипі 2.0-27.3% шамасында қатты қаракүйемен залалданып, орташа төзімді деп танылды. Жасанды жағдайда қатты қаракүйе ауруы бидайдың агрономиялық көрсеткіштеріне әртүрлі әсер етті. Бидай линияларының өнімділік деңгейі 1,13 т/га-дан 7,29 т/га-ға дейін ауытқыды. Болжам жасалынған жоғары оң корреляция коэффициенті дән саны мен дән салмағы (r = 0,7), дән салмағы мен 1000 дәннің салмағы (r = 0,75) және 1 масақтағы дән салмағы мен жалпы дән салмағы (r = 0,79) арасында байқалды. Ал теріс корреляция аурумен залалданған масақтар саны мен басқа агрономиялық көрсеткіштердің арасында байқалды. Идентификацияланған төзімдді генотиптер Қазақстандағы қатты қаракүйеге төзімді БИДВАЙ сорттарын құруға арналған селекциялық бағдарламаларда қолдану үшін құнды болып табылады.

Түйін сөздер: бидай, бидай линиялары, қатты қаракүйе, төзімділік, өнімділік, агрономиялық көрсеткіштер.

К. Ж. Тагаев[1], А. И. Моргунов[2], М. А. Есимбекова[3], А. И. Абугалиева[3], Г. О. Баядилова[1]

[1]Казахский национальный аграрный университет, Алматы, Казахстан,
[2]Международный центр улучшения кукурузы и пшеницы (СИММИТ), Анкара, Турция,
[3]Казахский научно-исследовательский институт земледелия и растениеводства,
Алмалыбак, Алматинская область, Казахстан

ВЛИЯНИЕ ТВЕРДОЙ ГОЛОВНИ НА АГРОНОМИЧЕСКИЕ ПОКАЗАТЕЛИ И УСТОЙЧИВОСТЬ ЛИНИИ ОЗИМОЙ ПШЕНИЦЫ

Аннотация. Твердая головня (*Tilletiacaries*) является наиболее опасным грибковым заболеванием пшеницы. Из системы мероприятий по борьбе с твердой головней наиболее радикальной является создание устойчивых сортов и линий пшеницы. В данной работе использованы 75 сортов и линий пшеницы, созданные в «Международном центре по улучшению озимой пшеницы» (IWWIP), Турция. Эксперимент проведен в 2016–2017 гг. в инфекционном стационаре Казахского научно-исследовательского института земледелия и растениеводства. Восприимчивый контроль, GEREK 79, показала восприимчивость (59,7% поврежденных колосьев). Самая высокая уровень болезни составляла 74,4% пораженных колосьев. Шестнадцать генотипов были устойчивыми в условиях искусственного инфицирования. Сорок два генотипов пшеницы были умеренно-устойчивыми, их колосья поражались головней от 2,0% до 27,3%. Агрономические показатели в условиях искусственного инфицирования колебались по-разному по сравнению с контролем. Урожайность генотипов пшеницы колебалось от 1,13 до 7,29 т/га. Ожидаемая высокая положительная корреляция обнаружена между число зерен и массой зерна (r = 0,7), между массой зерна и массой 1000 зерен (r = 0,75), а также между массой зерна с главного колоса и общей массой зерна с растения (r = 0,79). Отрицательная корреляция обнаружена между колосьев пораженный твердой головней и другими агрономическими признаками. Идентифицированные устойчивые генотипы будут ценными в селекционных программах Казахстана для формирования устойчивых сортов пшеницы к твердой головне.

Ключевые слова: пшеница, линии пшеницы, твердая головня, устойчивость, продуктивность, агрономические признаки.

Information about authors:

Tagayev Kuttymurat Zhurgenbayuly – PhD student of Kazakh national agrarian university, PhD student; kuttymurat.tagayev@mail.ru.

Morgounov Alexey Ivanovich – CIMMIT, the CIMMYT country representative in Turkey; a.morgounov@cgiar.org

Yessimbekova Minura Akhmetovna – Head of Gene pool of Kazakh Research Institute of Agriculture and Plant Growing, Doctor of Biological Sciences; minura.esimbekova@mail.ru.

Abugalieva Aigul Izteleuovna – Head of laboratory biochemistry and grain quality of Kazakh Research Institute of Agriculture and Plant Growing, Doctor of Biological Sciences; kiz_abugalieva@mail.ru.

Bayadilova Gulsun Ongarovana, Associated professor of depertamen Agronomy of Kazakh national agrarian university, Candidate of Biological Sciences; zhalaiirka_kushik@mail.ru.

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A. N. Zhildikbayeva[1], A. I. Sabirova[2], T. P. Pentayev[1],
A. D. Omarbekova[1], Virginia Gurskienė[3]

[1]Kazakh National Agrarian University, Almaty, Kazakhstan
[2]KazRI of AIC Economy and Rural Areas Development, Almaty, Kazakhstan
[3]Alexander Stulginskis University, Kaunas, Lithuania
E-mail: a.zhildikbaeva@mail.ru; sabirova_alla@mail.ru; t_p_12@mail.ru; ardak_dd@mail.ru;
Virginija.Gurskiene@asu.lt

ESTIMATION OF THE EFFICIENT LAND USE IN THE LIMITS OF LAND PLOTS OF ACTING AGRI BUSINESSES

Abstract. This article examines the methodology of determining the efficiency of agricultural land use in terms of a multistructural economy, taking into account structural and resource indicators. The necessity of improving the system of land relations of peasant (private) farms with the purpose of optimizing their perspective activity is considered. The need to achieve optimal sizes of land plots in the process of increasing the profitability of agribusiness is justified. Studies have shown that the methodology of assessing the economic efficiency of land use should be simple in application to any business entity. One of the important moments is that all value indicators used in any methodology of assessing the economic efficiency of land use should be considered in terms of inflation and risk. It is necessary to make adjustments to prices as well, because the value of sold products is calculated taking into account purchase prices to determine the total income of the enterprise.

Key words: agribusinesses, efficiency, gross agricultural output, rational use of farmland, optimal land use.

Introduction. In conditions of agricultural production development, the issues of regulation of land relations are of special importance, where the formation of land plots of optimal size in various forms of business plays the most important role [1].

Currently the solution of the tasks of effective land use requires the organization of accounting and assessment of soil fertility on soil bonitet in the frames of land use. It is known that even in the case of one land plot, the economic land fertility differs from the main group of soils in terms of low bonitet score, which affects the production results [2].

As a rule by actual gross output or its value per 1 ha or 100 ha of land one can judge on the level of farmland use.

Analysis of the land use structure of agribusinesses for the period from 1995 to 2016 in Kazakhstan showed that the share of peasant farms (96.3%) is prevailing in their total number, whilethe number of agricultural enterprises in 2016 is only 6.9 thous. [3].

The average sizes of land use are also differentiated. The LLPs and agricultural enterprises have the largest land areas. At present, the tendency of reduction of the number of agricultural production cooperatives is observed despite more democratic form of management.

Results and discussion. Efficiency of agricultural land use is also different and varies according to the periods and categories of farms due to the increasing level of inflation and prices for agricultural products (table 1).

The main reasons for the disintegration of production co-operatives into LLPs and peasant farms and, accordingly, the size of land use are as follows: incompliance with democratic management principles, exclusion of land holders from management, non-transparency of profit distribution, small amounts of dividends, preferential taxation of peasant farms, which are the main factor of their mass organization.

Table 1 – Tendencies of changes in the number, sizes of various forms of businesses and efficient use of agricultural lands in the Republic of Kazakhstan for 1995-2016

Farm category	1995	2000	2010	2015	2016
Number of agribusinesses					
Agri enterprises	5787	5345	5702	6906	12310
Peasant farms	30785	95460	193435	216567	219759
Average sizes of agribusinesses, ha					
Agri enterprises	15602	10680	5780	5701	3312
Peasant farms	412	260	233	270	273
Gross output production per 100 ha of agricultural plots, mln. Tenge					
Agri enterprises	100,4	249,7	495,5	212,3	312,1
Peasant farms	136,5	461,8	612,8	177,1	273,4

The most efficient production and land use has been achieved in large-scale agribusinesses, where high-performance machinery is used, crop rotations are being observed, and there is greater accessibility to loans, subsidies, and leasing.

On the basis of the land of production cooperatives, the process of organization of LLPs andPF is taking place, which average size of land use over the past 2 years has stabilized, whilethere are peasant farms with small land plots in the southern region (table 2).

Table 2 – Grouping of land use sizes of small peasant farms by composition of farmland and arable land in the regions of the southern Kazakhstan

Region, area	Number of PF with ag.plots, thous.ha	Up to 50 ha		Number of PF with arable lands, thous.	Up to 50 ha	
		thous.	share %		thous.	share %
Republic of Kazakhstan	148,9	94,4	63,4	119,7	97,2	81,2
Southern region	108,5	88,4	81,5	98,1	90,7	95,5
Almaty region	41,3	31,3	75,8	35,3	32,2	91,2
Zhambyl region	16,3	12,0	73,6	14,6	12,4	84,9
Kyzylorda region	2,3	0,6	26,1	0,9	0,5	55,6
South Kazakhstan	48,6	44,5	91,6	47,3	45,6	96,4

Note. Calculations were performed on the basis of data from the Committee on Statistics of the RK. Col. "Agriculture, Forestry and Fisheries in the Republic of Kazakhstan" for 2016.

Monitoring data of the Statistics Committee of RK as of 1.01.2016 show that 93.7% of peasant and private farms have land area of up to 500 ha. To the greatest extent, small-scale peasant farms became widespread in the southern region, where the share in the total number of plots of 50 ha is 90.1%, while in the northern region only 8.1%, central - 3.9%, western - 11 , 3%. Most of them have narrow specialization, many of them are natural and semi-natural farms [4].

Small-scale type of production does not allow to manage agricultural production on an intensive basis, to ensure full use of material, labor and other resources, to comply with environmental requirements. Small and even medium private and peasant farms due to the lack of financial resources don't have the opportunity to introduce new technologies in the development of their production.

Small-scale agricultural production is not attractive for outside investors. Like investors, loan and bank organizations don't make investments to small-scale farms, which is one of the main reasons for the reduction of production volumes and failures in timely logistical support. The main condition for the investors is the possibility to have complete influence on product output, using modern production means and technologies. And this can be achieved only if the business has sufficient scale and size. As a result, the main source of financing is a significant public support of the entrepreneurs who have small share of own funds.

At present, the issue of organizing effective land use aimed at the rational use of land which aims at the development of crop rotations, a new moisture-resource-saving technology, and the use of more productive machinery is very relevant.

One of the main directions in solving the problem of peasant farms with small land plots is the development of cooperation, unification into single crop rotation areas. The study of cooperative processes in agricultural sector has shown that three main directions can be distinguished here.

The first direction is co-operation of agricultural entitiesby production: the cultivation of labor-intensive crops (fruit and vegetable specialization), fattening and raising livestock, etc. This is a production cooperation where the shareholders and labor team are the same people.

The second direction is cooperation (unification) in the sphere of material and technical services. This form of cooperation can be spread due to the lack of financial and material resources and underdevelopment of the service sector. The first and the second direction can have a mixed character, since the purpose of these co-operations is the production of agricultural products, and it is extremely difficult to differentiate them as a pure type.

The third direction is establishing of cooperatives on processing and selling products based on joint funds and material and technical resources by peasant farms and personal subsidiary farms.

We see the solution of this problem not only in view of enlarging the land areas, but also providing public support, especially to small peasant farms, since they play an important role in production of gross agricultural - they produce 25% of the value of the gross agricultural output of the republic.

The economic efficiency of a particular form of management depends on increasing labor productivity, strengthening saving regime, increasing production intensification, using internal reserves and possibilities of agricultural production, and, especially, rational use of land.

With regard to land use, rationality assumes the expediency of productive and non-productive use of land by applying both intensive and extensive factors that ensure a constant increase of soil fertility. But the use of intensive factors should not lead to the decrease in land fertility and their withdrawal from agricultural production.

At the present stage, in the conditions of intensive farming, new peculiar problems arise in land use including the decrease of humus concentration in soil which is the basis of its fertility is of a particularly concern. The experience of world land cultivation also confirms that one of the indicators of the evaluation of land cultivation system is the level of humus concentration in soil. Soils with high humus concentration have more favorable water-physical and other properties. They are less susceptible to side effects of pesticides, and mineral fertilizers are more effectively used on such soils. In connection with this, the level of humus concentration in soil is one of the most important indicators of the rational land use, reproduction of soil fertility.

The formation of farms according to the area depends on the nature of the land plots, i.e. their structure (size of arable land, hayfields, pastures); specifics of particular sectors; zonal conditions. Rational land use excludes monocrops, because the seasonal character of agricultural production determines the need for full employment of labor forces during the year. To regulate these processes, a rational combination of crop production and livestock production sectors is necessary. Foreign and domestic experience shows the rational combination of crop production and livestock production sectors in the ratio of 60:40 and 50:50.

Another criterion for establishing optimal land use sizes for the farms is the output of agricultural products per 100 ha of farmland (arable land); net profit per 100 ha of farmland (arable land); level of own commodity production; the level of application of innovative technologies, the process of diversification, the maintenance of an optimal livestock population; cost of fixed production assets; number of permanent employees, availability of own working capital and high level of creditworthiness, level of profitability [5].

This issue is closely related to land turnover, especially in view of small farms that are unable to use crop rotation and high-performance machinery. The cancellation of sublease caused significant damage in the formation of optimal parameters of land use. Therefore, the main mechanism governing the parameters of enterprises is the organization of simple partnerships and the development of horizontal cooperation.

The effective agriculture directly depends on the ongoing activities on land reclamation. In this regard, the State policy on maintaining the quality of irrigated lands should be developed and implemented in comprehensive and close interaction with other agricultural activities.

Let's consider the state of land use by different categories in the Enbekshikazakh district of Almaty region (table 3).

Table 3 – Availability of land and its distribution by categories in Enbekshikazakh district of Almaty region for 2016

Name of categories of land, landowners and land users (possession and temporary use)	Total area (ha)	including:						
		Arable lands (ha)		Perennial plantations (ha)			Hay fields (ha)	Pastures (ha)
		total (ha)	of them irrigated	total (ha)	Of them:			
					Orchards (ha)	vineyards (ha)		
Agricultural lands	394351	85487	77527	9164	5338	3716	15118	278197
Land of citizens for farming	315803	63130	57781	5170	4194	976	13057	233988
Averagesize of 1 PF	23,1	4,6	5,3	0,4	0,3	0,07	0,9	17,1
Lands of economic partnerships and joint-stock companies	58359	17298	15310	2563	34	2529	1556	31594
Average size of 1 LLP and JSC	367,0	108,8	166,4	16,1	0,2	15,9	9,8	198,7
Land of agricultural cooperatives	17285	4181	3565	368	167	201	505	12181
Average size of 1 cooperative	480,1	116,1	169,8	10,2	4,6	5,6	14,0	338,4

Note. Compiled by the authors according to the data of the Land Relations Department of Enbekshikazakh district, for 2016.

In the structure of agricultural land use, the largest share belongs to peasant farms - 80.1%, LLP and JSC - 14.8%, and PC - 4.4%. The average size per one PF -23.1 ha, which indicates the small land area, and the average size per cooperative - 480.1 ha which is higher than one LLP and JSC. Land users (PF, LLP, PC) in the district are highly specialized, and there is no rational combination of sectors.

Specialization is represented by a diversified structure. In the structure of the sown area, specific weight is as follows: 40.2% - cereals, 15.4% - oilseeds, and 5.4% - perennial plants. In addition, a large share in production have fruits and berries. Of the total production volume of fruits and berries, 5.3% are stone fruit and pome fruits.

The main criterion characterizing the marginal (minimal) size of peasant farms is its annual turnover - gross production of goods (gross income) in monetary terms, which determines the level of competitiveness. The level of intensity and efficiency of land use is determined by the index of gross (sold) production per 100 ha of farmland (table 4).

The gross output of agriculture increased by 9.1% per year.

For example, LLP "Fresh Fruit Kazakhstan" has a land area of 60 ha. Agricultural land - 60 ha, including perennial plantations - 40 ha. Irrigated - 40 ha, of which stone fruits- 10 ha, pome - 30 ha. The annual profit, total - 803 thous. Tenge.

Table 4 – Comparative indicators of the efficient use of farmland in Enbekshikazakh district for 2015- 2016, mln Tenge

Index	2015	2016	2016 to 2015., %
Gross agricultural production, million tenge	72414,7	79209,4	109%
Area of agricultural land, thousand hectares	785787	785798	100%
Area of arable land, thousand hectares	164993	170096	103%
per 100 hectares of farmland, million tenge	921,6	1008,0	109%
per 100 hectares of arable land	413	465,7	113%

Note. Compiled by the authors according to the data of the Land Relations Department of Enbekshikazakh district for 2015-2016.

LLP JSC "Issyk Wine Plant" -agricultural land is 350 ha, including perennial plantations - 280 ha, of which 280 ha are irrigated. The annual profit, total - 1079 thous. tenge.

By group of peasant farms of Enbekshikazakh district the indicators are as follows: PF "Rafikov" - the area from 11 to 20 h, PF "Aldazharova" from 41 to 50 ha were accepted, the "Shimgambaev" farm- from 51 to 100 ha, "Aidarbaev" farm over 100 ha.

Analysis of the financial situation of the PFof Enbekshikazakh district shows that the medium-sized farms (from 31 to 40 ha) have the most high profit which is 5286 thous. Tenge and large (over 40 ha) - 5931 thous. tenge.

In a number of certain territories, as a result of heavy soil exploitation, due to the severe anthropogenic impact in recent years, there is the depletion of soils, a sharp drop in soil fertility, which is irrational, since fertility can be restored very slowly.

Processes and phenomena that reduce soil fertility, destroying land resources of the country can be divided into 4 groups:

- natural processes, the adverse effect of which on soil surface cannot be prevented. These are earthquakes, mudflows, floods, etc.;

- natural processes that a person can prevent to some extent or reduce the negative impact on soil. For example, soil wind and water erosion, salinization of soils due to the lack of engineering structures associated with functioning of drainage system, flushing and erosion of soils on slopes due to improper tillage of crop rotation fields;

- natural processes, the intensive manifestation of which is due to unreasonable human economic activity. This is the degradation of land due to the high pressure of livestock, desertification of the territory, due to deforestation, intensive flushing and erosion of soil surface runoff of temporary water flows, salinization of soil associated with excessive irrigation;

- phenomena entirely related to human economic activity.

Information and advisory services and scientific provision, training and upgrading courses of farmersare very important for the further development of peasant farms. In order to meet the needs of peasant farms, cooperatives and other agricultural producers in information and advisory services, it is necessary to establish a single information and advisory service, including sectoral and regional centers with a network of district consultants, as well as relevant units in the government bodies of the agro-industrial complex. The information and advisory service should assist in mastering the achievements of science and technology, advanced production technologies, in marketing, economics of cooperation, social and legal protection [6].

Agricultural research institutions will expand studies on economic, legal, technological and social problems of farming and development of agricultural cooperation, they should develop optimal models of peasant farms and cooperatives of different production specialization, taking into account the natural and economic zones. It is important to expand training and professional development of farmers and cooperative workers, including loan and insurance cooperatives.

Conclusions. The assessment of the efficient land use in small peasant farms of fruit and vegetable specialization using the index method has made it possible to identify groups that can withstand a sufficient level of competitiveness in case of the use of innovative technologies in irrigated lands and increase of government support measures.

The index of the efficient land use, labor productivity, technical equipment in all groups, recommended peasant farms is approximate or equal to 1. Thus, these peasant farms can withstand competition if public support measures will be increased and, first of all, subsidies for drip irrigation, mineral fertilizers, plant protection, as well as providing preferential loans for leasing of machinery and equipment [7].

Many cost types are determined comprehensively for the whole farm (fuel and lubricants, depreciation and current repair of machinery, etc.), and are transferred in respective shares for each crop.

In this regard, priority tasks include conservation of productive agricultural lands, optimization of arable land and sown areas by quantitative and qualitative characteristics of land.

The solution of these tasks is related to the improvement of technologies of maintaining and increasing bioproductivity of agricultural lands, the development of technologies of rational land management, land use and land protection, establishing the effective organizational and legal mechanisms of agricultural land management, and the development of public monitoring of agricultural lands.

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А. Н. Жилдикбаева[1], А. И. Сабирова[2], Т. П. Пентаев[1],
А. Д. Омарбекова[1], Виргиния Гурскиене[3]

[1]Қазақ ұлттық аграрлық университеті, Алматы, Қазақстан,
[2]Қазақ аграрлық-өнеркәсіптік кешенінің экономикасы және ауылдық аумақтарды дамыту ғылыми-зерттеу институты, Алматы, Қазақстан,
[3]Александр Стульгинскис университеті, Каунас, Литва

ЖҰМЫС ІСТЕП ТҰРҒАН АГРОҚҰРЫЛЫМДАРДЫҢ ЖЕР ПАЙДАЛАНУ АУМАҒЫНДА ЖЕРДІ ПАЙДАЛАНУ ТИІМДІЛІГІН БАҒАЛАУ

Аннотация. Мақалада құрылымдық және ресурстық көрсеткіштерді есепке ала отырып, көп секторлы экономикада ауыл шаруашылық жерлерін тиімді пайдаланудың анықтау әдістемесі қарастырылды. Шаруа қожалықтарының болашақтағы жұмысын оңтайландыру мақсатында жер қатынастары жүйесін жетілдіру қажеттілігі қарастырылады. Аграрлық бизнестің өнімдік тиімділігін арттыру үдерісінде жер учаскелерінің оңтайлы мөлшеріне жету қажеттілігі негізделген. Зерттеулер көрсеткендей, жерді пайдаланудың экономикалық тиімділігін бағалау әдістемесі кез келген кәсіпкерлік субъектісіне пайдалануда өте қарапайым болуы керек. Сондай-ақ, жерді тиімді пайдаланудың кез келген әдістерінде экономикалық бағалаудың барлық құндық көрсеткіштерінің бірден бір маңызды кезеңі болып, олардың тәуекелділігі және инфляциясы арқылы қарастырылуы тиіс. Бағаларына өзгеріс енгізу қажет, өйткені сатылған өнімнің бағасы кәсіпорынның жалпы кірісін анықтау үшін сатып алынған баға есебімен есептеледі.

Түйін сөздер: агроқұрылымдар, тиімділігі, ауыл шаруашылығының жалпы өнімі, ауыл шаруашылығы мақсатындағы жерді ұтымды пайдалану, жерді оңтайлы пайдалану.

А. Н. Жилдикбаева[1], А. И. Сабирова[2], Т. П. Пентаев[1],
А. Д. Омарбекова[1], Виргиния Гурскиене[3]

[1]Казахский национальный аграрный университет, Алматы, Казахстан,
[2]КазНИИ экономики АПК и развития сельских территорий, Алматы, Казахстан,
[3]Университет Александра Стульгинскиса, Каунас, Литва

ОЦЕНКА ЭФФЕКТИВНОСТИ ИСПОЛЬЗОВАНИЯ ЗЕМЕЛЬ В ГРАНИЦАХ ЗЕМЛЕПОЛЬЗОВАНИЙ ДЕЙСТВУЮЩИХ АГРОФОРМИРОВАНИЙ

Аннотация. В статье рассмотрена методика определения эффективности использования земель сельскохозяйственного назначения в условиях многоукладной экономики с учетом структурных и ресурсных показателей. Рассмотрена необходимость совершенствования системы земельных отношений крестьянских

(фермерских) хозяйств в целях оптимизации их деятельности на перспективу. Обоснована необходимость достижения оптимальных размеров земельных площадей в процессе роста доходности аграрного бизнеса. Исследования показали, что методика оценки экономической эффективности использования земли должна быть достаточно проста в применении к любым хозяйствующим субъектом. Также одним из важных моментов является то, что все стоимостные показатели, используемые в любых методиках оценки экономической эффективности использования земли, должны рассматриваться с учетом инфляции и риска. Необходимо вносить коррективы в цены, т.к. стоимость реализованной продукции рассчитывается с учетом закупочных цен для определения общего дохода предприятия.

Ключевые слова: агроформирования, эффективность, валовая продукция сельского хозяйства, рациональное использование сельхозугодий, оптимальное землепользование.

Information about authors:

Zhildikbayeva A. N. – PhD student, Kazakh National Agrarian University, Almaty, Kazakhstan; a.zhildikbaeva@mail.ru; https://orcid.org/0000-0002-3556-651X

Sabirova A. I. – Candidate of economic sciences, Kazakh Research Institute of economics in Agro-Industrial Complex and development of rural areas, Almaty, Kazakhstan; sabirova_alla@mail.ru; https://orcid.org/0000-0003-2519-4123

Pentayev T. P. – Doctor of technical sciences, prof. chair "Land resources and cadastre", Kazakh National Agrarian University, Almaty, Kazakhstan; t_p_12@mail.ru; https://orcid.org/0000-0001-8446-6972

Omarbekova A. D. – Doctor PhD, Kazakh National Agrarian University, Almaty, Kazakhstan; ardak_dd@mail.ru; https://orcid.org/0000-0002-6607-7292

Virginija Gurskienė – Doctor of technology science, assoc. prof. Alexander Stulginskis University, Kaunas, Lithuania; Virginija.Gurskiene@asu.lt; https://orcid.org/0000-0003-3697-9006

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Z. Amangeldikyzy[1], A. S.Kochorov[2], Aziz Karakaya[3]

[1]Kazakh National Agrarian University, Almaty, Kazakhstan,
[2]Institute of Agriculture named after A.I. Baraev, LLP, Depute general director, Almaty, Kazakhstan,
[3]Ankara University, Faculty of Agriculture, Department of Plant Protection, Dışkapı, Ankara, Turkey.
E-mail: zako_89@mail.ru

IMMUNE-PHYTOPATHOLOGICAL ASSESSMENT OF RESISTANCE OF SPRING WHEAT VARIETIES TO STEM RUST IN THE NORTHERN, WESTERN AND SOUTH-EASTERN REGIONS OF QAZAQSTAN

Abstract. Stem rust is the most common and dangerous disease of wheat. Despite comprehensive studies of stem rust, protection of wheat from this disease is still relevant. In order to determine resistance to stem rust under field and laboratory conditions, phenologic, phytopathological were conducted on 90 varieties of spring wheat varieties. The paper also presents biological features and harmfulness of stem rust (*Puccinia qraminis Pers*). In addition, farmers and agricultural organizations are informed that the new virulent Ug99 stem rust race found in Uganda is now rapidly spreading, creating devastating epiphytoties on wheat, which is dangerous for the Central Asian region, including Kazakhstan. A long time ago, stem rust has been of particular concern to scientists. The rapid spread of new strain of the pathogenic agent may endanger the world's grain reserves. For many years, linear stem rust has been of particular concern to scientists. Kazakhstan farmers should also remember about stem rust.

Keywords: phytopathogen, wheat, monitoring, stem rust, inoculum, resistance.

Introduction. We know that not so long ago stem rust was an example of how the selection science has “killed” an extremely dangerous disease of cereals. It would seem that by the 1970s, the pathogen, which in the first half of the twentieth century had resulted in serious crop losses, was killed by spreading new resistant varieties around the globe.

However, in fact, in 30 years of silence, the fungus mutated into a new extremely aggressive race and in 1999 struck the crops of the North African state of Uganda. Thus, its name and that of the strain justifies itself: stem rust of wheat (*Puccinia qraminis f., tritici*) has the ability to transform crops that look quite healthy a few weeks before harvest, into tangled black stems with wrinkled grains by the time of harvest. Under certain conditions, a loss of 70% or more of the crop is possible. In recent years, the close attention of breeders to stem rust of wheat has been caused by concern about the high aggressiveness of this pathogen. A characteristic feature of this type of rust, in contrast to brown and yellow rust, is that it affects stems, leaves and ears of wheat, and can almost completely destroy wheat crops. It is no accident that during the Cold War this pathogen was considered a biological weapon. Before 2004-2005, the struggle against stem rust was cited as a classic example of effective and long-term genetic protection of plants. For the last 30 years, the presence of the Sr31 gene in many cultivated wheat varieties provided protection of wheat against diseases (Shamanin et al., 2012). In 1999, in Uganda, the affection of genotypes with the Sr31 gene with stem rustwas first noted, which up to that time had been practically unaffected with stem rust. This single incident alerted the world about the appearance of new stem rust race called Ug 99. It took only a few years for the new race to spread in the wheat sowing regions of Kenya and Ethiopia. Already in 2005-2006, the cultivation of wheat in these countries without chemical treatment was almost impossible (Singeetal., 2008).

Sh. S. Rsaliev, M. Koishibaev noted the foci with the moderate and strong development of stem rust on spring wheat crops in the Kostanay and North Kazakhstan regions. The spread of the disease varied in the range of 20-40%, while in some fields this indicator reached 90-100%. However, the degree of damage to plants did not exceed 10%, and only in rare cases it was 25%.

Materials and methods. The studies were conducted in 2014-2017 based on stationary experiments of the Kazakh Research Institute of Agriculture and Plant Growing, in the Kazakh Research Institute for Plant Protection and Quarantine named after Jh. Zhiembaev and in the CIMMYT-Turkey greenhouse.

The resistance of wheat varieties and samples was evaluated by the dominant types of rust. The resistance of wheat lines to stem rust was evaluated in points at the stages of earing and milky ripeness of grain.

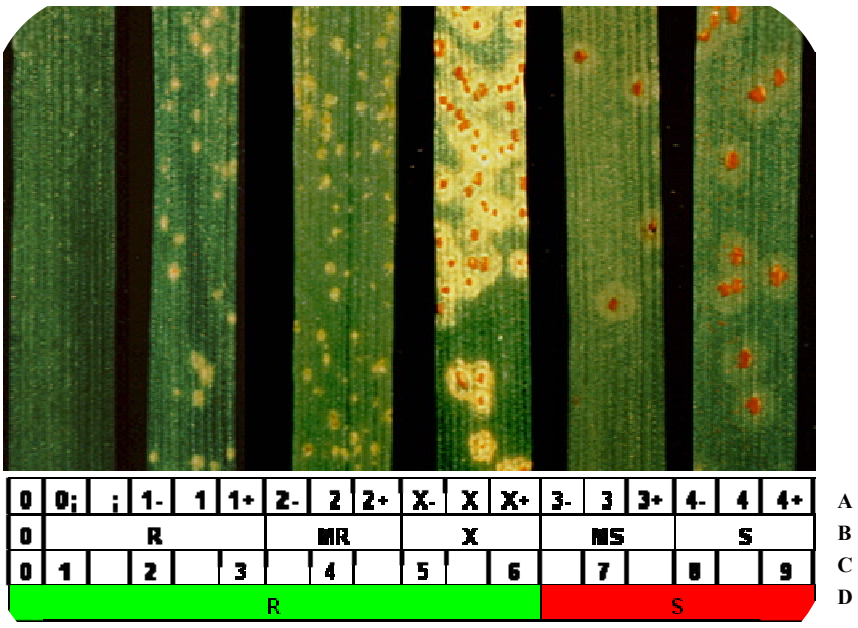

Figure 6 – Scales of resistance of wheat to stem rust:
A - photographs of types of damage; B - scoring scale from 0 to 4 points, where X is a heterogeneous reaction;
C - unified scoring scale, D - scalefrom 0 to 9 points, E - qualitative damage reactions: resistance (R) and susceptibility (S)

In Turkey, 90 samples of the seeds of the 17F1SYNT-OMSK-LIST farm were sown in a greenhouse in one row of 1 meter long. There was one replication. On an artificial infection background of stem rust (*P. graminis*Pers.f. sp.*Triticieeriks* and *E. hernn*), the collection of synthetic wheat for resistance to diseases was evaluated. Inoculation was conducted to assess stem rust in greenhouse conditions. Samples of rust uredopustule were collected during the milky-wax stage in the greenhouse by artificial means using a special apparatus. Reproduction of the inoculum was carried out under the greenhouse conditions on the Demir universally susceptible wheat variety. Shoots were inoculated into a 2-3-leaf stage. The incubation period of the disease depends on the room temperature. For brown rust at a temperature of 26-28 °C the incubation period was 7-8 days, for the yellow rust pathogen, the optimum temperature for infection of plants and the development of the disease was in the range of 15-20 °C.

The manifestation of the disease was taken into account after 14 days on the Mackintosh scale (figure 1, 2).

The study of cereals in the greenhouse conditions is shown in figures 1, 2, 4.

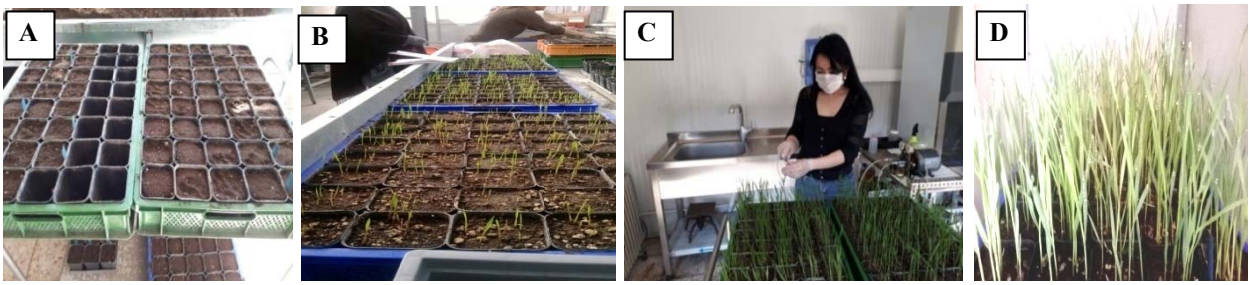

Figure 1 – A - Sowing of wheat material, B - care, C - Day of inoculation, D - A day after inoculation

Figure 2 – Collection of stem rust spores for artificial inoculation

In the spring, in the tillering stage, the crops of spring wheat were infected with uredospores of stem rust. For infection, only the local fungus population, or the races (pathotypes) with a certain virulence were used. The inoculum taken for infection was activated at a temperature of 37-40 °C for 30 minutes, followed by watering in a moist chamber at a temperature of 18-22 °C for 2-4 hours. The infectious material was applied to the plants by spraying with an aqueous spore suspension from 0.001% Tween 80 according to E.E. Geshele, or by powdering a mixture of spores with talc (at a ratio of 1: 300) according to G.S. Turov et al.. The plants were infected in the evening in windless weather after preliminary watering and moistening of leaves of plants of experimental crops. The spore infectious load was 20 mg/m^2. After the infection, the plots were covered with a polyethylene film for 16-18 hours to create high humidity (figure 3).

Figure 3 – Establishment of the field experiment on creating an infection background of stem rust of wheat

Results. After the manifestation of diseases on susceptible control varieties, the resistance of plants to rust types according to the established scales was assessed 2 to 3 times (figures 4).

Figure 4 – A - Assessment of resistance of wheat varieties to stem rust in the greenhouse
B - Assessment of resistance of wheat varieties to stem rust in the field

According to the results of the research from the 17F1SYNT-OMSK-LIST farm, 90 lines were identified. 8 of them were resistant varieties, entry no 69, 71,72, 74,75,77,78,89. 16 varieties were moderately resistant to stem rust, 26 varieties were moderately susceptible, 19 varieties were susceptible, and 1 varieties possessed the R-S reaction type - SY ROWYN, 20 varieties possessed the MR-MS reaction type (table 1, figure 6).

Table 1 – Damage to nursery 17F1SYNT-OMSK-LIST to stem rust
in the northern, western and south-eastern regions of Qazaqstan

Entry no.	Variety or breeding line	Origin	Defeat, score			
			Almaty	WKO		Shortandy
			17.08.17	08.08.17	19.08.17	28.08.17
			SR	SR	SR	SR
1	2	3	4	5	6	7
1	SERI	KAZ	1 MR	1 MR	5 MR	50S
2	STEPNAYA75	KAZ	10 MR	5 MR	20 MS	60S
3	STEPNAYA1414	KAZ	10 MR	5 MR	20 MS	80S
4	GVK2055-1	KAZ	30 MS	5 MS	20 MS	80S
5	LUTESTSENS2	KAZ	30 MS	5 MS	20 MS	80S
6	LINE-C-19SB	KAZ	1 MR	1 MR	1 MR	10MRMS
7	KARABALYKSKAYA 20	KAZ	30 MR	10 MS	40 MS	100S
8	FANTAZIYA	KAZ	30 MR	5 MR	30 MS	100S
9	BOSTANDYK	KAZ	10 MR	5 MS	20 MS	80S
10	LUTESCENS 30 69/97	KAZ	30 MS	5 MS	20 MS	80S
11	KARAGANDINSKAYA 30	KAZ	10 MR	5 MS	30 MS	80S
12	KARAGANDINSKAYA 31	KAZ	30 MR	20 MS	80 S	80S
13	PAVLODARSKAYA YUBILEYNAYA	KAZ	30 MS	5 MS	80 S	100S
14	KONDITERSKAYA YAROVAYA	KAZ	5 MR	5 MR	5 MS	15MRMS
15	FITONC-50SB	KAZ	10 MR	5 MR	5 MS	10MRMS
16	FITON82	KAZ	30 MR	10 MR	15 MS	30MRMS
17	FITON-C-54SB	KAZ	30 MS	5 MS	10 MS	40MS
18	EKADA148	KAZ	30 MS	5 MS	30 MS	40MS

Continuation of table 1

1	2	3	4	5	6	7
19	EKADA 113	KAZ	10 MR	5 MR	15 MS	30MRMS
20	LYUBAVA	KAZ	5 MR	5 MR	15 MS	40MS
21	FITON 41	KAZ	30 MS	10 MS	60 S	80S
22	FITON 204	KAZ	40 S	5 MR	60 S	80S
23	VLADIMIR	KAZ	30 MS	10 MS	40 S	80S
24	TSELINA50	KAZ	40 S	5 MR	50 S	80S
25	TSELINNAYA NIVA	KAZ	10 MS	5 MR	50 S	80S
26	ASYLSAPA	KAZ	30 MS	10 MS	40 S	80S
27	AKMOLA 2	KAZ	40 S	5 MR	40 S	100S
28	AK ORDA	KAZ	30 MS	10 MS	40 S	80S
29	SHORTANDINSKAYA 2012	KAZ	40 S	5 MS	60 S	100S
30	TSELINNAYA 3S	KAZ	30 MS	10 MS	50 S	80S
31	ASTANA	KAZ	40 S	5 MS	40 S	80S
32	ALTAISKAYA70	RUS	30 MS	5 MR	40 S	80S
33	ALTAISKAYA110	RUS	30 MS	5 MS	40 S	80S
34	TOBOLSKAYA	RUS	10 MS	20 MS	40 S	100S
35	ALTAYSKAYA ZHNITSA	RUS	10 MS	20 MS	50 S	80S
36	STEPNAYA VOLNA	RUS	40 S	20 MS	30 MS	80S
37	APASOVKA	RUS	30 MS	10 MR	30 MS	80S
38	LUTENSCENS89-06	RUS	30 MS	20 MS	40 S	80S
39	DUET	RUS	30 MS	10 MR	40 S	80S
40	PAVLOGRADKA	RUS	10 MS	5 MS	60 S	80S
41	LUTESCENS29-12	RUS	1 MR	5 MR	1 MR	10MRMS
42	LUTESCENS106-11	RUS	5 MR	1 MR	1 MR	10MRMS
43	TULAIKOVSKAYA110	RUS	10 MR	5 MR	10 MS	20MRMS
44	LUTESCENS916	RUS	10 MR	1 MR	5 MR	20MRMS
45	GRECUM1003	RUS	10 MR	1 MR	5 MR	30MS
46	LUTESCENS1062	RUS	10 MR	5 MR	5 MR	20MRMS
47	LUTESCENS89-06	RUS	10 MR	1 MR	1 MR	20MRMS
48	ERITROSPERMUM85-08	RUS	10 MR	1 MR	1 MR	20MRMS
49	SEREBRISTAYA	RUS	20 MS	20 MS	50 S	60S
50	SERI	RUS	1 MR	1 MR	5 MR	5MR
51	BOEVCHANKA	RUS	10 MR	5 MS	20 MS	50MS
52	OMSKAYA 37	RUS	5 MR	5 MR	5 MR	20MRMS
53	LUTESTSENS7-04-4	RUS	5 MR	5 MR	10 MR	20MRMS
54	LUTESTSENS197-04-7	RUS	5 MR	5 MR	20 MS	30MRMS
55	LUTESTSENS220-03-45	RUS	5 MS	5 MS	30 MS	40MS
56	TULAIKOVSKAYA 10	RUS	10 MR	5 MR	30 MS	40MS
57	TULAIKOVSKAYA ZOLOTISTAYA	RUS	10 MR	10 MR	40S	60S
58	TULAIKOVSK 100	RUS	5 MS	5 MS	15 MS	40MS
59	GREKUM 650	RUS	5 MS	5 MR	15 MS	40MS
60	LUTESCENS 920	RUS	5 MR	5 MR	10 MR	40MS
61	EKADA 121	RUS	40 S	10 MS	30 MS	80S

Continuation of table 1

1	2	3	4	5	6	7
62	CIMMYT	RUS	30 MR	10 MS	10 MS	40MS
63	P-23-17	RUS	30 MR	10 MR	60 S	80S
64	PAMYATI RUBA	RUS	10 MS	20 MS	60 S	80S
65	CHELYABA 75	RUS	5 MR	5 MR	10 MR	15MRMS
66	ERITROSPERMUM 23707	RUS	30 MS	10 MS	40 S	60S
67	SY TYRA	US-SYN	10 MR	1 MR	1 MR	5MRMS
68	SY GOLIAD	US-SYN	5 MR	5 MR	5 MR	15MRMS
69	SY SOREN	US-SYN	5 MR	5 MR	1 R	5MR
70	SY ROWYN	US-SYN	5 MR	10 MR	60 S	1MR-80S
71	SY INGMAR	US-SYN	R	1 MR	R	1R
72	SELECT	US-SDSU	1 MR	1 R	1 MR	1R
73	FORE FRONT	US-SDSU	1 MR	1 MR	1 MR	5MR
74	PREVAIL	US-SDSU	1 MR	1 R	1 MR	5MR
75	ADVANCE	US-SDSU	1 MR	1 R	R	5MR
76	BRICK	US-SDSU	10 MR	5 MR		
77	CARBERRY	CAN	1 MR	1 R	1 MR	1R
78	MUCHMORE	CAN	1 MR	1 MR	1 MR	5MR
79	URALOSYBIRSKAYA	RUS	5 MR	5 MR	1 MR	20MRMS
80	TORNADO 22	KAZ	20 MS	10 MS	50 S	50S
81	LYUTESTSENS 1012	RUS	30 MS	20 MS	50 S	80S
82	LYUTESTSENS 7-04-10	RUS	10 MR	5 MR	10 MR	20MRMS
83	LYUTESTSENS 208-08-4	RUS	5 MR	5 MR	15 MS	30MRMS
84	LYUTESTSENS 27-12	RUS	10 MS	5 MR	20 S	40MS
85	ERITROSPERMUM 85-08	RUS	10 MR	5 MR	15 MS	20MRMS
86	LYUTESTSENS 6-04-4	RUS	5 MR	5 MR	15 MR	20MRMS
87	LYUTESTSENS 186-04-61	RUS	10 MS	20 MS	20 MS	60S
88	CHEBARKULSKAYA 3	RUS	20 MS	5 MS	40 MS	80S
89	LINE D 25	RUS	1 MR	5 MR	1 MR	5MR
90	LINE 654	RUS	10 MR	5 MR	10 MS	30MS

Based on the results of the statistical processing of the data obtained on the productivity of the ear, the best samples were identified, which showed the maximum grain mass index from the ear in comparison with the standards, the length and density of the ear, and also the mass of 1,000 grains, by which they exceeded the standard Kazakhstanskaya 10.Samples No. 87, 41, 56, 20, 81, 30 and 53, 80, 65, 37, 62, 19, 22, 54, 21, 64, 40, 32 exceeded the standard by weight of grain from the ear, all samples except for CYMMIT (7 cm) were by 2 cm less in length of the ear, and many synthetics were not inferior to the standard by weight of 1,000 grains (table 2).

In samples No. 87, 41, 20, 30, 37, 62, 19, 54, 40, 32, the weight of 1,000 grains was higher than that of the standard variety. From 97 varieties and lines, one variety - Altaiskaya 70 -had the same yield-compared with the standard, 18 varieties exceeded the standard, and the remaining varieties showed lower yields than Kazakhstanskaya 10. This, apparently, was due to higher productive bushiness in the local variety, while the samples of synthetic wheat studied were less bushy. The obtained data are preliminary; the splitting of hereditary traits must be studied in subsequent generations (see table2).

Table 2 – Yields of varieties and wheat lines in comparison with the standard variety

Item No.	Variety, line	Bushiness, pcs		Ear length, cm	Number of ears, pcs.	Number of grains from 1 ear, pcs.	Mass of grains from 1 ear, g.	Mass, 1,000 grains, g	Yield, c/hectare
		total	productive						
87	Lyutestsens 186-04-61	2.8	1.5	11	19	34.2	3.063	36.98	61.26
41	Lutescens29-12	2.5	1.2	12.5	20	36	2.854	35.59	57.08
56	Tulaikovskaya 10	2.5	1.2	12	20	36	2.613	34.24	52.26
20	Lyubava	2.5	1.2	12	21	35.8	2.563	34.12	51.26
81	Lyutestsens 1012	2.7	1.4	11	20	36	2.523	34.58	50.46
30	Tselinnaya 3s	2.7	1.4	11.6	17	30.6	2.296	32.1	45.92
53	Lutestsens7-04-4	2.8	1.5	11	19	34.2	2.292	32.54	45.84
80	Tornado 22	2.7	1.4	12.8	20	36	2.271	31.3	45.42
65	Chelyaba 75	2.6	1.3	11.5	18	32.4	2.251	31.06	45.02
37	Apasovka	2.5	1.2	11.5	19	34.2	2.242	33.23	44.84
62	Cimmyt	2.6	1.3	7	17	30.6	2.21	33.02	44.20
19	Ekada 113	2.6	1.3	11.5	18	32.4	2.153	32.45	43.06
22	Fiton 204	2.8	1.5	12	20	36	2.106	31.12	42.12
54	Lutestsens197-04-7	2.5	1.2	11	19	34.2	2.071	32.56	41.42
21	Fiton 41	2.6	1.3	12	21	33.8	2.024	31.84	40.48
64	Pamyati ruba	2.6	1.3	12	18	32.4	1.978	31.0	39.56
40	Pavlogradka	2.7	1.4	10	18	32.4	1.939	33.09	38.78
32	Altaiskaya70	2.5	1.2	11.5	18	32.4	1.896	31.37	37.92
	Kazakhstanskaya 10	2.8	1.2	9	18	32.4	1.896	30.1	37.92

Conclusion. In the field, as a result of phenological observation, 11 varieties of Seri, Pamyatiruba, Sytyra, Sygoliad, Sysoren, Syrowyn, SyIngmar, Select, Carberry, Muchmore proved to be the fastest-growing ones.

Of the tested varieties and lines there are no the varieties absolutely resistant to stem rust, but at the same time they differ in stability and susceptibility.

According to V.N. Tishenko and N. M. Chekalin (Tishenko, Chekalin, 2005) [18], the size of the crop depends on the mass of the grain from one ear and productive bushiness. Reduction of these indicators occurs due to losses of plants and their vegetation stems. The elements of the crop pattern of wheat selection lines are unstable in terms of sowing years and times due to the extreme variability of the trait - the number of ears per 1 m^2.

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З. Амангелдіқызы[1], А. С. Кочоров[2], Азиз Каракай[3]

[1]Қазақ ұлттық аграрлық университеті, Алматы, Қазақстан,
[2]"А. И. Бараев атындағы астық шаруашылығының ҒӨО" ЖШС, Астана, Қазақстан,
[3]Анкара университеті, ауыл шаруашылығы факультеті, өсімдік қорғау бөлімі, Дышкапі, Анкара, Түркия

ҚАЗАҚСТАННЫҢ СОЛТҮСТІК, БАТЫС ЖӘНЕ ОҢТҮСТІК-ШЫҒЫС АЙМАҚТАРЫНДАҒЫ ЖАЗДЫҚ БИДАЙ СОРТТАРЫНЫҢ САБАҚ ТАТЫНА ТӨЗІМДІЛІГІН ИММУНДЫ-ФИТОПАТОЛОГИЯЛЫҚ ТҰРҒЫДА БАҒАЛАУ

Аннотация. Сабақ тат ауруы бидайдың кең тараған және қауіпті ауруы болып табылады. Бидайд сабақ таттан қорғау, осы ауруды барлық қырынан зерттеуіне қарамастан, өзекті мәселе болып отыр. Далалық және зертханалық жағдайда сабақ татқа төзімділікті анықтау мақсатында 90 жаздық бидай сорттарына фенологиялық, фитопатологиялық зерттеулер жүргізілді. Сонымен қатар, жұмыста сабақ татының (*Puccinia qraminis Pers)* зияндылығы мен биологиялық ерекшеліктері қарастырылған. Содан басқа, ауыл шаруашылық органдары мен фермерлер айтуынша, Угандада сабақ татының жаңа верулентік раса Ug99 табылған, бидайда эпифитотия кезеңін тудырған, Орталық Азияға аймақтарына қауіп төндіруде, сонымен қатар Қазақстанға. Ғалымдаға көптен бері сабақ таты ерекше алаңдаушылық тудыруда. Жаңа штамм ауру қоздырғышының тез таралуы әлемдік астық резервтеріне қауіп төндіруі мүмкін. Көпетеген жылдар бойы ғалымдар сабақ таты ауруына ерекше назар аударуда. Қазақстандық фермерлердің сабақ татын естен шығармағаны дұрыс.

Түйін сөздер: фитопатоген, бидай, мониторинг, сабақ тат, инокулум, төзімді.

З. Амангелдикызы[1], А. С. Кочоров[2], Азиз Каракай[3]

[1]Казахский национальный аграрный университет, Алматы, Казахстан,
[2]«НИИ сельского хозяйства им. А. И. Бараева», Астана, Казахстан,
[3]Университет Анкары, факультет сельского хозяйства, отдел защиты растений, Дышкапы, Анкара, Турция

ИММУННО-ФИТОПАТОЛОГИЧЕСКАЯ ОЦЕНКА УСТОЙЧИВОСТИ СОРТОВ ЯРОВОЙ ПШЕНИЦЫ К СТЕБЛЕВОЙ РЖАВЧИНЕ В СЕВЕРНОМ, ЗАПАДНОМ И ЮГО-ВОСТОЧНОМ РЕГИОНАХ КАЗАХСТАНА

Аннотация. Стеблевая ржавчина особо опасный и распространенный болезь пшеницы. Зачита пшеницы от стеблевой ржавчине, не смотря на то, что он изучал болезнь во всех отношениях, проблева остается. В работе представлены результаты фитопатологические и фенологические оценки сортов яровой пшеницы в количестве 90 образцов яровой пшеницы. А также, в работе приводятся данные биологические особенности и вредоносности стеблевой ржавчины (*Puccinia qraminis Pers)*. Кроме того, информируются фермеры и с/х организации, что обнаруженная в Уганде новая вирулентная раса стеблевой ржавчины Ug99, в настоящее время быстро распространяется, создавая разрушительные эпифитотии на пшенице, что представляет опасность для Центрально-Азиатского региона, в том числе и для Казахстана. Уже давно стеблевая ржавчина вызывает особое беспокойство ученых. Быстрое распространение нового штамма возбудителя заболевания может поставить под угрозу мировые запасы зерна. Уже более много лет стеблевая ржавчина вызывает особое беспокойство ученых. Помнить о стеблевой ржавчине следует и казахстанским фермерам.

Ключевые слова: фитопатоген, пшеница, мониторинг, стеблевая ржавчина, инокулум, устойчивость.

Information about authors:

Amangeldikyzy Zamzagul – PhD student plant protection, Kazakh national agrarian university, Almaty, Kazakhstan; zako_89@mail.ru; https://orcid.org/0000-0002-8701-6819

Kochorov Abdumamat Suleymanovih – candidate of agricultural sciences, doctor PhD, Institute of Agriculture named after A. I. Baraev, LLP, Depute general director, Astana, Kazakhstan; kochorov@mail.ru; https://orcid.org/0000-0002-6080-683X

Aziz Karakaya – professor, Ankara University, Faculty of Agriculture, Department of Plant Protection, Dışkapı, Ankara, Turkey; azizkarakaya@hotmail.com; https://orcid.org/0000-0002-0902-0310

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R. S. Karmaliyev[1], V. P. Krotenkov[2], Zh. T. Usenov[1], K. M. Akhmedenov[1], B. M. Sidikhov[1], B. E. Aytuganov[1], B. O. Ertleuova[1], D. E. Gabdullin[1], S. Kh. Beketova[1]

[1]Non-commercial joint-stock company "Zhangir Khan West Kazakhstan Agrarian Technical University", Uralsk, Kazakhstan,
[2]Smolensk State Agricultural Academy, Smolensk, Russia.
E-mail: karmalyev@mail.ru, elenamedvedeva@yandex.ru, usenov79@mail.ru, kazhmurat78@mail.ru, sidihovbm@mail.ru, bulat_aytuganov@mail.ru, aliba.87@mail.ru, dosya_gabdullin@mail.ru, beketova_2094@mail.ru

THE LEVEL OF HELMINTHS INVASION OF DIGESTIVE TRACT OF CATTLE AND SAIGAS IN WEST KAZAKHSTAN REGION

Abstract. Helminth fauna commonness at cattle and saigas was noticed in West Kazakhstan region. The results of helminthoovoscopic researches of animals' excrements by Fulleborn have shown that cattle and saigas are infested with Trichostrongylidae family (Strongylata suborder) strongyloides of digestive tract from Nematodirus, Ostertagia, Cooperia, Haemonchus, Trichostrongylus, Marshallagia genus, and also with Moniezia genus cestodes. Invasion extensiveness of cattle with digestive tract strongyloides was 31,3% on the average, and moniesia - 16,4%. Invasion extensiveness of saigas was 88,8% and 7,4%, respectively. Besides, similarity of seasonal and age dynamics of digestive tract strongyloides was observed at cattle and saigas. In winter, invasion extensiveness of animals decreases, and the peak of invasion falls on summer period. Thus, animals during the whole year is infested with digestive tract strongyloides. Invasiveness decreases with age of animals. Contacts of saigas and cattle in pasturable territories bring to the commonness of helminths composition. Saigas are natural tank and constant source of helminths invasion for domestic ruminants in West Kazakhstan region. Therefore, when planning treatment-and-prophylactic actions against helminthoses it is necessary to consider this factor.

Key words: cattle, saigas, helminthoses, invasion extensiveness, seasonal and age dynamics, West Kazakhstan region.

Introduction. Cattle breeding in West Kazakhstan region is one of the leading branches of livestock production. However, extensive economic damage is caused to it by helminthic diseases. The data on specific composition of helminths, epizootology, seasonal and age dynamics in different regions is necessary for the development of fight measures against cattle helminthoses. K.I. Skryabin has for the first time conducted researches on studying of helminth fauna of cattle in the territory of Kazakhstan. [1]. He and his students organized over 30 helminthological expeditions which have collected the big material characterizing specific composition of cattle helminths. New data on cattle helminths fauna in Kazakhstan was obtained by G.I. Dikov, etc. [2]. Cattle helminth fauna in Kazakhstan was studied by K.I. Skryabin, R.S. Schultz [1], S.N. Boev, etc. [3], E.I. Pryadko [4], B.M. Shonov [5], K.M. Erbolatov [6], V.S. Petrov [7], M.Zh. Suleymenov [8], V.T. Ramazanov [9] and others. 35 types of helminths from trematode, cestode and nematode classes were registered at cattle in the territory of West Kazakhstan. For last years, specific composition of cattle helminths could undergo considerably changes owing to various factors. One of such factors is wild animals living in the territory of West Kazakhstan region. The most numerous of them are saigas.

Saiga (lat. Saiga tatarica) - is an artiodactyl mammal from antelope subfamily. It is rather small artiodactyl animal, length of body is 110-146 cm, height in withers is 60-79 cm, weight is 23-40 kg, extended trunk on thin, rather short legs.

According to "Kazakhstan Today Media Group (2015), the number of saigas in 2014 has reached about 260 thousand individuals relating to Saiga tatarica tatarica subspecies and living in Russia and three areas of Kazakhstan [10,11,12]. By data of K.K. Baytursinov [13] it was determined that natural seasonal migrations of saigas make one of ecological features of their adaptations. Seasonal location on natural zones is distinctly expressed at animals. Saiga herds during migration are grazed generally on the same pastures as sheep. However, saigas constantly replace sites of pastures.

Commonness of saiga and domestic sheep parasites is 50-100%. However, a part of these parasites is more specific to saiga, such as *A.centripunctata, S.ovis and N.gazellae*. Undoubtedly, saiga plays a significant role in the distribution and infection of pets. On the contrary, sheep are more intensively infested with taenia *E.granulosus* and *T.hydatigena*. Dogs play active role in the distribution of these parasites. Invasion extensiveness of saigas with these cysts during researches were rather high. The third group of parasites is nematodes which invasive elements are adapted to life in dry landscapes. They are *Marshallagia* and *Nematodirus* nematodes. Both groups of animals to the same extent participate in the circulation of these parasites in nature. But depending on the number of populations, density of pasture load by wild and domestic hoofed animals, the role of separate group of the specified nematodes in distribution can strongly vary.

A.G. Bannikov [14] notes that 55 species of endoparasites and about 10 ectoparasites were revealed in Caspian Sea region and in Kazakhstan at saigas. They are species of parasitic protozoa, cestodes, nematodes. The coefficient of helminths commonness of farm animals and saigas in Kazakhstan makes 67-84,7%; analogous situation was noted in Caspian Sea region.

According to M.Yu. Treus [15], etc. the structure of saigas helminth fauna in Askania-Nova includes 6 types of strongylidae – digestive tract helminths and 1 species of cestode (Moniezia expansa). Interesting observations on the formation of parasite fauna of saiga herd were made here.

Contacts of wild and domestic ruminants in pasturable territories bring to the composition commonness of helminths that is found at autopsy and scatological researches. It is known that wild hoofed animals are subject to various parasitic diseases which often terminate in a lethal outcome or loss of valuable trade qualities that causes extensive economic damage and reduces prestige of national parks and reserves. Although adult animals can be less infected than young growth, they are an important source of invasion distribution and promote developing of epizooty. The threat of invasion transfer from wild to domestic animals and to human is possible at wide expansion of parasitic diseases. Various measures of fight against parasitic diseases of farm and wild animals were proposed, including control of livestock number, destruction of corpses of animals, change of pastures, rational placement of biotechnical objects and other veterinary sanitary and general economy actions [16].

Comparisons of saigas and sheep helminth fauna were given in literature. However, there are no data on comparison of helminth fauna of saigas and cattle. There are no researches of seasonal and age dynamics of cattle and saigas invasion with helminths in comparative aspect.

The purpose of our researches is to determine specific structure, invasion degree, seasonal and age dynamics of main helminthoses of digestive tract in an organism of cattle and saigas in conditions of West Kazakhstan region.

Materials and methods. The work was performed within AP05136002 project on the subject "Development of measures of fight against main helminthoses of cattle in steppe, semi-desert and desert zones of West Kazakhstan region depending on weather conditions".

Invasion of cattle was defined in country farms in steppe, semi-desert and desert zones of West Kazakhstan region. Invasion of saigas was determined in the Center of preservation of biodiversity of wild animals, Zhangir Khan West Kazakhstan Agrarian Technical University located in the territory of Taskalinsky area of West Kazakhstan region where saigas are kept in captivity [17, 18]. Species composition, invasiveness degree, seasonal and age dynamics of main helminthoses of digestive tract of animals were studied. For this purpose, samples of excrements of cattle and saigas were taken. Researches of excrements were conducted by Fulleborn in the laboratory of research institute of biotechnology and environmental management at Zhangir Khan West Kazakhstan Agrarian Technical University. Scatolo-

gical researches of 319 samples of excrements from cattle and from 28 species of saigas were done. Calculation of helminths eggs amount in 1 gram of excrements was carried out with the use of VIGIS calculating camera. [19]. Samples of excrements at animals were taken in the morning, per rectum. Helminthoscopic and larvaescopic methods of excrements research were used for studying of seasonal dynamics of contamination of cattle and saigas with main types of digestive tract helminths. Researches were conducted quarterly, during different seasons. Invasiveness of various age groups of cattle and saigas was studied - below one year, 1-3 years, 4-5 years, 6-9 years, 10 years and more. The genus of helminths was determined by invasive larvae by P.A. Polyakov [20]. Excrements of animals were kept in the thermostat at the temperature of 25-30^{o}C in Petri dishes within 7 days for larvae cultivation. Excrements were daily humidified and aerated. The method of helminthological autopsy by K.I. Skryabin was used to determine species composition of digestive tract helminths of saigas [21]. For this purpose, helminthological research of fore stomachs, maw and intestines of five killed saigas were done. The contents of bodies were washed out 2-3 times, the deposit was poured out in sacks of mill gas. The sacks were tied and rinsed in water before complete cessation of dregs separation. Then, the content was studied by parts by means of microscope in Petri dish; selection of helminths was made by brush or microscopic needle. Identification of helminths was carried out by determinants of K.I. Skryabin, N.P. Shikhobalova, R.S. Schultz, etc. "Determinant of parasitic nematodes. V.3 Strongylata" [22]. Parenchymatous organs (liver and lungs) were investigated for studying of larvae echinococcosis dynamics.

Results of researches and their discussion. As a result of the conducted researches it was determined that cattle was infested with digestive tract strongyloides of Trichostrongylidae family (Strongylata suborder) from Nematodirus, Ostertagia, Cooperia, Haemonchus, Trichostrongylus genuses. Invasion extensiveness of animals with strongyloides has averaged 31,3%, and invasion intensity - 98,8±8,9 eggs in 1 gram of excrements (table 1). Cattle was infested with cestodes from Moniezia genus, M. benedeni species. Invasion extensiveness of animals with moniezia has averaged 16,4%, and invasion intensity - 114,5± 10,4 eggs in 1 gram of excrements.

Table 1 – Infectiousness of cattle digestive tract helminths according to excrement researches

#	Helminths	Animals studied	Animals infected	Invasion extensiveness, %	Average amount of eggs in 1 gram of excrements, specimen
1	Strongylata	319	100	31,3	98,8±8,9
2	M. benedeni.	319	52	16,4	114,5± 10,4

Helminthooscopic researches of excrements from saigas have shown that animals were infested with digestive tract strongyloides from Trichostrongylidae family (Strongylata suborder), Nematodirus, Ostertagia, Marshallagia, Trichostrongylus genuses and also with cestodes from Moniezia genus, Moniezia expansa species.

Invasion extensiveness of saigas with strongyloides has averaged 88,8%, and invasion intensity - 152,4±13,8 eggs in 1 gram of excrements (table 2). Invasion extensiveness of animals with moniezia has averaged 7,4%, and invasion intensity - 76,2±6,9 eggs in 1 gram of excrements.

Table 2 – Infectiousness of saigas with digestive tract helminths according to excrement researches

#	Helminths	Animals studied	Animals infected	Invasion extensiveness, %	Average amount of eggs in 1 gram of excrements, specimen
1	Strongylata	28	16	57,1	152,4±13,8
2	M. expansa	28	2	7,4	76,2±6,9

The analysis of the received results of helminthological autopsy of digestive tract of five saigas has shown that all animals were infested with helminths from Nematoda class. Existence of 5 types of helminths relating to 5 genuses of Nematodirus spathiger was noticed (invasion extensiveness – 80%, invasion intensity –35,2±3,2 specimen), Ostertagia ostertagi (invasion extensiveness – 40%, invasion intensity – 18,2±1,6 specimen), Trichostrongylus colubriformis (invasion extensiveness – 60%, invasion

intensity - 12,8±1,1 specimen), Marshallagia marshalli (invasion extensiveness – 80%, invasion intensity – 17,3±1,5 specimen), Haemonchus contortus (invasion extensiveness – 20%, invasion intensity - 11,8±1,07). Invasion extensiveness has averaged 56%, and invasion intensity - 19,1±1,7. All found parasites are geohelminths (table 3, figure 1).

The difference of invasion extensiveness with helminths at saigas between data of candling and autopsy is insignificant. Therefore, it is possible to be based on the data of candling.

By the results of researches, seasonal dynamics of digestive tract strongyloides in an organism of cattle in West Kazakhstan region varies considerably. In winter, invasion extensiveness of animals has decreased to 22,1%. During the spring period, cattle infectiousness was 24,6%. In summer – 40,2%, and in autumn – 38,7%. Average per year, invasion extensiveness of animals has averaged 31,4%. The peak of invasion falls on summer period, and minimum - on winter (table 4). Thus, cattle during the whole year is infested with digestive tract strongyloides.

Table 3 – Infectiousness of saigas with digestive tract helminths according to helminthological autopsy

#	Type of helminths	Animals studied	Animals infected	Invasion extensiveness, %	Invasion intensity, specimen
1	N. spathiger (Railliet, 1896)	5	4	80	35,2±3,2
2	O. ostertagi (Stiles, 1892)	5	2	40	18,2±1,6
3	T. colubriformis (Giles, 1892)	5	3	60	12,8±1,1
4	M. marshalli (Ransom, 1907)	5	4	80	17,3±1,5
5	H. contortus (Rudolphi, 1803)	5	1	20	11,8± 1,07
	Average			56	19,1±1,7

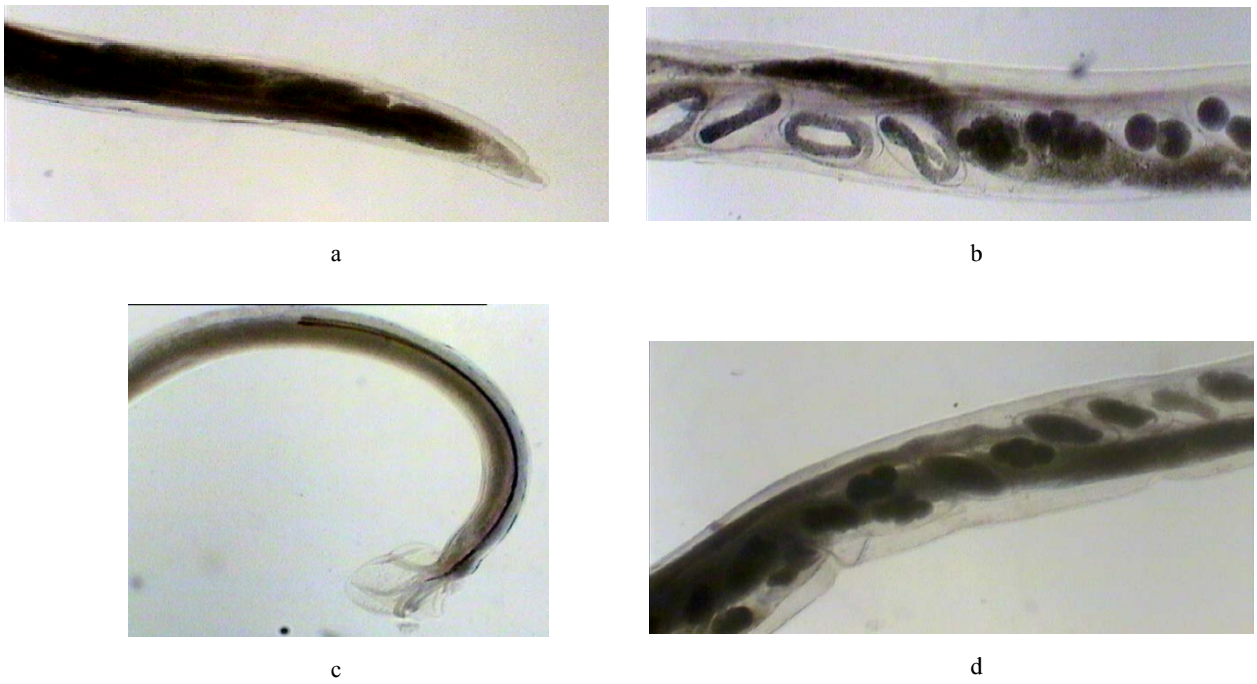
Table 4 – Seasonal dynamics of digestive tract strongyloides at cattle in West Kazakhstan region

Season	Animals studied	Animals infected	Invasion extensiveness, %
Spring	318	78	24,6
Summer	320	128	40,2
Autumn	321	120	38,7
Winter	319	70	22,1
Average			31,4

Helminthooscopic researches of excrements from cattle have shown that invasion extensiveness with digestive tract strongyloides of animals decreases with age. At young growth of cattle aged below one year it has made 27,4%, at the age of 1-3 years - 51,2%, at cattle at the age of 4-5 years - 32,7%, at animals at the age of 6-9 years - 22,5%, 10 years and more - 19,2%. Invasion extensiveness has averaged 30,6% (table 5).

Table 5 – Age dynamics of cattle invasiveness with digestive tract strongyloides

Age of animals	Animals studied	Animals infected	Invasion extensiveness, %
Below one year	58	13	27,4
1-3 years	43	22	51,2
4-5 years	85	26	32,7
6-9 years	71	16	22,5
More than 10 years	66	19	19,2
In total	323	96	
On average:			30,6



a b

c d

Figure 1 – Nematodirus spathiger.: a - tail end of female, b - female with eggs of different stage of development, c - tail end of male, d - vulva area of female. Increased by 60 times. Original. Author's photo.

Studied seasonal dynamics of saigas' invasiveness. The researches results are presented in table 6. During the spring period, invasiveness of saigas was 49,7%. In summer – 77,6%, and in autumn – 51,4%. In winter, invasion extensiveness of animals has decreased to 48,5%. Average per year, invasion extensiveness of animals has averaged 56,8%. The peak of invasion falls on the summer period, and minimum - on winter. Thus, saigas are infected with digestive tract strongyloides during the whole year.

Table 6 – Seasonal dynamics of digestive tract strongyloides at saigas in West Kazakhstan region

Season	Animals studied	Animals infected	Invasion extensiveness, %
Spring	28	14	49,7
Summer	32	25	77,6
Autumn	32	16	51,4
Winter	31	15	48,5
Average			56,8

Helminthooscopic researches of excrements from saigas have shown that invasion extensiveness with digestive tract strongyloides of animals decreases with age. At young growth of saigas aged about one year it has made 71,4%, at the age of 1-3 years - 58,5%, more than 4 years - 41,1%. Invasion extensiveness has averaged 57,0% (table 7).

Table 7 – Age dynamics of invasiveness of saigas with digestive tract strongyloides

Age of animals	Animals studied	Animals infected	Invasion extensiveness, %
Below one year	14	10	71,4
1-3 years	8	4	58,5
More than 4 years	6	2	41,1
In total	28	16	
On average:			57,0

Conclusion. Thus, cattle, and saigas in West Kazakhstan region is infested with helminths from Trichostrongylidae family (Strongylata suborder) of genus, but with different invasion extensiveness. From figures 2 and 3 it is visible that cattle and saigas have similar seasonal and age invasion dynamics. That is cattle and saigas are infested during all seasons of year with digestive tract strongyloides. Invasiveness of animals decreases with age. Saigas are natural tank and constant source of helminths invasion in West Kazakhstan region. Therefore, when planning treatment-and-prophylactic actions against helminthoses of domestic ruminants it is necessary to consider this factor.

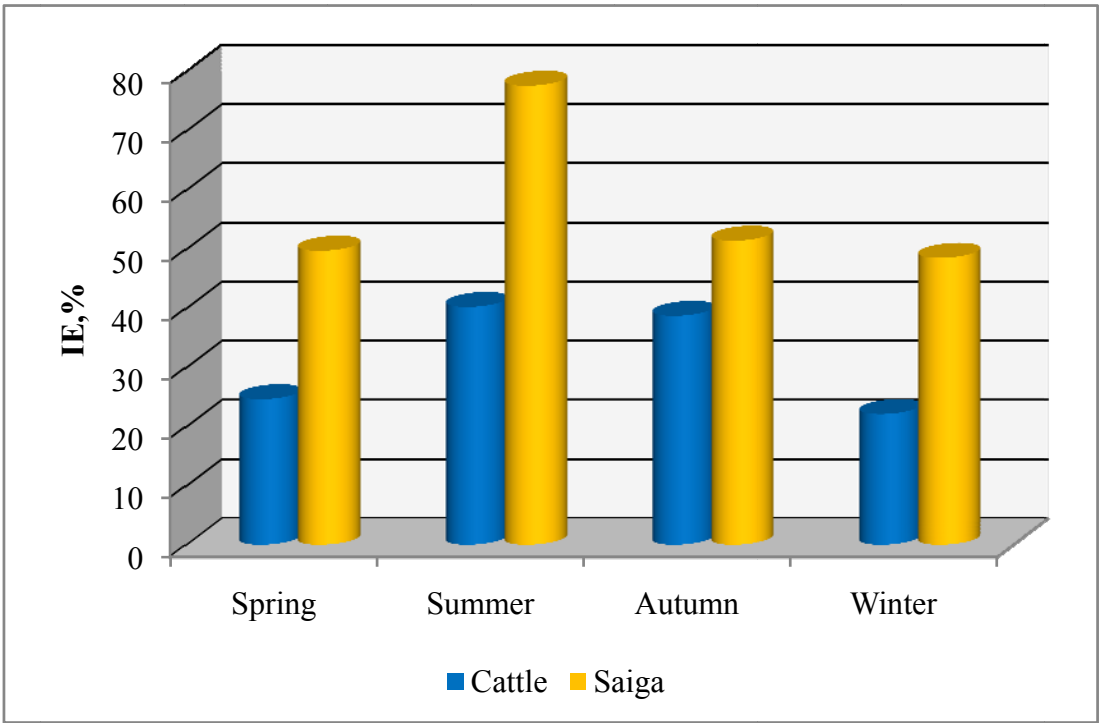


Figure 2 – Seasonal dynamics of invasion extensiveness with digestive tract strongyloides of cattle and saigas

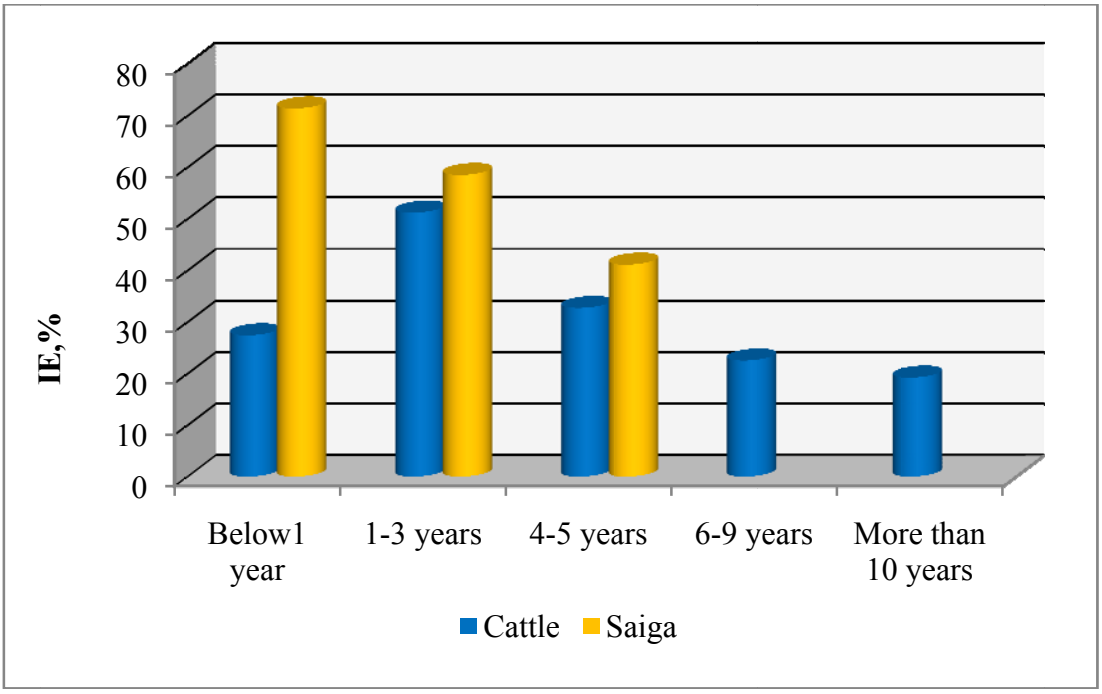


Figure 3 – Age dynamics of invasion extensiveness of digestive tract strongyloides of cattle and saigas

Conclusions.

1. Commonness of helminth fauna at cattle and saigas was noted in West Kazakhstan region.
2. All animal are infested with helminths from Nematoda class.
3. Nematodes from Nematodirus, Ostertagia, Marshallagia, Trichostrongylus, Cooperia, Haemonchus genuses and cestodes from Moniezia genus were found in cattle and saigas.
4. Invasion extensiveness with digestive tract strongyloides at cattle is 31,3%, at saigas - 57,1%.
5. Invasion extensiveness with moniezia at cattle is 16,4%, at saigas - 7,4%.
6. Cattle and saigas during all seasons of year are infested with digestive tract strongyloides.
7. Invasiveness of animals decreases with age.

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Р. С. Кармалиев[1], В. П. Кротенков[2], Ж. Т. Усенов[1],
К. М. Ахмеденов[1], Б. М. Сидихов[1], Б. Е. Айтуганов[1],
Б. О. Ертлеуова[1], Д. Е. Габдуллин[1], С. Х. Бекетова[1]

[1]НАО «Западно-Казахстанский аграрно-технический университет имени Жангир хана»,
Уральск, Казахстан
[2]Смоленская государственная сельскохозяйственная академия, Смоленск, Россия

ИНВАЗИРОВАННОСТЬ ГЕЛЬМИНТАМИ ПИЩЕВАРИТЕЛЬНОГО ТРАКТА КРУПНОГО РОГАТОГО СКОТА И САЙГАКОВ В ЗАПАДНО-КАЗАХСТАНСКОЙ ОБЛАСТИ

Аннотация. В Западно-Казахстанской области у крупного рогатого скота и сайгаков отмечена общность гельминтофауны. Результаты гельминтоовоскопических исследований фекалий животных по Фюллеборну показали, что крупный рогатый скот и сайгаки инвазированы стронгилятами пищеварительного тракта семейства Trichostrongylidae (подотряд Strongylata) из родов Nematodirus, Ostertagia, Cooperia, Haemonchus, Trichostrongylus, Marshallagia, а так же цестодами из рода Moniezia. Экстенсивность инвазии крупного рогатого скота стронгилятами пищеварительного тракта в среднем составила 31,3%, а мониезиями - 16,4%. Экстенсивность инвазии сайгаков 88,8% и 7,4%, соответственно. Кроме того, у крупного рогатого скота и сайгаков наблюдается схожесть сезонной и возрастной динамики стронгилят пищеварительного тракта. Зимой экстенсивность инвазии животных снижается, а пик инвазии приходится на летний период. Таким образом, животные в течение всего года инвазированы стронгилятами пищеварительного тракта. С возрастом животных инвазированность снижается. Контакты сайгаков и крупного рогатого скота на пастбищных территориях приводят к общности состава гельминтов. Сайгаки являются природным резервуаром и постоянным источником инвазии гельминтами для домашних жвачных в Западно-Казахстанской области. Поэтому при планировании лечебно-профилактических мероприятий против гельминтозов необходимо учитывать этот фактор.

Ключевые слова: крупный рогатый скот, сайгаки, гельминтозы, экстенсивность инвазии, сезонная и возрастная динамика, Западно-Казахстанская область.

Р. С. Кармалиев[1], В. П. Кротенков[2], Ж. Т. Усенов[1],
К. М. Ахмеденов[1], Б. М. Сидихов[1], Б. Е. Айтуганов[1],
Б. О. Ертлеуова[1], Д. Е. Габдуллин[1], С. Х. Бекетова[1]

[1]КеАҚ «Жәңгір хан атындағы Батыс Қазақстан аграрлық техникалық университеті»,
Орал, Қазақстан,
[2]Смоленск мемлекеттік ауыл шаруашылық академиясы, Смоленск, Ресей

БАТЫС ҚАЗАҚСТАН ОБЛЫСЫНДАҒЫ ІРІ ҚАРА МАЛЫ МЕН АҚБӨКЕНДЕРДІҢ АЗЫҚ ҚОРЫТУ ТРАКТІСІНІҢ ГЕЛЬМИНТТЕРІМЕН ИНВАЗИЯЛАНУЫ

Аннотация. Батыс Қазақстан облысында ірі қара малы мен ақбөкендерде гельминтофаунаның кездесуі ортақ байқалған. Жануарлардың нәжісін Фюллеборн әдісі бойынша гельминтоовоскопиялық зерттеу кезінде ірі қара малы мен ақбөкендер Trichostrongylidae (Strongylata түптармағы) тұқымдасының Nematodirus, Ostertagia, Cooperia, Haemonchus, Trichostrongylus, Marshallagia туыстарымен, сонымен қатар цестодтар қатарынан Moniezia туысымен зарарланған. Жануарлардың азық қорыту трактісінің стронгиляттарымен зарарлану экстенсивтілігі орташа 31,3% құраса, ал монезиямен - 16,4% құрады. Ақбөкендерде инвазия экстенсивтілігі сәйкесінше 88,8% және 7,4%. Бұған қоса, азық қорыту трактісі стронгиляттарының маусымдық және жастық дамуы ірі қара малы мен ақбөкендерде ұқсас екені байқалады. Қысқы кезеңде инвазия экстенсивтілігі азайып, жазғы кезеңде көбейеді. Сол себепті жануарлар жыл бойы азық қорыту трактісі стронгиляттарымен зарарланады. Жануарлардың жасы артқан сайын инвазиямен зарарлану көрсеткіші азаяды. Ірі қара малы мен ақбөкендерде жайылымдық аумақтарда ортақ болуы гельминттердің ортақтығына алып келеді. Ақбөкендер Батыс Қазақстан облысында гельминттердің табиғи резервуары және үнемі таратушы көзі болып табылады. Сондықтанда емдік-алдын алу шараларын жоспарлағанда осы факторды ескеру қажет.

Түйін сөздер: ірі қара малы, киіктер, гельминтоздар, инвазия экстенсивтілігі, маусымдық және жастық дамуы, Батыс Қазақстан облысы.

Information about authors:

Karmaliyev Rashid Sagitovich - Doctor of veterinary sciences of the Russian Federation, associate professor, Zhangir Khan WKATU, Uralsk; karmalyev@mail.ru; https://orcid.org/0000-0003-2565-3107

Krotenkov Vladimir Pavlovich – Doctor of veterinary sciences, professor, Smolensk SAA, Smolensk, Russia; elenamedvedeva@yandex.ru; https://orcid.org/0000-0002-4965-4182

Akhmedenov Kazhmurat Maksutovich – Candidate of geographical sciences, director of scientific research institute of biotechnology and environmental management at Zhangir Khan WKATU, Uralsk; kazhmurat78@mail.ru; https://orcid.org/0000-0001-7294-0913

Sidikhov Bekzhasar Mustakhapovich - Candidate of veterinary sciences of the Russian Federation, Zhangir Khan WKATU, Uralsk; sidihovbm@mail.ru; https://orcid.org/0000-0001-6471-3737

Aytuganov Bulat Ermekovich – Candidate of veterinary sciences, Zhangir Khan WKATU, Uralsk; bulat_aytuganov@mail.ru; https://orcid.org/0000-0002-2429-2517

Usenov Zhangeldy Tarikhovich – PhD student of Veterinary medicine and biotechnology faculty, Zhangir Khan WKATU, Uralsk; usenov79@mail.ru; https://orcid.org/0000-0002-2100-1948

Ertleuova Balausa Otargaliyevna – Master of Veterinary Sciences, Zhangir Khan WKATU, Uralsk; aliba.87@mail.ru; https://orcid.org/0000-0003-1990-570X

Gabdullin Dosmukan Ermakhanovich – Master of Veterinary Sciences, Zhangir Khan WKATU, Uralsk; dosya_gabdullin@mail.ru; https://orcid.org/0000-0002-2681-6599

Beketova Sabilya Khamitovna – Master student of Veterinary medicine and biotechnology faculty, Zhangir Khan WKATU, Uralsk; beketova_2094@mail.ru; https://orcid.org/0000-0003-2184-5961

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A. K. Zatybekov[1, 2], A. Z. Agibaev [2], S. V. Didorenko[3], S. I. Abugalieva[1], Y. K. Turuspekov[1]

[1]Institute of Plant Biology and Biotechnology, Almaty, Kazakhstan,
[2]Kazakh National Agrarian University, Almaty, Kazakhstan,
[3]Kazakh Research Institute of Agriculture and Plant Production, Almalybak, Kazakhstan.
E-mail: alexbek89@mail.ru, agibaev52@mail.ru svetl_did@mail.ru, absaule@yahoo.com, yerlant@yahoo.com

ANALYSIS OF RESISTANCE TO *SEPTORIA GLYCINES* IN SOYBEAN WORLD COLLECTION HARVESTED IN SOUTH-EASTERN KAZAKHSTAN

Abstract. The increase of soybean area, yield losses, leads to the search resistant genotypes to common fungal diseases, one of which is brown spot, caused by *Septoria glycines*. In this regard, the analysis of the resistance of the world soybean collection to this disease on the natural infectious background in the conditions of the south-east of Kazakhstan was carried out. The soybean collection consisted from 182 cultivars and lines of different origin from five regions of the world.

As a result of the analysis was shown that 79.3% of the collection is highly resistant and resistant to brown spot. The share of susceptible and highly susceptible samples was 12.1%. The studied collection was also divided into 6 maturity groups depending on the length of vegetation period. The results of a comparative analysis between maturity groups on the basis of resistance revealed that ultra-ripening accessions were more susceptible to brown spot than late-ripening accessions.

The structural analysis identified the economically valuable soybean cultivars and lines. Based on plant height, eighteen accessions that suitable for optimal parameters 95-105 cm were identified. Cultivars Supra, Slavia, Vega were with high yield from maturity group I and registered as the group of highly resistant accessions to brown spot.

Statistical analysis showed a negative correlation between the main economically valuable traits and the resistance to brown spot. The correlations of resistance with plant height and number of fertile nodes were most significant ones. Obtained results are important for breeding program in development of high-yielding soybean cultivars with resistance to brown spot.

Key words: soybean, brown spot, resistance, world collection.

Introduction. Soybean (*Glycine max* (L.) Merrill.) is an important food, feed (protein-oil), technical culture in the world and in Kazakhstan [1]. In the Republic of Kazakhstan according to the program for diversification of agricultural crops, soybean area will expanded to 400,000 hectares by 2020, which should ensure the production of soybeans in the country to 1 million tons [2].

One of the main problems in the cultivation of soybean is fungal diseases [3]. The relationship between resistance to fungal diseases and yield components depends on the level of disease infection, which in turn depends on the species of pathogens in certain agro-climatic zones, the resistance of cultivated lines, agricultural technology and the influence of environmental factors. Some years, the death of the plant can reach practically 100% and the seedlings 37-43% [4, 5].

One of the most common fungal diseases is brown spot, which affects the leaf surface of soybean, covering with brown spots with a yellow band. This fungal disease is common in soybean cultivation area around the world [3, 6]. The causative agent is a fungus from the genus of anamorphic sphaeropsidales fungi-deuteromycetes - *Septoria glycines* Hemmi. At the beginning, small brown spots develop on leaves in the lower tier and then progress up the plant as the season progresses, rising to the middle, and then upper tier. Individual spots may coalesce, and the surrounding tissue becomes chlorotic, with occurrence of premature defoliation [7, 8, 9]. The yield losses associated with *S. glycines* infection ranged from 12 to 17% in fields with a simulated infectious background, and from 1 to 8% on a natural infectious back-

ground [8, 10, 11]. Cooper R.L. *et*.al [12] described a decrease of yield by 40% in irrigated fields in 1980. This trend is associated with an increase in humidity, which is a favorable condition for the spread of fungal diseases [13]. However, sometimes brown spot is considered a non-dangerous disease, with a limited impact on yields [12]. In the United States, yield losses ranging from 0.6 to 2.6% of the total yield were attributed to brown spot during 1999 to 2003 and 2005 [14]. The highest losses reported were in 2004 in the states of Iowa and Illinois, approximately 305.7 thousand tons and 223.8 thousand tons, respectively [14]. The assessment of the level of yield losses is in the range of 8 to 15% and occurs when 25-50% of the leaves fall prematurely. The level of damage by the disease at the stage R6 (full seed), gives a preliminary forecast for yield. The presence of large brown spots on the leaves is usually accompanied by a decrease in the size of the soybean seeds, which in turn affects to the yield [15, 16].

Material and methods. The studied soybean collection consisted from 182 cultivars and lines from the countries of Eastern and Western Europe, North America, East Asia and Kazakhstan (figure 1).

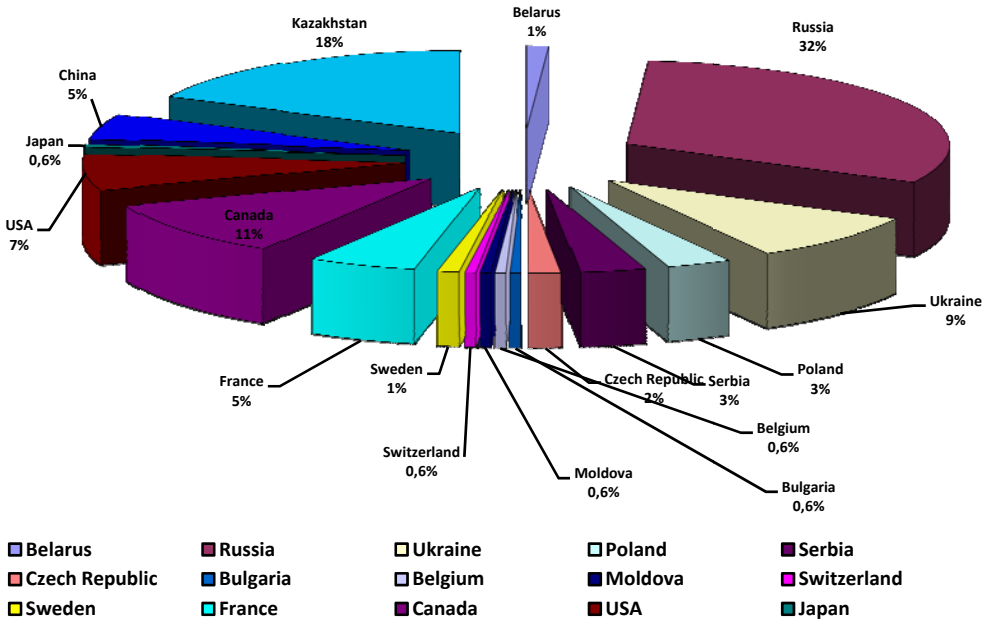

Figure 1 – The collection by the origin country

Plants were grown in 1 meter long rows with 30 cm distance between adjacent rows and 5 cm space between plants within rows [17].

The development of the disease in the field is recorded during the emergence, flowering, beginning and ripening of the seeds. The level of damage or the percentage of development of the disease, is characterized by the number of spots, ulcers, plaque on the affected organs. Quantitative scales for evaluation of the resistance in the field conditions were used. These scales were used both natural and simulated infectious backgrounds. According to the, The internationally recognized classifiers and parameters have as shown in table 1 were applied (figure 2) [18].

Table 1 – Scale of level of damage and resistance to fungal diseases

Degree of defeat	Score on a 9-point scale	Percentage of damage	Letter designation of resistance
absent or very weak	1	0-5%	RR - highly resistant
weak	3	5-19%	R - resistant
medium	5	20-49%	MR - medium resistant
strong	7	50-79%	S - susceptible
very strong	9	< 80%	SS - highly susceptible

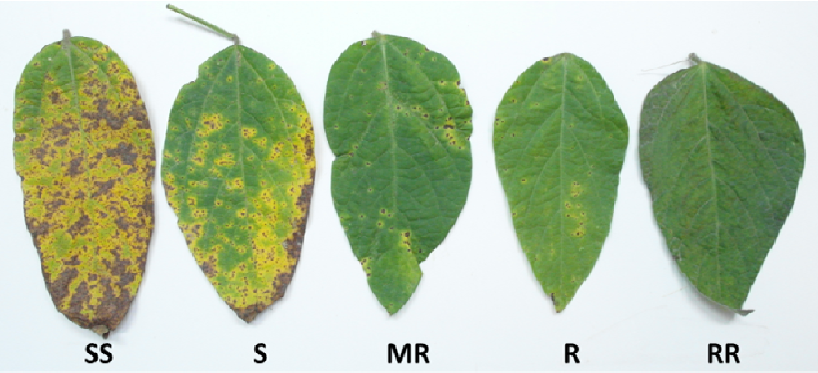

Figure 2 – Scale of soybean resistance to brown spot

Cultivar Vilana from the breeding of the All-Russian Research Institute of Oilseeds was used as a control as it was a highly resistant to brown spot. For comparison of economic-valuable traits, the Zhansaja cultivar (breeding of the KazSRIAP), which was regionalized in the Almaty region, was taken as the standard.

Structural analysis was conducted using methodological guidelines of the State Commission of the Republic of Kazakhstan [19]. During the maturity time, before harvesting the plots, a structural sheaf was selected from the registration sites. In the laboratory analysis the following components of yield were taken into account: plant height, cm - length of stem from the root to the top; number of fertile nodes, pcs. – number of nodes bearing seeds when maturing; number of seeds per plant, pcs. - number of seeds from the plant; yield per plant, g – weight of seeds from one plant; thousands seeds weight, g – weight of thousands seed without any selection [20].

Statistical analysis of the obtained data was carried out using the computer program SPSS16.0 (www.ibm.com/analytics/spss-statistics-software).

Results and discussion. Analysis of resistance to brown spot was carried out in the experimental sites of KazSRIAP on a natural infectious background. Response to lesions causative agents of the disease made it possible to reveal the diversity in the studied collection. Most accessions of the collection have shown themselves to be highly resistant (RR) and resistant (R) (Figure 3, Table 2). A small number of samples showed themselves as susceptible and highly susceptible. The first symptoms of the lesion were observed in stage R1 (budding time). Mass infection of plants was observed at the stage of full seeds (R6).

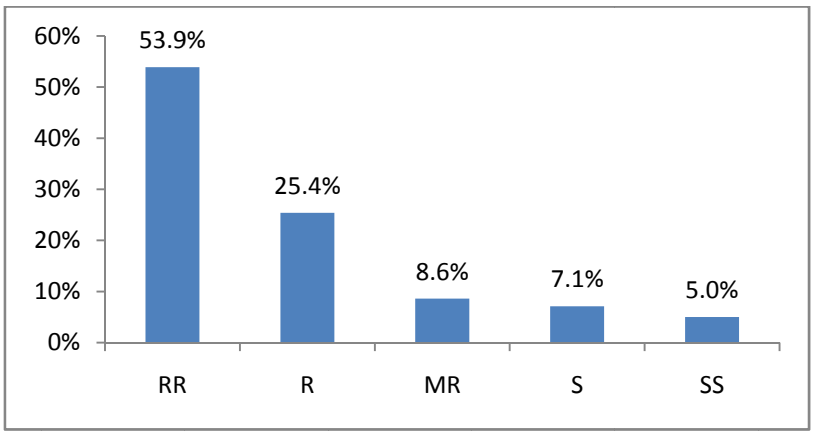

Figure 3 – Diagram of resistance of the world soybean collection accessions to brown spot

During the growth and development of plants, the collection was characterized and divided into maturity groups depending on the length of the vegetation time (Table 3). The most representative was the maturity group OO (57 accessions), the smallest number of accessions (7) was in late maturity group (III).

Table 2 – The world soybean collection by groups of resistance to brown spot

Resistance	Name of cultivars and lines
RR	Jasel'da, Pripjat', Emerson, Supra, Maple Ridge, Mapleglen, Mapleamber, KG 20, AC Brant, Harbin, LMF, Lidija, Luchezarnaja, Zlata, Vega, Zakat, Zernica, Niva 70, Garmonija, Romantika, Belgorodskaja 6, Daksoy, Dawson, Terek, Horol, Jug 30, Estofita, Podjaka, Viktorina, Sepia, Amphor, Toury, Turijskaja masnaja, Oyachi №2, 209/1, 350/1, 362/2, 371/2, Roza, Misula, Almaty, Evans, Lambert, Mc call, Parker, Dekabig, Jachynes Brond, Lara, OAO Wallace, GEO, Buster, SL 01 26, Sl 02 25, RCAT Persian, Enterprise, Voevodzhina, Ana, Nikko, Sava, Venera, Protina, Sponsor, Isidor, Shama, Santana, Lada, Vesta, Vilana, Del'ta, Lan', Runo, Astra, Slavija, Biser 291, Iskra, Zhansaja, Vita, Bolashak, Sabira, Pamjat' JuGK, Jevrika, Sulamit, Kazahstanskaja 2309, Akku, Radost', Nadezhda, Xinjiang a don 1, Xinjiang heihe 38, Xinjiang D09-676, Xinjiang D10-51, Xinjiang D10-130, XinjiangD10-135, Xinjiang D11-252, Lybid', Cheremosh, Korsak, Tanais, Desna
R	R-73-3, Maplearrow, Gaillard, Chabem Wekoju, Kollekcyina, Hejhek 14, Severnaja 5, Soer 3491, Omskaja 4, VNIIS-1, Soer-4, Bara, Zolotistaja, Mageva, Soer-5, Okskaja, Maleta, Svapa, Vejdelevskaja 17, Jantarnaja, Sib NIISHOZ 6, Belor, Gribskaja Kormovaja, Prikarpat'ska 81, Chernovickaja 7, Ustja, Fvour, 186/1, 404/2, 370/2, Zara, Zhalpaksaj, Agassiz, Wilstar 194, Elgin 141, Cobb 266, Zen, Safrfna, Lira, Bystrica 2, Renta, Bukurija, Zispida 641, Perizat, Danaja, Lastochka
MR	OAC Vision, Maplepresto, Rassvet, Nadezhda, VNIIS 2, Luch nadezhdy, Lancetnaja, Soer 345, USHI 6, Kalmit, Rana, Fiskeby III, 173/1
S	Nawiko, Warsawska, Amurskaja 401, Soer-3, Brjanskaja, Sibniik 315, Sonata, Sibirjachka, Jel'dorado, PJeP 26, Krasivaja mechta, Carola, Spritna, Annushka, 422/1, 407/2
SS	Arctic, Kasatka, Smena, Svetlaja, Altom, Fiskeby V, 308/1, 126/1, 261/1

Table 3 – The world soybean collection by maturity groups

Maturity group	Vegetation period	Name of cultivars and lines
OOO	79-85 days	Svetlaja, Soer 5, Kollekcyina, Kasatka, Svapa, SibNIISHZ 6, Nawiko, Zolotistaja, Mageva, Maleta, Zernica
OO	86-95 days	Hejhek 14, LMF, Severnaja 5, Okskaja, Maplepresto, Arctic, Smena, Sibniik315, Sonata, Zakat, Sibirjachka, Jel'dorado, PJeP 26, Annushka, Rana, Fiskeby v, 308/1, Warsawska, Luch nadezhdy, Lancetnaja, Omskaja 4, Brjanskaja, Krasivaja mechta, 350/1, Soer 3, Soer 4, Zlata, Soer 345, 173/1, Chabem Wekoju, Rassvet, Amurskaja 401, Chernovickaja 7, Soer 3491, 126/1, 261/1, OAC Vision, Maple Ridge, Lidija, Bara, Altom, Mapleamber, VNIIS 2, Niva 70, USHI 6, 186/1, 209/1, Gaillard, VNIIS-1, Garmonija, Vejdelevskaja 17, Jantarnaja, Belor, Prikorpat'ska 81, JuG 30, 422/1 (Ivushka), Tanais
O	96-105 days	Nadezhda, Luchezarnaja, Ustja, Kalmit, Fiskeby III, KG20, Oyachi №2, Pripjat', R-73-3, Romantika, Gribskaja kormovaja, Viktorina, Turijskaja masnaja, Mc call, Carola, Daksoy, Lada, Jasel'da, AC Brant, Protina, Belgorodskaja 6, Spritna, Xinjiang a don 1, Toury, Cobb 266, Xinjiang heihe 38, Estofita, 370/2
I	106-115 days	Emerson, Harbin, Podjaka, Vega, Horol, Sepia, 407/2, Lybid', GEO, Renta, Cheremosh, Agassiz, SL 01 26, Slavija, Desna, Supra, Maplearrow, Mapleglen, Buster, Terek, Amphor, 362/2, 404/2, Evans, Enterprise, Bystrica 2, Vilana, Del'ta, Dawson, Lambert, Lira, Iskra, Pamjat' JuGK, Misula, Nikko, Almaty, 371/2, Lan'
II	116-125 days	Zara, OAO Wallace, SL 02 25, Xinjiang D10-51, Amour, Isidor, Safrfna, Xinjiang D11-252, Korsak, Zen, Zhalpaksaj, Elgin 141, Astra, Bolashak, Xinjiang D10-135, Dekabig, Sava, Shama, Biser 291, Danaja, Xinjiang D10-130, Jachynes Brond, Wilstar 194, Perizat, RCAT Persian, Venera, Vita, Xinjiang D09-676, Roza, Voevodzhanka, Vesta, Runo, Parker, Sponsor, Zispida 641, Zhansaja, Lara, Ana, Santana, Bukurija, Sabira
III	126-135 days	Radost', Nadezhda, Sulamit, Kazahstanskaja 2309, Lastochka, Akku, Jevrika

As a result of the analysis of the relationship between the vegetative period and the resistance to brown spot, it was established that early maturity lines are more susceptible to brown spot damage compared with late maturity lines (figure 4). This trend may be related to the climatic conditions of the region, since the temperature regime and the period of vegetation of early maturity lines of the OOO and OO groups are much favorable for the infection by brown spot.

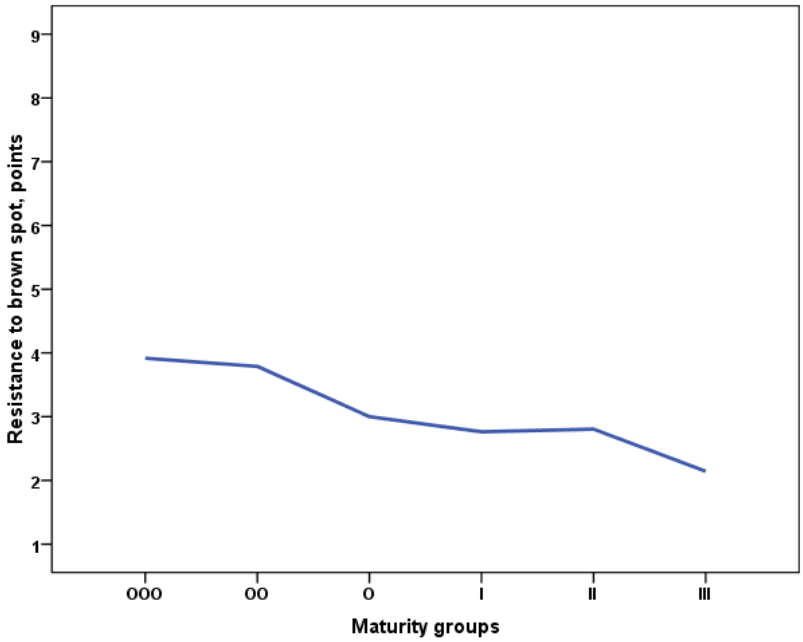

Figure 4 – Resistance to brown spot depending on maturity group

The world collection was studied by morphometric and economically valuable traits. One of the main traits is the plant height. We found that the optimal height at which the best yields showed in the Almaty region is 95-105 cm, since low-growth cultivars are characterized by low attachment of the seeds, and tall ones are prone to lodging, which in both cases leads to a loss of yield when harvesting by combine. Thus, the most optimal plants for this trait were cultivars with medium plant height.

Figure 5 shows the average of plant height by maturity group, as well as the data of the most prominent lines. According to the optimal plant height parameters, 10 samples from the maturity group I were identified with an average plant height of 101.2 cm (figure 5). The list of these cultivars and lines included Nikko, 362/2, Slavia, Buster, Iskra, Delta, Evans, Vilana, Lyra, Podyaka. From the maturity group II, seven samples were selected mainly from Chinese breeding (Santana, Zen, Zara, Xinjiang D10-130, Xinjiang D09-676, Xinjiang D10-135, Xinjiang D11-252), and one cultivar from Kazakhstan breeding (Lastochka) from the maturity group III. It is important to note that there are no accessions suitable for optimum plant height from ultra-maturity groups OOO, OO and O.

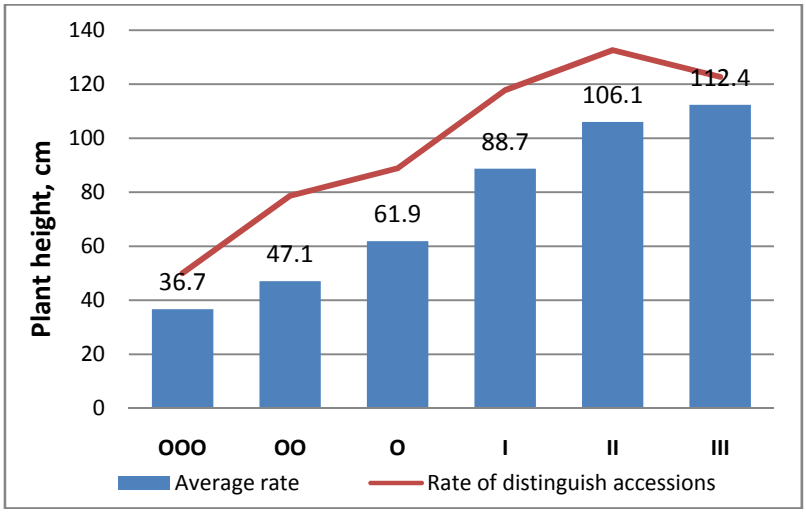

Figure 5 - Characteristics of cultivars and lines of soybean of different maturity groups in the South-East of Kazakhstan in terms of plant height

The number of fertile nodes varied according to the average data from 12.5 pcs from ultra-maturity group (OOO) accessions to 19.8 pcs in the maturity group III accessions (Table 4), with the highest rate for the Supra cultivar - 29.0 pcs, which included in maturity group II. In the standard Zhansai cultivar this trait was 16.1pcs.

On the basis of the number of seeds per plant, the average data varied from 25.8 to 45.3 pcs, depending on the maturity group. The highest rate was in the Slavia cultivar of Russian breeding, 93.7 pcs, which was twice as high as the standard (42.5 pcs).

Average data on the yield per plant varied from 7.5 to 13.2 g. In the Zhansai standard it was 12.1 g. The Canadian cultivar Supra showed the highest result - 23.0 g, which is two time larger than the standard. The smallest result showed the PEP26 (Russia) - 2.5 g, which is 5 times less than the standard.

The thousands seeds weight varied from 150.3 to 175.2 g. This trait characterizes the performance of seeds. In the standard Zhansai cultivar, it was 159.4 g. The lowest result was shown by the cultivar Bystrica 2 (Russia) 90.0 g, the highest result for the cultivar Vega (Russia) 243.0 g.

Table 4 – Structural analysis of economical valuable traits by maturity groups

Maturity group	Number of accessions, pcs	Plant height, cm	Number of fertile nodes, pcs	Number of seeds per plant, pcs	Yield per plant, g	Thousands seeds weight, g
OOO	11	36.7±6.7	12.5±3.0	25.8±7.5	7.9±2.4	171.0±16.4
OO	57	47.1±10.8	12.7±2.9	26.3±6.4	7.5±2.3	171.7±20.5
O	28	61.9±12.3	15.3±3.4	32.8±6.7	9.9±2.6	177.1±23.8
I	38	88.7±15.7	17.4±3.7	40.5±11.7	12.2±3.6	175.2±21.9
II	41	106.1±14.3	17.7±3.1	44.1±10.3	13.2±2.6	165.1±18.1
III	7	112.4±8.3	19.8±4.1	45.3±7.0	12.2±2.1	150.3±28.7

The study of the relationship with the main economic-valuable traits revealed a significant negative correlation with the plant height, the number of fertile nodes and the thousands seeds weight. This correlation based on the thousand seeds weight was noted in previous works [15] on the analysis of resistance to brown spot. At the same time, correlations with the number of seeds per plant and the yield per plant traits were not significant (table 5).

Table 5 – Correlation analysis of economic-valuable traits with resistance to brown spot

Traits	Plant height	Number of fertile nodes	Number of seeds per plant	Yield per plant	Thousands seeds weight	Resistance to brown spot
Plant height	1	0.591**	0.684**	0.648**	-0.194**	-0.164**
Number of fertile nodes	0.591**	1	0.813**	0.766**	-0.049	-0.156**
Number of seeds per plant	0.684**	0.813**	1	0.848**	-0.173**	-0.094
Yield per plant	0.648**	0.766**	0.848**	1	0.036	-0.083
Thousands seeds weight	-0.194**	-0.049	-0.173**	0.036	1	-0.127*
Resistance to brown spot	-0.164**	-0.156**	-0.094	-0.083	-0.127*	1
**Correlation significant $P \leq 0.01$, *correlation significant $P \leq 0.05$.						

It is interesting to note that all values of economically valuable traits correlated positively with each other, except for the thousands seeds weight, which, on the contrary, showed a negative correlation.

Conclusion. In the course of the research carried out on the resistance to brown spot, it was determined that 53.9% of the studied collection (98 accessions from 182 studied) are highly resistant to the disease, from this group it is possible to distinguish the cultivars Iskra, Zhansaja and Sabira, local breeding, on which there were practically no symptoms of disease. Resistant accessions were 25.4% of the collection (46 accessions), 8.6% showed themselves as medium-resistant, which amounted to 16 accessions. The number of susceptible and highly susceptible was 7.1% (13 accessions) and 5% (9 accessions), respectively.

The studied collection was divided into maturity groups. Comparative analysis between maturity groups on the basis of resistance to brown spot revealed a relationship between resistance and maturity. Accessions from ultra-maturity groups are more susceptible to brown spot than late maturity.

Carrying out a structural analysis of the main economic-valuable traits made it possible to identify high-yielding and economically valuable lines. On the basis of plant height, the most optimal parameters were in 10 accessions of maturity group I, 7 accessions of maturity group II, and one accession of maturity group III in the range of 95-105 cm. The cultivar Supra from Canada showed highest number of fertile nodes and yield per plant. The cultivar Slavia (Ukraine) showed the highest number of seeds per plant. The cultivar Vega (Russia) showed highest thousands seeds weight value. All of these cultivars belong to the maturity group I and are highly resistant to brown spot.

Correlation analysis revealed a negative relationship between economically valuable traits and resistance to brown spot. The most significant traits were the plant height and the number of fertile nodes.

Cultivars Iskra, Zhansaja, Sabira, Supra, Slavia and Vega are promising for use in breeding for resistance to brown spot, and carry a variety of genes controlling this trait.

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А. К. Затыбеков[1,2], А. Ж. Агибаев[2], С. В. Дидоренко[3], С. И. Абугалиева[1], Е. К. Туруспеков[1]

[1] Институт биологии и биотехнологии растений, Алматы, Казахстан,
[2]Казахский национальный аграрный университет, Алматы, Казахстан,
[3]Казахский научно-исследовательский институт земледелия и растениеводства, п. Алмалыбак, Казахстан

АНАЛИЗ УСТОЙЧИВОСТИ МИРОВОЙ КОЛЛЕКЦИИ СОИ К СЕПТОРИОЗУ В УСЛОВИЯХ ЮГО-ВОСТОКА КАЗАХСТАНА

Аннотация. Увеличение посевных площадей сои, потери урожая, приводят к необходимости поиска генотипов, устойчивых к распространенным грибковым болезням, одной из которых является септориоз, вызываемый *Septoria glycines*. В связи с этим проведен анализ устойчивости мировой коллекции сои к данной болезни на естественном инфекционном фоне в условиях юго-востока Казахстана. Коллекция сои состояла из 182 сортов и линий различного происхождения из 5 регионов мира.

В результате анализа установлено, что 79,3% коллекции являются высокоустойчивыми и устойчивыми к септориозу. При этом доля восприимчивых и сильно восприимчивых образцов составила 12,1%. Изучаемая коллекция была также разделена на 6 групп спелости в зависимости от длины вегетационного периода. Результаты сравнительного анализа между группами спелости по признаку устойчивости выявили, что ультраскороспелые образцы были более восприимчивыми к поражению септориозом, чем позднеспелые образцы.

Структурный анализ идентифицировал хозяйственно-ценные сорта и линии сои. По признаку высоты растения идентифицированы 18 образцов, подходящие под оптимальные параметры 95-105 см. По основным компонентам урожайности выделились сорта Supra, Славия, Вега из группы спелости I. Они относятся к группе высокоустойчивых к септориозу образцов.

Статистический анализ позволил выявить отрицательную корреляцию между основными хозяйственно-ценными признаками и устойчивостью к септориозу. Наиболее значимыми были корреляции устойчивости и 1) высоты растения и 2) количества продуктивных узлов. В то же время наблюдали положительную корреляцию между хозяйственно-ценными признаками, кроме признака массы тысячи семян. Полученные результаты важны для селекции с целью создания отечественных устойчивых и высокоурожайных сортов сои.

Ключевые слова: соя, септориоз, устойчивость, мировая коллекция.

А. К. Затыбеков[1,2], А. Ж. Агибаев[2], С. В. Дидоренко[3], С. И. Абугалиева[1], Е. К. Туруспеков[1]

[1] Өсімдіктердің биология және биотехнология институты, Алматы, Қазақстан,
[2]Қазақ ұлттық аграрлық университет, Алматы, Қазақстан,
[3 \]Қазақ егін және өсімдік шаруашылығы ғылыми-зерттеу институты, Алмалыбақ, Қазақстан

ҚАЗАҚСТАННЫҢ ОҢТҮСТІК-ШЫҒЫС ЖАҒДАЙЫНДА СОЯНЫҢ ӘЛЕМДІК ТОПТАМАСЫНЫҢ СЕПТОРИОЗҒА ТӨЗІМІДІЛІГІН ТАЛДАУЫ

Аннотация. Соя егістік алқабының ұлғайтуы, өнімнің азайыуы, саңырауқұлақ ауруларының тарағанына төзімді генотиптердін іздеуіне талап етеді, олардың бірі септориоз, *Septoria glycines* зақымдайды. Осыған байланысты Қазақстанның оңтүстік-шығыс жағдайында сояның әлемдік топтамасының осы ауруға төзімділік талдауы табиғи инфекциалық фонда өткізілді. Соя топтамасы әлемнің әртүрлі 5 аймағынан шыққан 182 сорт және дақылдардан тұрды.

Талдау нәтижесінде, топтаманың 79,3% септориозға өте төзімді және төзімді болып анықталды. Бұл ретте төзімсіз және қатты төзімсіз дақылдардын үлесі 12,1% құрады. Зерттелген коллекция сондай-ақ, вегетациялық кезеннің ұзындығы бойынша, пісіп жетілген 6 топқа бөліңді. Пісіп-жетілу топтар арасындағы төзімділік белгілері бойынша өткізілген салыстырмалы талдау нәтижелері арасында, кеш пісетін дақылдарға қарағанда ультрапісетін дақылдардың септориозбен зақымдалуына тым төзімсіз екені анықталды.

Құрылымдық талдау сояның шаруашылық-құнды сорттары мен дақылдарын анықтады. Өсімдіктің биіктігі бойынша оңтайлы параметрлерге лайық 95-105см сәйкестендірілген 18 үлгілері анықталды. Өнімділіктің негізгі компоненттері бойынша I пісіп жетілетін тобының Supra, Славия, Вега сорттары бөлініп шықты. Олар септориозға өте төзімді дақылдарының тобына жатады.

Статистикалық талдау негізгі шаруашылық-құнды белгілері мен септориозға төзімділігі арасындағы жағымсыз корреляцияны анықтауға мүмкіндік берді. Неғұрлым маңызды корреляция төзімділікпен және 1) өсімдік биіктігі және 2) өнімді тораптар саны бойынша болды. Сондай-ақ, мың тұқым масса белгісінен басқа, шаруашылық-бағалы белгілері арасындағы жағымды корреляция байқалды. Алынған нәтижелер, отандық төзімді және өте өнімді сорттарының алу мақсатында, селекция үшін маңызды.

Түйін сөздер: соя, септориоз, төзімділік, әлемдік топтама.

Сведения об авторах:

Затыбеков Алибек Камзабекович – PhD-студент, Казахского Национального Аграрного Университета, научный сотрудник лаборатории молекулярной генетики Института биологии и биотехнологии растений, Алматы, Казахстан; alexbek89@mail.ru; ORCID ID: 0000-0003-4310-5753.

Агибаев Алексей Жартаевич – доктор биологических наук, профессор кафедры защита растений и карантин Казахского национального аграрного университета; agibaev52@mail.ru; ORCID ID: 0000-0002-6855-9228

Дидоренко Светлана Владимировна – кандидат биологических наук, ведущий научный сотрудник отдела зернобобовых Казахского научно-исследовательского института земледелия и растениеводства, Алмалыбак, Казахстан; svetl_did@mail.ru; ORCID ID: 0000-0002-2223-0718

Абугалиева Сауле Изтелеуовна – доктор биологических наук, ассоциированный профессор, главный научный сотрудник лаборатории молекулярной генетики Института биологии и биотехнологии растений, Алматы, Казахстан; absaule@yahoo.com; ORCID ID: 0000-0002-9748-507X

Туруспеков Ерлан Кенесбекович – кандидат биологических наук, профессор, заведующий лабораторией молекулярной генетики Института биологии и биотехнологии растений, Алматы, Казахстан; erlant@yahoo.com; ORCID ID: 0000-0001-8590-1745

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K. Mirzaliev[1], Zh. Tuleubaev[1], G. K. Ziyaeva[2], S. S. Yergaliyev[1], H. K. Kydyrbaeva[3]

[1]Taraz state pedagogical university, Kazakhstan,
[2]M. Kh. Dulaty Taraz state university, Kazakhstan,
[3]M. Auezov South Kazakhstan state university, Shymkent, Kazakhstan.
E-mail: tuleubayev51@mail.ru, gulnarzia-71@mail.ru, halima-7301@mail.ru

PRODUCTIVITY OF SUGAR BEET DEPENDING ON APPLICATION OF EXTRAORDINARY SUB-CODE AND IRRIGATION REGIME ON FLOUR SEEDS OF SOUTH KAZAKHSTAN

Abstract. The article summarizes the results of 3-year scientific research works (2015-2017) and a modern solution to the problems of sugar beet yield increase based on application of basic and foliar top dressing and irrigation regime in meadow gray soils of the South of Kazakhstan.

Key words: sugar beet, basic, foliar top dressing. Liquid fertilizer, kas, novosil, humate, application dose, irrigation regime, yield of root crops, collection of sugar.

Introduction. One of the priority technical crops for the South and South of the East of the Republic is sugar beet, which has a high potential for productivity. This Culture is the only source of local raw materials for sugar production in Kazakhstan. An analysis of the current situation with the production of sugar beet has shown that the crop of this crop in recent years is at a level of 150-240 c / ha. This testifies to the extremely inadequate realization of the potential of this valuable culture, the low level of technology for its cultivation, the insufficient application of agro-technological and chemical measures to combat weed vegetation.

In the context of a decline in the cropping economy, a reduction in the volume of use against the backdrop of shortage of working capital and capital investments, the authors suggest creating a favorable and, first of all, reviving crop rotations, with a short rotation, with a set of priority crops for the regions, taking as a basis new agrotechnologies in highly productive varieties and means of plant protection and are new farms of fertilizers and plant growth regulators.

The choice of fertilizer from the commercially available assortment should be reduced to the definition of such a form, the use of which will be cheaper compared to others and at the same time to ensure the greatest possible increase in yield.

The novelty and practical significance of the work consists in the fact that in the Zhambyl region, in the meadow-gray soils with close groundwater occurrence in short rotary beet crop rotations, the influence of liquid forms of fertilizers (karabamide-ammonium nitrate) CAS and regulators of the plant company (PPP) novosilogamat and irrigation regime for the yield and sugar content of sugar beet. The growth regulator, regardless of the chemical composition, has a close mechanism of action at the level of physiological reactions, activates plant growth, increases the accumulation of biomass due to more active growth of the leaf apparatus by optimizing the irrigation regime.

Conditions and methods of research. The humus content in the plow layer is 1.40-1.59%, total nitrogen 0.106%, and the total phosphorus 0.135-0.153%. The content of nitrates (NO_3) is 22.1; mobile phosphorus (P_2O_5) - 29.3 and exchangeable potassium (K_20) - 302.6 mg / kg soil.

According to the classification of NA. Kachinsky this soil belongs to medium loams. The bulk density is 1.30-1.50 g / cm^3, the specific gravity is 2.50-2.57 g / cm^3, the limiting moisture capacity (PPV) is 18.6-19.5%. The reaction of the soil solution is slightly alkaline, pH is 7.2-7.3.

Field experiments on the use of new forms of liquid fertilizers and biopreparations of a new generation in order to obtain optimal yields of sugar beet were carried out by meadow-serozem soils. The level of occurrence of groundwater to a depth of 100-120 cm.

Table 1 – Scheme of experience

#	1	2	3	4	5	6	7
Options	Without	$N_{150}P_{120}R_{90}$	КАС -	КАС -	КАС -	Новосил -	Новосил -
	Fertilizers	(fon)	0,5 l / ha	0,7 l / ha	1,0 l / ha	20 l / ha	40 l / ha
	(control-1)	(control-2)	3 times	3 times	3 times	3 times	3 times
#	14	13	12	11	10	9	8
Options	fon + Гумат	fon + Новосил	fon +Кас-	Gumat-	Gumat-	Gumat-	Новосил-
	40 g / ha	40 g / ha	-0,7 g / ha	80 g / ha	40 g / ha	20 g / ha	60 g / ha
	3 times	3 times	3 times	3 times	3 times	3 times	3 times

The experiment is laid down in the above scheme in 3-fold repetition (table 1). The plot size is 100 m^2, the total area is 1 hectare. Sowing variety of sugar beet of French selection. Avantage. In carrying out the field experiment, they were guided by methodological provisions [1] and P.N. Konstantinova, B.A. Armor "method of research on sugar beet VNISS" [2]. Agrotechnical experience on the recommendation of 1976, 1988, 1994 adopted [3-5].

Aqueous solutions of biostimulators were prepared immediately before their use. Spraying of sugar beet plants was carried out with a backpack sprayer with a rate of application of working fluid of 250 liters / ha.

The first treatment with regulators was carried out by closing the beet leaves in rows, the second before closing the leaves in interrow rows, the third before harvesting (30 days prior to harvesting).

Results of the study and their discussion. Growth of plants is a complex and at the same time a well-organized and harmonious process. Back in 1880, Sachs proposed the existence of "chemical messengers", which coordinates the growth between different parts of the plant. A real springboard to the identifications of these messengers, which were called phytohormones (from the Greek phyton-plant hormoo-induce) was the book Darwin (1881) "The power of movement in plants".

Natural growth regulators are produced by the plants themselves, these are the so-called endogenous phytohormones. In very small concentrations, they stimulate or inhibit growth processes. This was known more than 100 years ago. At the beginning of the last century, D.N. Nalyubov discovered the compound - ethylene, which inhibited the growth of plants. In the mid-20-ies Academician N.G. Cold in Germany published a work on plant regulation. [6].

And artificially it is possible to create preparations of complex action, which in some cases show useful qualities of several groups of phytohormones [7].

In the North-Caucasian branch of VNIS (1982-1984), the effectiveness of HCS on foliar top dressing of sugar beet was studied. Studies have shown that the most effective was a two-fold feeding of beets with an aqueous HCA solution in a ratio of 1: 1 with a working fluid flow rate of 100 liters/ha. The sugar content of the root crop increased on average over three years - by 0.7%, an increase in the yield of 2.1 tons / ha, and the collection of sugar by -0.62 tons / ha. [8].

The highest yields against microfertilizers were noted in the conditions of the Vinitsa region of Ukraine - 51.5 t/ha with a sugar content of 18.3% [9].

According to the data of [10] in Russia only humic preparations of albite, novosil, biosil, larixin, milivalikatsin, epin, zircon are widely used from the whole range of registered PPPs. Humates are sodium or potassium salts of humic acids, which are isolated from humic substances of natural organic biocose formations such as chernozem, peat, coal, sapropel, slate.

The movement of water and nutrients from the root system to the aerial organs and plastic substances coming from the root system into the above-ground organs and plastic substances moving from the leaves to the root system occurs through the root crop. Therefore, in the first year of life, as the root crop develops, it has an increasing influence on the nature and intensity of metabolism in both directions.

Moving from the root system, the water completely saturates the tissues of the root crop, and then the above-ground organs. Therefore, the root crop adapts to increased water supply and nutrition, so that it tolerates even the smallest dehydration of tissues. When drought, the growth of the root crop stops, and it intensively draws water and plastic substances from the above-ground organs. With a lack of water, the juicy tissues of the root crop begin to lignify before the temporary drying of the leaf mass and a decrease in the photosynthetic potential.

Therefore, during cultivation it is very important to maintain uninterrupted moistening of the soil.

Proceeding from the above stated, the optimal irrigation regimes for the growing season of sugar beets were constantly adhered to. With this irrigation regime, inter-row cultivation during the growing season is no longer [3,4] when sowing on the width of the rows of 60 and 45 cm, but only cutting irrigation furrows for the first and second irrigation of sugar beet.

Therefore, the number of irrigation was increased to 12 times, so that before irrigating soil moisture during the vegetation period was maintained at a level of 75.0-80% of PPV. The inter-irrigation period at the beginning of the vegetation period was 10-12 days, in the middle of 8-9 days and at the end of 10-12 days. The irrigation norm was 550-600, and the vegetable norm was 6600-7200 m^3/ha (table 2).

Table 2 – Regime of irrigation of sugar beet during the vegetative period on experimental crops, depending on the maximum field moisture capacity of the soil

Number of irrigation / Timing of watering	1	2	3	4	5	6	7	8	9	10	11	12
1. Timing of watering (day of the month)	10.06	19.06	29.06	08.07	18.07	26.07	04.08	15.08	26.08	07.09	18.09	02.10
2. Pre-irrigation soil moisture (h-30 cm), %	14,8	15,0	15,5	15,8	15,7	15,8	16,0	16,0	15,6	15,6	15,6	15,6
3. Maximum field humidity (PWV), %	75,8	76,9	79,5	81,0	80,5	81,0	82,5	82,5	80,0	80,0	80,0	80,0
Note: Inter-row cultivation of the soil during the vegetation period was not carried out, but only cutting of irrigation furrows was performed before the first and second irrigation.												

Such irrigation regimes of sugar beet in Kazakhstan are given in the works "Irrigation of sugar beet in Kazakhstan" [11].

Sowing of sugar beet was carried out from 3 May with an inter-row spacing of 60 cm. The duration of the seed-sprouting period is 12-14. According to the variants of the experiment, the first, second and third pairs of leaves were noted on May 17-21-26 with fluctuations 2-3 days earlier than between variants with fertilized and background compared to without fertilization.

The number of plants after hollow shoots was in the range of 6 to 9 plants per 1 linear meter of row, and after formation the number of plants varied from 4-5 plants 1 linear meter row.

The first period of vegetation (01.07.), The maximum mass of sugar beet leaves was noted for variants von + humate 40 g / ha, background + cass - 0.7 l / ha, and background + novosil - 40 g / ha. accordingly was 855; 850 and 843 g / plant, and on the control - 2 (N150P120P90) - 810 g / plant. On the variant (without fertilizers), only foliar top dressing of humate-40 g / ha, ca.-0.7 l / ha. novosil - 40 g / ha. respectively, amounted to 750, 700 and 710 gr / plants, and on control - without outside the root feeding - 650 gr. 1 plant.

The maximum growth of leaf mass in the second vegetative period (01.08) was noted in the variants with foliar top dressing of ca. 0.7 l / ha, novosil-40 g / ha, humate-40 g / ha, and background + 0,7 l / ha, Background + humate - 40 g / ha, iphone + novosil-40 g / ha, accordingly was 736; 728; 850; 1030; 1040 and 1020 g / plant.

In the third (01.09) and in the fourth (01.10) term, the total weight of plant leaves gradually decreases in all variants of the experiment, and the increase in the above variants increases during the vegetation period, mainly, respectively, 490; 460; 500; 695; 680 and 710 gr. 1 plant or leaf growth, respectively, 16.7; 9.5; 19.0; 21.9; 24,6 and 19,3% more than from control - 1 and 2 (table 3).

Table 3 – Dynamics of the increase in the mass of sugar beet leaves, depending on the use of KAS and biopreparations of a new generation (average from 1 plant gr.)

#	Options	Date of sampling, + Dynamics of accumulation							+ from controls	
		01.07	01.08	+,- growth	01.09	+,- growth	01.10	+,- growth	Гр.	%
1	Без удобр. К - 1	650	710	+60	477	-233	420	-57	–	–
2	$^{N}150^{P}120^{K}90$ (фон) К-2	810	940	+130	890	-50	570	-320	150	35,7
3	КАС - 0,5 л/га	660	715	+55	551	-164	484	-67	64	15,2
4	КАС - 0,7 л/га. 3 times	700	736	+36	570	-166	490	-80	70	16,7
5	КАС - 1 l/ha	680	720	+40	580	-140	460	-120	40	10,7
6	Novosil - 20 g/ha, 3 times	670	726	+64	558	-168	446	-112	26	6,2
7	Novosil - 40 g/ha 3 times	685	728	+43	575	-153	460	-115	40	9,5
8	Novosil - 60 g/ha 3 times	710	750	+40	583	167	456	-127	36	8,6
9	Gumat - 20 g/ha 3 times	720	800	+80	594	-206	466	-128	46	10,9
10	Gumat - 40 g/ha 3 times	750	850	+100	586	-264	500	-86	80	19,0
11	Gumat - 80 g/ha 3 times	755	863	+108	580	-283	510	-70	90	21,0
12	Fon + КАС - 0,7 lg/ha.	850	1030	+180	969	-61	695	-174	125	21,9
13	Fon + Novosil - 40 g/ha 3 times	843	1020	+177	950	-70	680	-270	110	19,3
14	Fon + Gumat - 40 g/ha 3 times	855	1040	+185	1010	-30	710	-300	140	24,6

The first period of vegetation (1-term 01.07), the largest mass of sugar beet root crops was noted for variants (K-2) N150P120K90 + top dressing with a background rate + guum-40 g / ha, background + CAS-0.7 l / ha. And the background + novosil-40 g / ha. respectively 567; 576 and 550 gr. or the daily increase was 12.5; 12,7 and 12,2 gr., And on a background without basic fertilizers on variants KAS-0,7 l / hectare. -40 g / ha. the root mass of 1 plant has 293; 283 and 293 gr., And the daily increment of 1 root is equal to 6.5; 6,3 and 6,5 gr., And on the control-245 and 5,4 gr. respectively.

It should be noted that both the leaf mass (Table 3) and the root mass in the second period (01.08) of the vegetation of sugar beet reaches a maximum of 40 g / ha in von + humate, background-CAS-0.7 l / ha. and background + novosil-40 g / ha. the mass of 1 root crop reaches 1087; 1024 and 1090 grams. or the daily increase was 17.3; 14.9 and 15.0 grams. and on the control - 668 and 13.3 gr. respectively, and subsequent terms (01.09 and 01.10) of the determination of the root growth are gradually reduced in the variants of background + humate, background + CAS and background + novosil 5.0-2.7; 4,0-2,8 and 4,3-2,7 gr. per day, and on variants without basic fertilizers KAS-0,7 l / ha, novosil-40gr / ha and Humat-40 g / ha. and was 4.0-1.8; 3,2 and 1,8 and 3,0 - 1,7 gr. per day, and at the control 2: 8 and 1.8; 3,5 and 2,0 gr. per day, respectively (K-2 and K-1) (Table 4).

So, as against the background of mineral fertilizers, the root mass of 1 root vegetable with foliar top dressing 3 times for humate 40 g / ha. 1 novosil-40 g.ha and KAS-0.7 l / ha, the increase was 234; 131 and 96 gr. or 20.1; 11.9 and 8.3%, and on the basis of the above-mentioned options, the increase was 113; 121 and 150 gr. or 18.3; 19.8 and 24.6%, respectively, compared to the control of K-2 and K-1.

One of the most important directions for the further rise of agricultural production in beet-growing agro-formations is a scientifically-based fertilizer system developed taking into account local soil-climatic conditions, as well as ecological features of culture.

An effective way to increase the productivity of sugar beet, which is widely used at present, is carrying out foliar top dressing by plant growth regulators.

Humaton - sodium and potassium salts of humic acids. Humaton and humic acids are the chemical basis of humus. Humic acids in a place with carbon dioxide dissolve minerals and contribute to the release of nutrients. The composition of the CAS includes a mixture of carbamide - 35.4%, ammonium nitrate - 44.3%, water 19.4%, ammonia water - 0.5%.

Average for the period 2015-2017gg. the density of standing of plants for harvesting in variants treated with PPP was 3.1-4.3 thousand plants more than that of control, and was in the variants with KAS-0.5 l / ha -63.9, novosil 60 g / ha. - 64.9; humate-40 g / ha. - 67,6 thousand plants per hectare.

Table 4 – Dynamics of the increase in the mass of root crops of sugar beet, depending on the use of CAS and biopreparations (per plant gr.)

#	Options	Date of sampling, + Dynamics of accumulation							Addition and control of gr. %	
		01.07	01.08	+,- growth	01.09	+,- growth	01.10	+,- growth		
1	Without fertilizer. K-1	245 / 5,4	445	200 / 7,1	550	105 / 3,5	610	60 / 2,0	–	–
2	$^{N}150^{P}120^{K}90$ K-2	268 / 6,1	668	400 / 13,3	1,068	850 / 2,6	1,153	55 / 1,8	540	89,0
3	КАС-0,5 л/га. 3 times	303 / 6,7	553	250 / 8,3	658	95 / 3,2	713	55 / 1,8	103	16,9
4	КАС - 0,7 л/га 3 times	293 / 6,5	585	292 / 9,7	706	121 / 4,0	760	54 / 1,8	150	24,6
5	КАС - 1 л/га 3 times	287 / 6,4	590	303 / 10,1	700	110 / 3,7	758	58 / 1,9	148	24,5
6	Novosil - 20 g/ha 3 times	316 / 4,8	586	270 / 9,0	681	95 / 3,2	731	50 / 1,7	121	19,8
7	Novosil - 40 g/ha 3 раза	283 / 6,3	583	300 / 10,0	678	95 / 3,2	731	53 / 1,8	121	19,8
8	Novosil - 60 g/ha 3 times	280 / 6,2	576	290 / 9,7	672	96 / 3,2	722	50 / 1,7	112	18,4
9	Gumat - 20 g/ha 3 times	270 / 6,0	570	300 / 10,0	665	95 / 3,2	710	45 / 1,5	100	16,4
10	Gumat - 40 g/ha 3 times	293 / 6,5	583	290 / 9,7	673	90 / 3,0	723	50 / 1,7	113	18,3
11	Gumat - 80 g/ha 3 times	291 / 6,5	591	300 / 9,7	686	95 / 3,2	739	53 / 1,8	129	21,7
12	Fon + КАС 0,7 l/ha 3 times	376 / 12,7	1024	438 / 14,9	1144	120 / 4,0	1249	85 / 2,8	96	8,3
13	Fon + Novosil + 40 g/ha 3 times	550 / 12,2	1090	500 / 15,0	1220	130 / 4,3	1,290	70 / 2,3	13,7	11,9
14	Fon + Gumat - 40 g/ha 3 times	567 / 12,5	1087	520 / 17,3	1237	150 / 5,0	1,387 / 1,307	80 / 2,7	234	20,1

Note. In the denominator is a monthly increase, and the numerator is the daily increase in root crop, gr.

On the yield of root crops and sugar sugar beet harvest, plant growth regulators also had a significant effect. The highest yield and collection of sugar were obtained in variants with processing plants by growth regulators humate - 40 g / ha, novosil - 40 g / ha. and carbamide ammonium mixture - 0.7 l / ha along the background of mineral fertilizers 77.1; and 12.0; 71.0, 11.1; 69.8 and 10.9 t / ha or an increase of 12.9 and 2.0, respectively; 6.8 and 1.1 and 5.6 and 0.9 t / ha or 20.0; 11.0 and 9.0% more than the control variant (K-2), and on humate-40 g / ha, novosil-40 g / ha. and ca. 0.7 l / ha. on without basic backgrounds the yield of root crops was obtained and the collection of sugar 52.9 and 8.1; 51.5 and 8.0

and 48.7 and 7.6 t / ha, i.e. The increase in the yield of root crops and the collection of sugar amounted to 12.5 and 2.2; 11.9 and 2.1 and 9.3 and 1.7 tons / ha. or 30.9 and 36.7, respectively; 30.7 and 35.6; 23.6 and 28.8% more than in comparison with control-1 (table 5).

Table 5 – The productivity of sugar beet and the collection of sugar, depending on the use of liquid forms of fertilizers and biopreparations. (Data for 2015-2017)

#	Options	Density of the planting. thousand pieces/ha.	Root weight, gr.	Harvest, t / ha	Suga-riness %	Sugar collection t / ha.	Addition to			
							root crop		collection of sugar	
							t / ha	%	t / ha	%
1	Without fertilizer. Control 1	1.60,6 2.64,5*	65,3 62,5	39,4 40,4	15,0 14,85	5,9 6,0	- -	- -	- -	- -
2	$^{N}150^{P}120^{K}90$ Control 2	63,1	1,017	64,2	15,5	10,0	58,9	4,0		
3	КАС-0,5 l/ha 3 times	63,9	698	44,6	15,5	6,9	5,2	13,2	1,0	16,9
4	КАС-0,7 l/ha 3 times	63,7	765	48,7	15,6	7,6	9,3	23,6	1,7	28,8
5	КАС-1 l/ha 3 times	62,0	768	47,6	15,6	7,4	8,2	20,5	1,5	25,4
6	Novosil - 20 g/ha 3 times	63,1	748	50,5	15,4	7,8	11,1	21,2	1,9	32,2
7	Novosil – 40 g/ha. 3 times	63,6	809	51,5	15,5	8,0	11,9	30,7	2,1	35,6
8	Novosil – 60 g/ha. 3 times	64,9	798	51,8	15,4	7,8	12,4	31,4	1,9	32,2
9	* Gumat- – 20 g/ha 3 times	64,4	717	47,6	15,3	7,3	7,2	17,8	1,3	21,7
10	* Gumat- – 40 g/ha 3 times	67,6	782	52,9	15,3	8,1	12,5	30,9	2,2	36,7
11	* Gumat- – 80 g/ha 3 times	66,8	739	49,4	15,3	7,6	9,0	22,3	1,6	26,7
12	Fon +КАС- 0,7 l/ha 3 times	66,5	1,050	69,8	15,6	10,9	5,6	8,7	0,9	9,0
13	Fon+ Novosil -40 g/ha 3 times	65.2	1,089	71,0	15,6	11,1	6,8	10,6	1,1	11,0
14	Фон+ Gumat-– 40 g/ha 3 times	64, 1	1,203	77,1	15,6	12,0	12,9	20,1	2,0	20,0
*Average data for two years.										

Thus, the highest increase in the yield of root crops and the collection of sugar was obtained on the variants of foliar dressing of plants by the growth regulators of humate-40l / ha, novosila-40l / ha and carbamide-ammonium mixture-0.7l / ha on the background of mineral fertilizers respectively amounted to 12.9 and 2 , 0 6.8 and 1.1 and 5.6 and 0.9 t / ha, or 20.1 and 20.0; 10,6 and 11,0 and 8,7 and 9,0% more than from control-2, and in variants without basic fertilizers, the yield of root crops was increased and the collection of sugar accordingly was 12.5 and 2.2; 11.9 and 2.1 and 9.3 and 1.7 tons / ha. or by 30.9 and 36.7; 30.7 and 35.6; 23.6 and 28.8% higher than from control without fertilizers.

Conclusions. Optimum supply of irrigation water during the vegetative period of sugar beet within the limits of 70-80-70% of PPV, on fertilized and without fertilized background application of foliar top dressing of HCS and growth regulators provided high yields of root crops and sugar intake from 69.8 and 10.9 and to 77 , 1 and 12.0 t / ha. and 48.7 and 7.6 to 52.9 and 8.1 t / ha. respectively.

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Ж. Тулеубаев[1], К. Мирзалиев[1], Г. Зияева[2], С. Ералиев[1], Х. Кидирбаева[3]

[1]Тараз мемлекеттік педагогикалық университеті, Тараз, Қазақстан,
[2]М. Х. Дулатм атындағы Тараз мемлекеттік университеті, Тараз, Қазақстан,
[3]М. Х. Әуезов атындағы Оңтүстік Қазақстан мемлекеттік университеті, Шымкент, Қазақстан

ОҢТҮСТІК ҚАЗАҚСТАННЫҢ ШАЛҒЫНДЫ СҰР ТОПЫРАҒЫНДА ТАМЫРДАН ТЫС ҚОРЕКТЕНДІРУ МЕН СУҒАРУ РЕЖИМІНЕ БАЙЛАНЫСТЫ ҚАНТ ҚЫЗЫЛШАСЫНЫҢ ӨНІМДІЛІГІ

Аннотация. Мақалада 3-жылғы ғылыми-зерттеу жұмыстарының (2015-2017ж.) нәтижелері қортындыланып, Оңтүстік Қазақстан суғармалы шалғын сұр топырақты алқабында қызылша егісіне негізгі тыңайтқыштармен қатар жапырақ алаңына берілген сұйық тыңайтқыштардың және суғару режимдерінің қызылша өніміне тиімділігі зерттелген.

Түйін сөздер: негізгі тыңайтқыш, қосымша қоректендіру, сұйық тыңайтқыш, жапырақ арқылы, карбамидаминакселитра (КАС), жаңа күш, гумат, нормасы, суғару режимі, тамыр жемісі, қант өнімі.

Ж. Тулеубаев[1], К. Мирзалиев[1], Г. Зияева[2], С. Ералиев[1], Х. Кидирбаева[3]

[1]Таразский государственный университет, Казахстан,
[2]Таразский государственный университет им. М. Х. Дулати, Казахстан,
[3]Южно-Казахстанский государственный университет им. М. Ауезова, Шымкент, Казахстан

ПРОДУКТИВНОСТЬ САХАРНОЙ СВЕКЛЫ В ЗАВИСИМОСТИ ОТ ПРИМЕНЕНИЯ ВНЕКОРНЕВОЙ ПОДКОРМКИ И РЕЖИМА ОРОШЕНИЯ НА ЛУГОВО СЕРЕЗОМАХ ЮГА КАЗАХСТАНА

Аннотация. В статье обобщены результаты 3-х летних научно-исследовательских работ – (2015-2017 гг.) и своевременное решение задач по повышению урожайности сахарной свеклы на основе применения основные и внекорневые подкормки и режима орошения на луговых сероземах Юга Казахстана

Ключевые слова: сахарная свекла, основная, внекорневая подкормка, жидкое удобрение, касс, новосил, гумат, доза внесения, режим орошения, урожайность корнеплода, сбор сахара.

Information about authors:

Mirzaliev Kuttybay – c.a.s., associate Professor of the Department «Biology and Methods of teaching biology», TarSPU.

Tuleubaev Zhaksibay – d.a.s., Professor, head of the Department of «Biology and Methods of teaching biology», TarSPU. E-mail: tuleubayev51@mail.ru

Ziyaeva Gulnar Kerimbekova - c.b.n., associate Professor of the Department "Biology", TarSU them. M. H. Dulaty. E-mail: gulnarzia-71@mail.ru

Yergaliyev Serik Saktapbayevich - master of biology, lecturer of the Department «Biology and Methods of teaching biology», TarSPU. E-mail: sam_big_f@mail.ru

Kydyrbaeva Halima Kerimbaevna - c.b.s., associate Professor of the Department "Biology", SKSU them. M. Auezova. E-mail: Halima-7301@mail.ru

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Sh. O. Bastaubayeva, M. B. Bekbatyrov, S. O. Ospanova

Kazakh Scientific Research Institute of Agriculture and Plant Growing, Almalybak, Kazakhstan.
E-mail: kazniizr@mail.ru, sh.bastaubaeva@mail.ru, ospanova.s.o@mail.ru

THE BIOLOGICAL EFFICIENCY OF CROP ROTATIONS AND GREEN MANURES TO IMPROVE THE PRODUCTIVITY OF IRRIGATED LANDS

Abstract. The results of studies on improving the basic conditions for the reproduction of soil fertility, increasing the productivity of irrigated lands and obtaining ecologically clean products in the system of biologized crop rotations are presented.

Key words: biologized crop rotations, green fertilizers, soil, humus, productivity agricultural crops.

The emergence of new concepts and requirements in the sustainable development of the world economy could not but affect such an important sector as agriculture, which directly depends on nature and causes no small environmental damage [1].

In the structure of world agricultural production today, there are obviously several directions that are the most promising for its development. One such area is organic farming.

Organic agriculture is a complex system of production management, oriented to improving the agroecosystem as a whole, as well as to maintain biodiversity, biological cycles and biological activity of the soil. Priority in it is given not to additives imported from outside, but to agrotechnical methods, taking into account the fact that local conditions require systems adapted to them. This is achieved by applying cultivation, biological and mechanical methods instead of using synthetic substances to implement any function within the system [2, 3].

The Republic of Kazakhstan has various natural and climatic, including soil and land resources. However, the scale of anthropogenic impact is such that a significant part of the land, including agricultural land (the total area of arable land is 26 million hectares), is in an unsatisfactory state due to various negative processes and phenomena [4].

The concept of the transition of the Republic of Kazakhstan to a "green economy" lays the foundations for profound systemic transformations with a view to shifting to the economy of a new formation by improving the welfare of the people, the quality of life of the population of Kazakhstan and entering the country among the 30 most developed countries of the world, and degradation of natural resources [5].

Agricultural production current stage of development, requires systematic and widespread increase in the fertility of Kazakhstan's irrigated lands.

The current environmental problems that have arisen as a result of anthropogenic overload and irrational use of natural resources have undoubtedly affected the state of the soil cover of the territory of Kazakhstan. The destabilization of the ecological situation has led to the degradation of the soil cover in all natural zones of the republic. As you know, Kazakhstan is one of the ten largest countries in the world with the largest area, and the population is on the 80th place in terms of population. Compiling 0.3 world population, Kazakhstan occupies 2% of the globe [6]. Territory of Kazakhstan according to aerospace survey and expert assessment, consist of medium-degraded soils are 35%, heavily-degraded soils - up to 15%. The solution of ecological problems of the soil cover of Kazakhstan now requires urgent measures. Moreover, both for the sake of the security of our state, and for preserving the healthy population of the

country as a whole. Already today, about 60% of the soil cover of the Republic of Kazakhstan refers to degraded to varying degrees, depending on the nature of the natural conditions and their economic use. Recently, according to scientists, in the republic there is a significant deterioration of soil-meliorative and soil-ecological status, intensive decline of soil fertility, development of water and wind erosion, and secondary salinization. As a result, the yields of agricultural crops in our country are noticeably behind the level of the countries that are with us in similar natural and climatic conditions. Therefore, the issues of improving the ecological situation in modern agro landscapes, maintaining and reproducing soil fertility and increasing crop productivity have become especially urgent at the present time. There was a need to create not only environmentally sustainable and safe technologies and techniques, but also the management of farming systems in general.

In this connection, we set ourselves the task of studying the influence of biologisation means and scientifically based selection of crops in the system of biologized crop rotations for the reproduction and conservation of soil fertility, increasing the productivity of irrigated lands and obtaining environmentally friendly products.

Research material and methods. The study of the effect of various biologic means and crops on the fertility and biochemical properties of light chestnut soils was carried out in the green manure link of the 8-field grass-grazing (winter wheat + alfalfa, alfalfa 2 years of life, alfalfa 3 years of life, winter wheat (used $N_{80}P_{50}K_{140}$; green manure -8.9 t / ha, manure-20 t / ha), sugar beet, soybeans, sugar beet, corn) and 3-hollow grain-crop rotations (winter wheat + siderates, sugar beet, soybeans).

In 8-field grassy-grained rotation, organic and mineral fertilizers were added to the sugar beets sown after winter wheat by the turnover of the alfalfa layer of 3 years of standing. In the experiment, variants were studied with the application of manure, the calculated dose of mineral fertilizers (by 500 centners / ha of root crops), as well as the sedimentation of the green manure (peas) of their action and aftereffect under the crops most productive use of the vegetative period for maximum accumulation of organic matter. The first control is a variant without applying fertilizers. The second option is the option of adding mineral fertilizers for sugar beet in doses calculated by the balance method. The principle of calculation of fertilizer doses was as follows: the average yield over a number of years of crop yields obtained with the application of recommended fertilizer doses, further increase in yield was determined by additional application of fertilizers.

In the 3-hollow grain-crop rotation after winter wheat, a vetch mixture (green manure) was grown, and then it's green plant mass, in an amount of 10 tons / ha, was plowed into the soil.

The activity of humic enzymes (polyphenol oxidase and peroxidase) was determined by the method of K.A. Mikhailovskaya and L.A. Karyaginoy on the photoelectric calorimeter (FEC). The humus content was determined by the method of I.V. Tyurin.

In the experiments, agricultural technology recommended for the irrigated zone of the southeast of Kazakhstan was used.

Research results and discussion. The activity of enzymes reflects the genetic features of soil processes. One of the sources of enzymes are soil microorganisms. With a significant level of metabolism, they release into the environment a large number of active enzymes. Enzymes are released from the cells of microorganisms during their autolysis and pass into the soil. High activity of enzymes indicates the vigorous activity of microflora and the activity of biological processes occurring in soils. Therefore, enzymatic activity can be considered as an important indicator of biological activity of soils and their productive capacity [7].

Humification of organic substances, which are basis of soil formation and soil fertility, is carried out by bacteria, fungi, actinomycetes and is accompanied by the manifestation of a high activity of phenoloxidases, in particular polyphenol oxidase, which favors polymerization reactions and the formation of polysaccharides, amino acids, polyphenols and other substances. Peroxidase activates the mineralization reaction, so that the soil is enriched with mineral substances necessary for the growth and development of plants. To characterize the dynamics of humus accumulation in soils, the ratio of polyphenol oxidase activity to peroxidase activity is used, expressed as a percentage and conventionally called the coefficient of humus accumulation. The data indicate that, on average, during vegetation, the activity of polyphenol oxidase in the soil of the control variant is 3.7 mg of benzoquinone in 30 minutes incubation, peroxidase - 4.8 mg. The coefficient of humus accumulation does not exceed 77%. When organic fertilizers are

introduced into the soil for sugar beets, the processes of transformation of humic substances are activated. The highest activity of polyphenol oxidase was observed in the soil of the variant, where green fertilizer was added-5.5 mg. In this variant, the process of mineralization of humus is the most vigorous - 5.7 mg. However, on average, during the vegetation the coefficient of humus accumulation is high - 96%.

The cultivation of soybeans after sugar beet contributes to the intensification of processes of polymerization and utilization of humic substances. According to the parameters of enzyme activity in the soil of the control variant, the polyphenol oxidase activity varies during the vegetation from 4.1 to 5.2 mg, peroxidase activity varies from 4.7 mg to 6.2 mg, and the humus accumulation coefficient ranges from 68 to 87%. A similar pattern has been established also in the soil of a variant of the aftereffect of mineral fertilizers. For two years, the positive effect of organic fertilizers on the processes of formation of humus components persists, especially in the variant where the green mass of peas was harrowed. The processes of mineralization of humus are reduced. The coefficient of humus accumulation during the soybean vegetation in the soil of these variants varies from 114% to 130% and from 92% to 113% (respectively aftereffects of mineral fertilizers and manure).

For the third year after the introduction of fertilizers, their effect on the accumulation of humus in the soil is reduced. The cultivation of sugar beet after soybeans, on average for vegetation according to options, provides the activity of polyphenol oxidase from 3.7 to 4.8 mg, peroxidase from 3.5 to 5.6 mg. The coefficient of humus accumulation is from 80 to 109%. It should be noted that only in the soil of the variant, where the aftereffect of manure was taken into account, and the intensity of the processes of humus transformation is much lower. The activity of polyphenol oxidase does not exceed 3.0-4.0 mg, peroxidase 3.4-3.6 mg, but the coefficient of humus accumulation is greatest. During the entire growing season, it varies from 86 to 117%.

In the 3-field crop rotation, the introduction of a large amount of plant residues of winter wheat into the soil and the easily hydrolyzed vico oatmeal mixture sharply activated the processes of humus formation and mineralization of organic matter. In autumn, the activity of polyphenol oxidase and peroxidase increases to 4.6-4.8 mg. Humus accumulation during the growing season was 98-111%.

Under sugar beet, the activity of polyphenol oxidase and peroxidase gradually increased from sowing to harvesting of root crops. However, in the soil of the control variant, the processes of mineralization of humus are more active. The activity of peroxidase exceeds the intensity of polymerization processes by 0.2 mg. The accumulation coefficient of humus is 89-90%.

Under the soybeans, which go after sugar beet, an intensive process of humus formation and a moderate process of its mineralization, especially in summer and autumn, are evidently connected with the active release of soybean exudates and the beginning of mineralization of nodules, litter and dead roots rich in nitrogen.

The highest activity of polyphenol oxidase (4.2 mg) was noted in the soil after the action of the green manure. The stock of legume-cereal grass mix for sugar beet for two years provides favorable conditions for accumulation of humus and stabilization of soil fertility in 3-grain grain-crop rotation.

Analysis of the values of the correlation coefficients shows that the activity of polyphenol oxidase and peroxidase positively correlates with the yield of sugar beet ($r = 0.73; 0.77$) only when cultivated without fertilization, which indicates intensive use of humus to create a crop.

In the case of applying mineral fertilizers and 20 tons of manure for sugar beet, a negative correlation was established between the activity of humic enzymes and the number of all physiological and taxonomic groups in the micropower population of the soil ($r = -0.66; 1.0$). In the soil of these options, the entire microbiocenosis involved in the transformation of plant and mineral compounds works to provide plants with basic nutrients.

When the green fertilizer is primed, the activity of polyphenol oxidase and peroxidase positively correlates ($r = 0.65; 0.99$) with the total biological activity of the soil. Consequently, the use of green manure contributes to an increase in the content of humus and the general level of soil fertility.

Reproduction of fertility of arable soils is one of the primary problems of modern agriculture. On irrigated lands in the south and southeast of Kazakhstan, this is accomplished through a three-year cultivation of alfalfa. The increase in humus content under perennial grasses is primarily due to the orientation in the soil of processes that ensure the restoration of the disturbed balance between the intake of organic matter and its decomposition. In the absence of intensive mechanical treatments on crops of

perennial grasses, the supply of organic matter to the soil prevails over its decomposition, which is determined by an increase in the activity of biochemical processes toward optimal modes of humus formation.

In our experiments, the state of soils under perennial grasses was close to the above conditions. So, in the spring period there was a combination of favorable moistening of the soil with temperature regimes, then in June there comes a period of moisture deficit, followed by July precipitation, followed by the August drought and all this is evident against the background of the compacted state of the soil. In the fields, multiple mechanical treatments, increasing soil aeration, intensified aerobic processes that destroy organic compounds involved in humus formation.

As our studies have shown, the dynamics of humus content in the soil in different years, and also during one growing season, varies continuously, depending on the complex of meteorological conditions and agro-practices that develop.

The initial content of humus before laying down the experience of 8-field crop rotation was 1.96%. After plowing 3-year-old alfalfa, the humus increased by 0.8-0.9%, that is, it amounted to 2.0%. When sowing winter wheat, which goes along the layer of perennial grasses, an increase in humus is observed up to 2.1%. That is, in the first link there is an increase in the humus content in the soil. (data of the department of agroecology of soils).

The introduction of organic and mineral fertilizers after harvesting winter wheat influenced the humus content of the soil in different ways. With siderates, a considerable amount of fresh organic matter enters the soil and a significant activation of humus occurs. With the biomass of green fertilizer, 132 kg / ha of nitrogen, 52.9 kg / ha of phosphorus and 176 kg / ha of potassium enter the soil.

In the course of its decomposition, these nutrients replenish the soil fund of nutrients, which provides additional nutrition for subsequent crops of crop rotation.

So, the aftereffect of the pea-seed mixture provided an increase in humus in subsequent sugar beet crops to 2.2%. The same result was obtained from the application of 20 tons per hectare of manure.

After sugar beet on soybean crops, the content of humus in the soil varied depending on the aftereffect of fertilizers 2.0-2.3%. These tables indicate the effectiveness of cultivation of legumes (in this case - soybeans). Soybean in this indicator of soil fertility is a good predecessor for other crops.

The obtained results indicate that in the 8-field grass-and-grained rotate crop rotation, a positive net balance of humus in the soil is formed for soil rotation. This is achieved, mainly due to the cultivation of alfalfa in the first link, the smell of organic fertilizers and soybeans before the culminating crops of crop rotation.

In the rotation with a short rotation (3-fold), the more frequent green manure and the cultivation of soybeans-legumes also contributed to the increase in the humus potential of the light chestnut soils studied. The priming of the vetch mixture allowed maintaining the optimum humus content in the soil for two years, especially in 2005, which was characterized by dry spring, which probably contributed to the strengthening of humification processes in the soil.

The humus content in the soil is largely determined by the cultivated crop and its predecessor, and its dynamics and seasonal balance by the climatic conditions of the year.

The obtained results indicate that on irrigated light chestnut soils humus potential is maintained by cultivation of alfalfa, soybean and using biologic means. Alfalfa provides a higher content of humus in the soil, which favorably affects the sown crops by its formation and turnover.

In the 8-hollow and 3-hollow biologized crop rotations, a positive humus balance was formed for rotation. This allows us to conclude that the use of green manure in the system: soil - organic fertilizers - the plant can provide a non - deficit balance of organic matter in irrigated agriculture.

So, on the basis of the data obtained, it is obvious that biologization means in crop rotations are economically and environmentally justified. But, despite the positive scientific results obtained, for Kazakhstan organic farming and production of organic products is still a "young sector", since there is no single concept and for the widespread introduction of the organic system in production it is necessary to solve the following tasks in the crop, livestock and processing industry:

– In the field of crop production: wide diversification, increased production of agricultural products, improvement of the basic conditions for reproduction of soil fertility, increased productivity of irrigated land and production of ecologically clean products, involve-ment in the agricultural turnover of currently unused lands and 6.8 million hectares of reserve land; restoration of 600 thousand hectares of previously used irrigated land;

– In the livestock sector: building up the export potential of meat, developing transhumant livestock, developing feed production, restoring and watering degraded pastures. It is planned to water 20 million hectares of pastures from 63 million hectares;

– In the sphere of processing: transition to international quality standards, technical and technological re-equipment of production, etc.

Conclusion.

1. Organic fertilizers (green mass of peas -11,7 t / ha, manure -20 t / ha), introduced under the sugar beet of the first link of 8-field crop rotation, enable the polymerisation processes and the formation of humic components in the soil. The activity of polyphenol oxidase increased from 3.7 to 5.5 mg, the activity of peroxidase does not exceed 5.7 mg. The coefficient of humus accumulation in the arable soil horizon of these variants ranges from 92 to 123%, the humus content increases from 1.9 to 2.0%.

2. In 3-rotary crop rotation, synthesis processes humus mineralization are less intensive, but more balanced. The vetch of the mixture improves the activity of polyphenol oxidase to 3.9 mg, reduces the activity of peroxidase to 3.8 mg, increases the humus content of 107%, and maintains the humus content in the soil at 1.82% until the end of rotation.

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Ш. О. Бастаубаева, М. Б. Бекбатыров, С. О. Оспанова

Қазақ егіншілік және өсімдік шаруашылығы ғылыми-зерттеу институты, Алмалыбақ, Қазақстан

СУАРМАЛЫ ЖЕРЛЕРДІҢ ӨНІМДІЛІГІН АРТТЫРУ ҮШІН БИОЛОГИЯЛЫҚ АУЫСПАЛЫ ЕГІСТІҢ ЖӘНЕ ЖАСЫЛ ТЫҢАЙТҚЫШТАРДЫҢ ТИІМДІЛІГІ

Аннотация. Топырақ құнарлылығын қалпына келтіру, суармалы жерлердің өнімділігін арттыру және биологиялық ауыспалы егістік жүйесінде экологиялық таза өнімдерді алудың негізгі шарттарын жетілдіру бойынша зерттеулер мен нәтижелер келтірілген.

Түйін сөздер: биологиялық ауыспалы егіншілік, жасыл тыңайтқыштар, топырақ, құнарлық, ауылшаруашылық дақылдардың өнімділігі.

Ш. О. Бастаубаева, М. Б. Бекбатыров, С. О. Оспанова

Казахский научно-исследовательский институт земледелия и растениеводства, Алмалыбак, Казахстан

ЭФФЕКТИВНОСТЬ БИОЛОГИЗИРОВАННЫХ СЕВООБОРОТОВ И ЗЕЛЕНЫХ УДОБРЕНИЙ ДЛЯ ПОВЫШЕНИЯ ПРОДУКТИВНОСТИ ОРОШАЕМЫХ ЗЕМЕЛЬ

Аннотация. Представлены результаты исследований по улучшению основных условий воспроизводства плодородия почв, повышения продуктивности орошаемых земель и получение экологически чистой продукции в системе биологизированных севооборотов.

Ключевые слова: биологизированные севообороты, зеленое удобрения, почва, плодородия, урожайность сельскохозяйственных культур.

Information about authors:

Bastaubaeva Sholpan Orazovna – Candidate of Agricultural Sciences, Kazakh Scientific Research Institute of Agriculture and Plant Growing; sh.bastaubaeva@mail.ru; ORCID ID 000-0003-2588-5880

Bekbatyrov Maripbai Burakojayevich – Candidate of Agricultural Sciences, Kazakh Scientific Research Institute of Agriculture and Plant Growing; kazniizr@mail.ru; ORCID ID 0000-0001-8865-2887

Ospanova Saltanat Ongarovna – Master of Agricultural Sciences, Kazakh Scientific Research Institute of Agriculture and Plant Growing; ospanova.s.o@mail.ru; ORCID ID 0000-0003-1399-0958

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B. T. Abdizhapparova[1], N. S. Khanzharov[1], B. O. Ospanov[1], A. V. Baranenko[2], A. A. Dosmakanbetova[1]

[1]M. Auezov South Kazakhstan State University, Shymkent, Kazakhstan,
[2]ITMO University, Russia.
E-mail: bahyt_04@mail.ru, atiko_96@mail.ru, baranenko@mail.itmo.ru

STUDY OF WHEY AND WHEY-BASED DRINKS

Abstract. The aim of the study is enhancement of efficiency of the applying of secondary dairy product whey by developing whey-based drinks. About 50% of milk solids, as well as vitamins A, C, E, nicotine acid, choline, biotin, a complete set of vitamins of group B remains in the whey. The yield of whey from 1 ton of milk spent for the production of high-protein products is from 65% to 82%. Such a large volume of secondary dairy products poses the problem of studying the properties of whey and finding the best ways of its processing. An effective technology for producing fruit and whey drinks has been developed by the study of perspective methods of processing of whey. Experimental samples of apple-whey and pear-whey drinks were obtained. On the basis of sensory analysis, the optimal formulations of apple-whey and pear-whey drinks were determined. The optimal ratio of whey and fruit juice for apple and whey juice is 60:40, for pear and whey is 55: 45. In the laboratory, physical and chemical parameters and mineral composition of whey, apple-whey and pear-whey drinks were determined. It was found that the whey is dominated by mineral elements such as sodium (~20%), phosphorus (11.6%), potassium (44.7%), sulfur (2.09%), and magnesium (1.78%). In contrast to the serum, in the pear and whey drink the content of potassium (75.2%), magnesium (2.99%) is increased significantly and the amount of phosphorus (11.53%) and calcium (10.15%) is decreased. In apple and whey drink the content of potassium (76.94%), magnesium (2.80%) is also significantly raised, and the amount of phosphorus (8.83%) and calcium (11.22%) is lowered. Overall, there are also elements such as manganese, iron, cobalt, copper, zinc, strontium, molybdenum, etc. in developed drinks. Low fat in the fruit-whey beverages can attribute them to the category of dietary ones.

Keywords: whey, drink, technology, composition, fruit, secondary product, dairy.

Introduction. The production of milk and dairy products is one of the most important sectors of the food industry in Kazakhstan. The consumption of milk and dairy products directly affects the state of health of the nation: it is well known that milk is one of the basic food products, an important component of a healthy diet of people of all ages. The urgency of an issue of the processing of secondary products grows up annually with increased volume of dairy production in Kazakhstan [1].

Milk whey is a by-product in the production of protein-fat products such as cheese, cottage cheese, casein. About 50% of milk solids, as well as vitamins A, C, E, nicotine acid, choline, biotin, a complete set of vitamins of group B remains in the whey. Whey proteins are the most full-fledged among all studied food proteins, they have the highest rate of degradation in the digestive tract and digestibility is 98 %. The most valuable are the so-called "native" ones, i.e. undenatured, whey proteins with immunomodulatory properties [2].

It is known that the yield of whey from 1 ton of milk sent to the production of high-protein products, ranging from 65% to 82%: natural cheese – 80%; skimmed cheese – 65%; low–fat cheese – 65%; cheese – 65%; cottage cheese – 80%; technical casein – 75%; food casein -82% [2].

Such a large volume of secondary dairy products poses the problem of studying the properties of whey and finding the best ways of its processing.

Various methods of whey processing, such as separation, concentration, preservation, membrane technologies, biological methods have been developed and successfully applied in the world practice [3].

In the food industry, whey is used in the production of bakery, confectionery and dairy products [4,5]. The most interesting is the development of functional beverages based on whey, assigned to compensate micronutrients and sports nutrition [6-8].

To preserve the whey before the main processing, it must be subjected to heat or preservation. Heat treatment of whey is carried out at a threshold temperature of denaturation of whey proteins, followed by cooling. After such treatment, the whey can be stored for 2 days. In addition, various preservatives are used: solutions of hydrogen peroxide, formaldehyde, sodium chloride.

Membrane technologies allow concentrating and fractionating the main components of whey, and, consequently, increase the volume of processed raw materials and the range of its applying. Depending on the pore size, the following types of membrane processes are distinguished: microfiltration, ultrafiltration, nanofiltration and reverse osmosis [9]. By treating curd whey with nanofiltration, it is possible to achieve the level of demineralization of 25-27% and the level of deoxidation – 15-18 % [10, 11]. The undeniable advantage of membrane processes is that they are carried out at low temperatures (8-10°C), which allows you to save the useful substances of whey.

To reduce the sour taste of curd whey obtained by nanofiltration, the minimum values of its neutralization level were studied and justified [12].

Voronova N. S. and Ovcharov V. D. developed a technology of functional drink based on whey with vegetable fillers, which are taken as puree Jerusalem artichoke, beets and carrots [6]. The whey was deoxidized to pH=6,2-6,6 by adding 5% sodium bicarbonate solution. Vegetable puree was added into the neutralized whey, the mixture was pasteurized, cooled and a concentrate of bifidobacteria was introduced for souring of the resulting mixture. The addition of vegetable mixture to the drink enhances its probiotic effect and symbiotic properties.

Zhaylaubaev Zh.D. et al. developed a composition of low-calorie diet fermented milk cocktail based on a milk mixture of milk and whey, mass.% [13]:

Milk mixture of skimmed milk and whey	71.5
Inoculum consisting of bacterial cultures (Streptococcus thermophilus and Lactobacillus delbrueckii subsp. bulgaricus)	5.0
A colloidal solution of gelatin	2.0
Chicory root extract	6.5
Fruit syrup	15.0

Shepochkina Y. A. proposed a method of producing a beverage from whey, providing heating the whey up to 95-96°C, holding at this temperature for 0.8 to 1.2 min, cooling with rate of at least 7.5°C/min up to 5-10°C, filtering, applying the filtrate flavorings, sugar syrup [14]. In the filtered whey as a flavoring additive, a watermelon peel is brought, pretreated with steam at a temperature of 90-120°C and rubbed in a puree, or pretreated watermelon peel and watermelon juice in an amount of 1-25% and 5-10%, respectively, from the mass of the filtered whey with subsequent mixing. The finished drink has no taste and smell of whey.

Employment of whey in the production of functional products, in particular, beverages with additives is some of great interest. As additives, it is advisable to use fruit crops. For this purpose, drinks from whey with fruit base were developed. The fruit base harmonizes the taste of the drink, giving it a pleasant fruit flavor with a sour shade. Initially, different types of raw materials were tested as a vegetable basis: cherry, raspberry, watermelon, melon, etc. The best sensory characteristics of the drink were achieved by adding apple and pear juices. Therefore, it was decided to develop a composition of drinks from whey with apple and pear juices.

The purpose of the study is to increase the efficiency of the use of secondary milk raw material and fruit crops by developing technology and formulations of fruit drinks based on whey.

Methods. The pilot study included:

- development of technology and composition of whey-based drinks.
- study of physical, chemical and mineral composition of whey and finished drinks.

The following devices were used to determine the physical, chemical and mineral composition:

- milk analyzer "Clever-2" - for determination of temperature, density, solids content;
- mass spectrometer with inductively coupled plasma with quadrupole mass analyzer MS-820 Varian.

Determination of temperature, density, solids content using the device "Clever-2. Milk analyser». The analyzer "Clever-2" is made in the form of two blocks, in the cases of which are placed:

- the power supply with voltage 12.6 V;
- in the measuring unit is an ultrasonic measuring cell, as well as the electronic circuit of the device. The measuring cell includes a sample receiver with a heating and thermo stabilization system, a source of ultrasonic vibrations, a detector and an amplifier. The control microprocessor unit provides registration of the ultrasonic signal, its processing according to the algorithm and the output of the data on the display.

The analyzer "Clever-2" is a device with direct indication in a compact splash-proof housing made of impact-resistant plastic (figure 1).

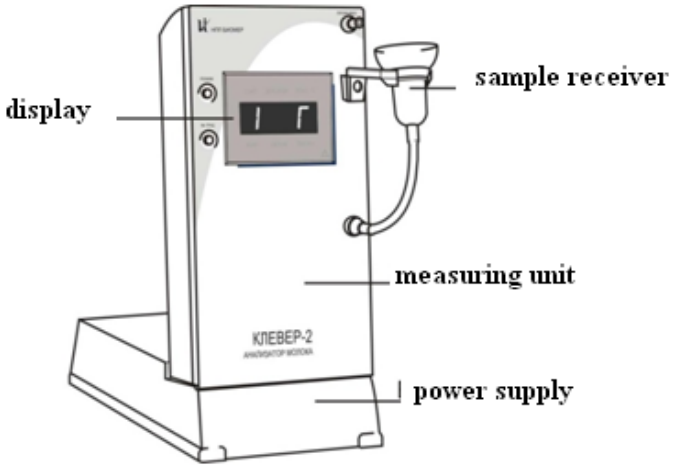

Figure 1 – General view of the analyzer "Clever-2"

The principle of operation of the analyzer is based on the measurement of the characteristics of ultrasound passing through the sample, depending on the concentration of substances and the temperature of the sample. The samples are poured directly into the probe of the device. The analyzer operation is controlled by a microprocessor. Measurement and results are automatically generated.

Samples saturated with gases are pre-degassed. To remove the air, it is necessary to degass the sample: heat it to a temperature (45 – 50)°C, hold at this temperature for 5 minutes, mix and cool to a temperature (25±2)°C .

The sample should be uniform. In the presence of a settled layer of fat (cream), the milk sample is heated in a water bath to (40-45)°C, mixed, cooled to a temperature of (25±2)°C and mixed again. In order to obtain the most accurate result, the temperature of the sample at the time of pouring it into the analyzer is maintained at the level (20±2)°C.

The physical and chemical parameters of whey and whey-based fruit drinks (apple and pear) were studied on the analyzer "Clever - 2".

Determination of macro- and microelements by the inductively coupled plasma spectrometer with mass spectroscopy by ST RK ISO 17294-2-2006. The content of macro-and microelements in the studied raw materials was determined by mass spectroscopy (ISP-MS) by means of dry mineralization of the product. For this purpose, a mass spectrometer with inductively coupled plasma with quadrupole mass analyzer MS-820 Varian (figure 2) was used. In a result of analysis, 35 elements were found, among which phosphorus, potassium, sodium, magnesium and calcium were found in a larger number.

Generally, the studied solution is fed by a peristaltic pump to a spray gun, in which by the argon stream it is converted into an aerosol. The aerosol through the central channel of the plasma burner enters the plasma, where under the influence of high temperature (7000-8000 K) the substances contained in the sample dissociate into atoms, which are then ionized. The resulting positively charged ions pass through the ion optics system to the analyzer, where the ion filtration by mass and detection of the ion flux intensity takes place. The received signal is transformed into the dependence of intensity on the value of m/z.

Figure 2 – Mass spectrometer with inductively coupled plasma quadrupole mass analyzer with MS-820 Varian

Results. The technological scheme for obtaining a fruit and whey beverage includes technological operations of preparation of whey and fruit juice, which are then mixed in the right proportions, then the mixture is pasteurized, bottled, sealed, the product is cooled and stored in a cooled state. Preparation of the whey includes its filtration, heating and cooling. Filtration of whey is required for the separation of proteins that make serum taste, create muddiness, and reduce the resistance during storage. The filtered whey was heated to 60 ^{0}C for 25-30 minutes to preserve its properties. Then the whey is cooled to a temperature of 4-6 ^{0}C. After cooling, such serum can be stored for up to 2 days. In the first variant, filtered apple juice was added to the curd whey. In the second variant, filtered pear juice was added to the curd whey.

Because pears and apples are seeded fruits, pear-whey and apple-whey beverages production technology are identical.

Apples and pears must be sorted out; fruits affected by diseases and pests or with mechanical damage are removed. Then the fruits are sorted by size, washed with running water.

The grinding process is a necessary operation in the preparation of apples and pears for pressing. From the degree of grinding, i.e. the number of destroyed cells depends on the output of the juice during pressing. The crushed mass is pressed to separate the juice. The squeezing, i.e. remains of pressing should be dry. The resulting juice was filtered.

The juice was heated at a temperature of 40-50ºC with holding for 60 seconds for clarification. The resulting juice is cooled for clarification. When the juice is cooled, the structure of protein molecules changes, protein coagulation and sedimentation occurs. The solids content in apple juice is10,0%.

The pasteurization temperature of the beverage is in the range of 87±3 °C, process duration is 30-45 sec. Technological scheme of production of whey beverage is shown in figure 2.

These regimes are necessary and sufficient to achieve the objectives.

The finished product was poured in hot view into prepared glass jars and sealed. Banks were cooled to 4-6 ^{0}C and stored at a temperature of air 6 °C and a relative humidity of air no more than 75%. The resulting drinks had good sensory characteristics (table 2).

With the help of sensory analysis, the optimal formulations of fruit and whey drinks were established (table 1).

Table 1 – Formulations of fruit and whey drinks

The name of the drink, its composition	Ratio of components, %
Apple and whey drink: - curd whey - apple juice	 60 40
Pear and whey drink: - curd whey - pear juice	 55 45

Table 2 – Sensory characteristics of fruit-whey drinks

Product	Sensory indicators			
	colour	smell	taste	consistency
Apple and whey drink	Yellowish with greenish tint	Peculiar to apple	Sweetish and sour	Homogeneous liquid mass
Pear and whey drink	Light yellow	Peculiar to pear	Sweetish and sour	Homogeneous liquid mass

Physico-chemical parameters of the beverages are shown in table 3.

Table 3 – Physical and chemical parameters of whey and fruit and whey drinks

Defined component	Experimental data		
	whey	apple and whey drink	pear and whey drink
DSMR*, %	7.29 %	–	–
Solids, %	–	10.74	10.86
Fats, %	0.19%	0.11%	0.13%
Proteins, %	2.69%	3.96	4.01
Density, kg/m^3	1027.00	1041.31	1041.00
* DSMR - dry skim milk residue.			

The results of studies of curd whey and fruit and whey drinks on the content of macro-and micro-elements by mass spectrometry with inductively coupled plasma are shown in table 4.

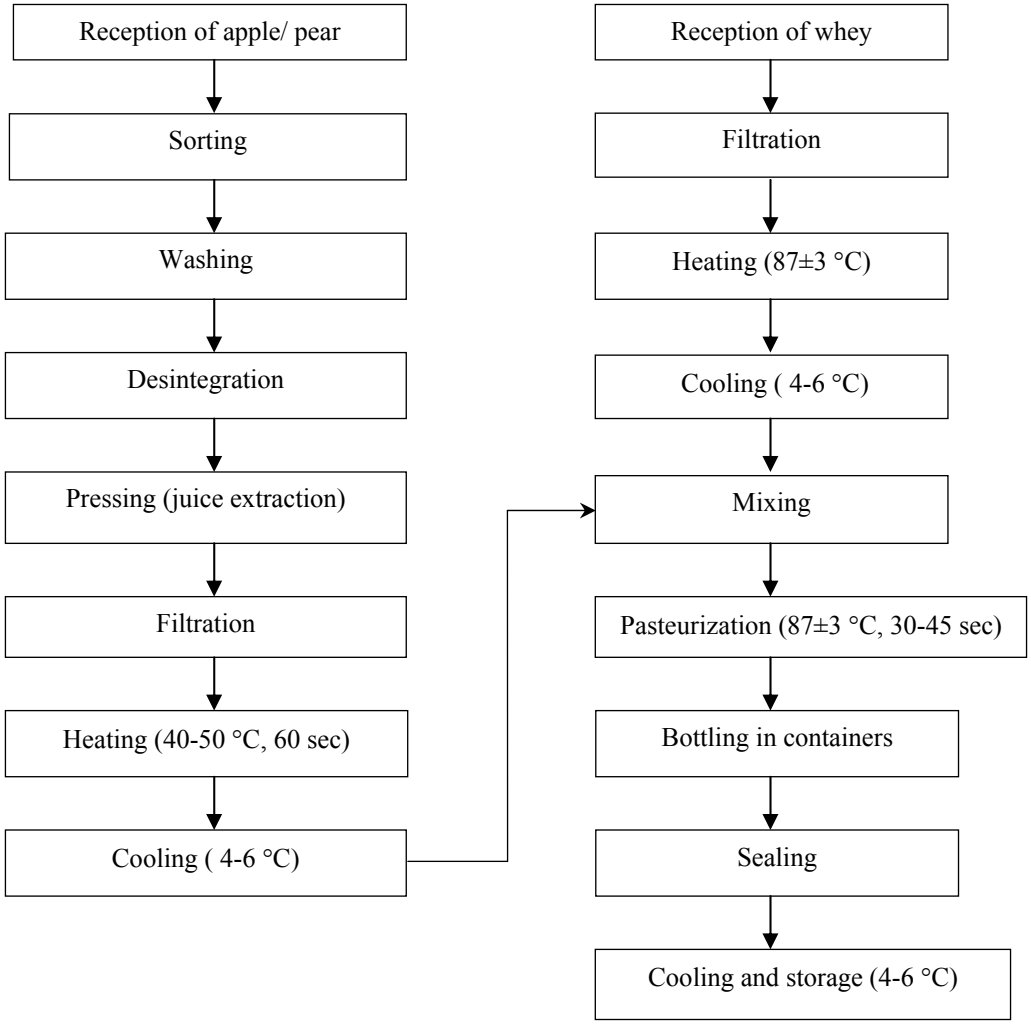

Figure 2 – Technological scheme of fruit and whey drink

Table 4 – Content of micro- and macronutrients in curd whey,
determined by inductively coupled plasma mass spectrometer with quadrupole mass analyzer MS-820 Varian

Name of micro-and macronutrients	Concentration of elements in μg / dm^3		
	whey	apple and whey drink	pear and whey drink
Be9	0.0000	0	0
Na23	117831.2000		
Mg24	10582.3333	2.802941114	2.532099814
Al 27	20.8031	0.006061966	0.019261433
Si29	0.0000		
P31	68822.3333	8.837428828	9.410853545
S34	12353.1633		
K39	264376.1333	76.94413687	73.04560334
Ca44	115828.1667	11.22404332	14.09385706
Ti47	175.4627	0.020135315	0.025408716
V51	0.4406	0	0
Cr53	15.0477	0	0.003521109
Mn55	0.9744	0.007318822	0.003804626
Fe57	1054.6133	0.013221087	0.062276864
Co59	0.2383	0.000149051	0.000104736
Ni60	28.8537	0	0.000391624
Cu63	27.3765	0.023565797	0.001244589
Zn66	29.4742	0.033216951	0.0082742276
As75	1.2498	0	0
Se78	5.9151	0	0
Rb85	202.1753	0.037185066	0.055609824
Sr88	50.0379	0.027559103	0.018577346
Mo95	10.7986	0.002152212	0.01796118
Ag107	0.1737	0	0.0001068
Sn118	0.2538	0	0
Sb121	0.0497	0	0
Cs133	1.2163	0	0.000112787
Ba137 ppb	5.8537	0.020645657	0.689618655
W182 ppb	0.1285		
Pb208 ppb	13.3806	0	0
U238 ppb	0.0106	0	0

Discussion. The ready drinks were characterized by a pleasant sourish-sweet taste and moderate aroma. The taste of the fruit base is quite clearly expressed.

Apple-whey drink had a yellowish color with a green tint, liquid consistency, sweetish and sour taste. Ready pear-whey drink had a light yellow color, liquid consistency, sweetish and sour taste. Compare to the whey, the color of the drink has changed from weak green to light yellow, the taste became sweetish-sour, there was a distinct pear smell.

As can be seen from table 3, drinks are characterized by a sufficiently high protein content (from 3.94 to 4.01%) and low fat content, which characterizes them as products that can be used in dietary nutrition.

As can be seen from table 4, the whey is dominated by mineral elements such as sodium (~20%), phosphorus (11.6%), potassium (44.7%), sulfur (2.09%), magnesium (1.78%).

Ash content of pear-whey beverage was 0.80 %. In contrast to the whey, in the pear-whey drink the content of potassium (75.2%), magnesium (2.99%) is significantly increased and the amount of phosphorus (11.53%) and calcium (10.15%) is decreased.

Ash content of apple-whey beverage was 0.26 %. As in the pear-whey drink, content of potassium (76.94%), magnesium (2.80%) into apple-whey drink was significantly raised, and amount of phosphorus (8.83%) and calcium (11.22%) was lowered. Generally, there are also elements such as manganese, iron, cobalt, copper, zinc, strontium, molybdenum, etc in the developed drinks.

The fruit base harmonizes the taste of the drink, giving it a pleasant fruit flavor with a sour shade.

Overall, producing drinks from whey fruit base seems promising way to recycle the last one.

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Б. Т. Абдижаппарова[1], Н. С. Ханжаров[1], О. Б. Оспанов[1], А. В. Бараненко[2], А. А. Досмаканбетова[1]

[1]М. Әуезов атындағы Оңтүстік Қазақстан мемлекеттік университеті, Шымкент, Қазақстан,
[2]АТМО университеті, Санкт-Петербург, Ресей

СҮТ САРЫСУЫН ЖӘНЕ ОНЫҢ НЕГІЗІНДЕГІ СУСЫНДАРДЫ ЗЕРТТЕУ

Аннотация. Жұмыстың мақсаты бұл сарысу негізінде сусындарды жасай отырып қайталама сүт өнімнің пайдалану тиімділігін жоғарылату болып табылады.

Сүтті сарысудың құрамында шамамен 50% құрғақ заттар, сондай-ақ А, С, Е дәрумендері, никотин қышқылы, холин, биотин және В тобы дәрумендерінің толық жинағы қалады. Ақуыз мөлшері жоғары өнімдердің өндірісіне жіберілетін 1 тонна сүттен сарысудың шығу мөлшері 65-82% құрайды. Қайталама сүт өнімдерінің мұндай үлкен көлемі сүтті сарысудың қасиеттерін зерттеу және оны тиімді өңдеу жолдарын іздеу мақсатын қояды. Сүтті сарысудың тиімді өңдеу тәсілдерін зерттеу негізінде жеміс пен сарысу қосылған сусындардың

тиімді технологиясы құрастырылды. Алма мен сарысу, алмұрт пен сарысу сусындарының тәжірибе жүзінде үлгілері алынды. Органолептикалық сараптама негізінде алма мен сарысу, алмұрт пен сарысу сусындарының тиімді рецептуралары анықталды. Сарысу мен жеміс шырының тиімді қатынастары: алма мен сарысу сусынына – 60:40, алмұрт пен сарысу сусынына – 55:45. Зертханалық жағдайларда сарысу, алма мен сарысу, алмұрт пен сарысу сусындарының физика-химиялық көрсеткіштері мен минералды құрамы анықталды. Сарысу құрамында натрий (~20%), фосфор (11,6%), калий (44,7%), күкірт (2,09%), магний (1,78%) сияқты минералды элементтер басым екендігі анықталды. Сарысуға қарағанда, алмұрт пен сарысу сусынында калий (75,2%), магний (2,99%) мөлшерлері өсті, ал фосфор (11,53%) және кальций (10,15%) мөлшерлері төмендеді. Алма пен сарысу сусынында да калий (76,94%) мен магнийдің (2,80%) мөлшерлері өсті, ал фосфор (8,83%) мен кальцийдің (11,22%) мөлшерлері төмендеді. Жалпы, жасалынған сусындарда марганец, темір, кобальт, мыс, мырыш, стронций, молибден және т.б. элементтер кездеседі. Дайындалған жеміс пен сарысу сусындардағы майдың төмен мөлшері оларды диеталық өнімдердің қатарына жатқызуға мүмкіндік береді.

Түйін сөздер: сарысу, сусын, технология, құрамы, жемістер, екінші өнім, сүт өнімдері.

Б. Т. Абдижаппарова[1], Н. С. Ханжаров[1], О. Б. Оспанов[1], А. В. Бараненко[2], А. А. Досмаканбетова[1]

[1]Южно-Казахстанский государственный университет им. М. Ауэзова, Шымкент, Казахстан,
[2]Университет ИТМО, Санкт-Петербург, Россия

ИССЛЕДОВАНИЕ МОЛОЧНОЙ СЫВОРОТКИ И НАПИТКОВ НА ЕЕ ОСНОВЕ

Аннотация. Целью исследования является повышение эффективности использования вторичного молочного продукта – сыворотки путем разработки напитков на ее основе. В молочной сыворотке остается около 50% сухих веществ молока, а также витамины А, С, Е, никотиновая кислота, холин, биотин, полный набор витаминов группы В. Выход молочной сыворотки из 1 т молока, направляемого на производство высокобелковых продуктов, составляет от 65% до 82%. Такой значительный объем вторичных молочных продуктов ставит задачу исследования свойств молочной сыворотки и поиска оптимальных путей ее переработки. На основе изучения перспективных способов переработки молочной сыворотки разработана эффективная технология получения фруктово-сывороточных напитков. Получены опытные образцы яблочно-сывороточного и грушево-сывороточного напитков. На основе органолептического анализа определены оптимальные рецептуры яблочно-сывороточного и грушево-сывороточного напитков. Оптимальное соотношение сыворотки и фруктового сока для яблочно-сывороточного сока составляет 60:40, для грушево-сывороточного – 55:45. В лабораторных условиях определены физико-химические показатели и минеральный состав сыворотки, яблочно-сывороточного и грушево-сывороточного напитков. Обнаружено, что в сыворотке преобладают такие минеральные элементы, как натрий (~20%), фосфор (11,6%), калий (44,7%), сера (2,09%), магний (1,78%). В отличие от сыворотки, в грушево-сывороточном напитке значительно повысилось содержание калия (75,2%), магния (2,99%), а количество фосфора (11,53%) и кальция (10,15%) понизилось. В яблочно-сывороточном напитке также значительно повысилось содержание калия (76,94%), магния (2,80%), и понизилось количество фосфора (8,83%) и кальция (11,22%). В целом, в разработанных напитках встречаются также такие элементы, как марганец, железо, кобальт, медь, цинк, стронций, молибден и др. Низкий уровень жира в полученных фруктово-сывороточных напитках позволяет отнести их к категории диетических.

Ключевые слова: сыворотка, напиток, технология, состав, фрукты, вторичный продукт, молочные продукты.

Information about authors:

Abdizhapparova B. T. – M. Auezov South Kazakhstan State University, Shymkent, Kazakhstan; https://orcid.org/0000-0001-8277-8243

Khanzharov N. S. – M. Auezov South Kazakhstan State University, Shymkent, Kazakhstan; https://orcid.org/0000-0002-7406-0386

Ospanov B.O. – M. Auezov South Kazakhstan State University, Shymkent, Kazakhstan; https://orcid.org/0000-0002-6437-5579

Baranenko A. V. – ITMO University, Russia; https://orcid.org/0000-0001-7203-1760

Dosmakanbetova A. A. – M. Auezov South Kazakhstan State University, Shymkent, Kazakhstan; https://orcid.org/0000-0002-9385-6267

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B. T. Abdizhapparova[1], N. S. Khanzharov[1], B. O. Ospanov[1], A. V. Baranenko[2], A. A. Dosmakanbetova[1]

[1]M. Auezov South Kazakhstan State University, Shymkent, Kazakhstan,
[2]ITMO University, Russia.
E-mail: bahyt_04@mail.ru**,** atiko_96@mail.ru**,** baranenko@mail.itmo.ru

STAGE VACUUM DRYING OF CAMEL MILK AND SHUBAT

Abstract. Processing of national dairy drinks in order to obtain long-lived commodities keeping own native properties is a topical issue of Kazakhstan food industry. A composition and medicinal properties of camel milk and national dairy drink "Shubat" is reported in the article. Drying till powder-like condition is the best preservation method.

At spray drying losses of dry product with outgoing drying agent (i.e. hot air) and its overheating are possible. In comparison to other drying methods vacuum-sublimation one requires high energy consumption. At vacuum-sublimation drying a liquid product is preliminary subjected to freezing because it is thought that drying of liquid milk or dairy product in vacuum is impossible due to its foaming and kicking over a capacity. Experimental data confirm that at definite vacuum level and heating temperatures phenomenon similar to camel milk boiling is observed. Especially strongly this phenomenon is observed at drying of Shubat that is explained by presence carbonic gas into it. Drying of dairy products into vacuum medium without preliminary freezing will increase intensity of dehydration process and decrease energy demands.

A technology of stage vacuum drying of camel milk and Shubat without their freezing has been developed. Mode of camel milk vacuum drying consists of four stages and is carried out at vacuum level (3-6) kPa and heating temperature (18-20) ^{0}C. Mode of Shubat vacuum drying is more complex because of presence of carbonic gas in it and consists of six stages, vacuum level (3-10) kPa and heating temperature is the same. A construction of experimental vacuum dryer has been presented. The optimal regimes of vacuum drying of these products have been defined. Ready powders of camel milk and Shubat have good sensory indicators and rehydrated properties.

Keywords: vacuum, drying, stage, dryer, camel milk, shubat.

Introduction. In Kazakhstan camel milk and its dairy drink "Shubat" are widely used in food. Camel milk is different by high content of fats, proteins, mineral substances and other valuable elements therefore it is considered as a high-nutritious food. Usually camel milk has pure white colour, flattish-sweet or sweetish-salty taste depending on camel feeding, dense consistency, at pouring-over it is strongly foamed. Mal and Pathak (2010) thoroughly described camel milk composition and products obtained from it in India. Grigor'yants (1954) compared chemical compositions of camel milk and Chal (Turkman analog of Shubat). Dikhanbayeva (2010) investigated a chemical composition of milk of Almaty region (Kazakhstan's district) camels of *Camelus dromedaries* breed in every year season.

Shyngissov and Nurseitova (2013) found out the presence of such macro- and microelements as titanium, strontium, argentums, tellurium, stannic, niobium, tantalum, etc. in a mineral composition of milk and Shubat from camels of South Kazakhstan.

Camel milk and Shubat possess by many medicinal properties. Camel milk is used for treating dropsy, jaundice, spleen ailments, tuberculosis, asthma, anemia and piles (Rao et al. 1970). The patients suffering from chronic hepatitis had improved liver functions after drinking of camel milk (Sharmanov et al. 1978). Yagil (1982) suggested that camel milk contains protective proteins which may have possible role for enhancing immune defense mechanism. Camel milk also contains higher amount of zinc. The

rapidly dividing cells of the immune system are sensitive to zinc deficiency. The role of Zn in the development and maintenance of a normally functioning immune system has been well established (Hansen et al. 1982). Antibacterial and antiviral activities of these proteins of camel milk were studied (El-Agamy et al. 1992). Lysozyme of camel milk showed a higher lysis value towards Salmonella typhimurium compared to egg white and bovine milk lysozymes. The inhibition of pathogenic bacteria by camel's milk was also observed (Barbour et al. 1984). Camel milk has insulin like activity, regulatory and immunomodulatory functions on β cells (Breitling, 2002).

Camel milk exhibits hypoglycemic effect when given as an adjunctive therapy, which might be due to presence of insulin like protein in it (Agrawal et al. 2003) and possesses beneficial effect in the treatment of diabetic patients. Camel milk has been used for the treatment of autism (Shabo and Yagil, 2005a) and food allergies (Shabo et al. 2005b). Camel milk can be used for the treatment of different types of tuberculosis (Mal et al. 2000, 2001 and 2006). Camel milk possesses medicinal properties to treat different ailments such as multiple sclerosis, psoriasis, lupus, allergies-asthma (Wernery, 2006). Camel milk drinking has shown a good effect for treating crohn's disease (Shabo et al. 2008). Shubat promotes curing of tuberculosis and gastric ulcer, normalizes the activity of sweetbread, stomach, liver and enhances organism resistance to infectious diseases (Sharmanov, 1991).

All of these medicinal properties are peculiar to fresh camel milk. But it was found that camel milk does not sour at temperatures below 10°C and this for up to 72 hours. At 30°C the milk sours in approximately 8 hours. Shubat sours after a day. At temperature below 5^0C it is possible to elongate shelf life of Shubat that is impossible without a refrigerator.

Therefore processing of national dairy drinks in order to obtain long-lived commodities keeping own native properties is a topical issue of Kazakhstan food industry. It is thought that drying till powder-like condition is the best preservation method. There are many Kazakhstani scientists have been investigating dairy drying. Their investigations are related to modernization of spraying and vacuum-sublimation drying methods. So, Omaralieva, Chomanov and Shyngissov (1999) have created optimal design of atomizing disk and defined its position in a drying chamber in order to provide high monodisperse degree of dry products. Seitov developed the method of vacuum-sublimation drying of mare's milk and kumiss - fermented mare's milk (1997).

At spray drying losses of dry product with outgoing drying agent (i.e. hot air) and its overheating are possible. In comparison to other drying methods vacuum-sublimation one requires high energy consumption. It is known that at vacuum-sublimation drying a liquid product is preliminary subjected to freezing because it is thought that drying of liquid milk or dairy product in vacuum is impossible due to its foaming and kicking over a capacity. Actually, experimental data confirm that at definite vacuum level and heating temperatures phenomenon similar to camel milk boiling is observed. Especially strongly this phenomenon is observed at drying of Shubat that is explained by presence carbonic gas into it. Meanwhile, drying of dairy products into vacuum medium without preliminary freezing will increase intensity of dehydration process and decrease energy demands.

Taking into account above mentioned facts, experimental vacuum drying installation and technology of stage vacuum drying of camel milk and Shubat (Khanzharov et al.2011) in unfrozen view have been created.

Methods. Investigations have been carried out on the developed experimental vacuum drying installation as shown on the figure 1. The installation is based on vacuum chamber 1 made in view cylinder capacity with hermetically closed lid. There are shelves 2 installed into the chamber for placing drying material. Vacuum pump 3 connects to vacuum chamber and allows keeping necessary meaning of atmosphere pressure into it. Degree of vacuum is regulated by valve 4. Refrigerating system is included in the scheme in order to most effective removing evaporated moisture from a product. Refrigerating agent is Freon. Refrigerating system consists of single-stage compressor 8, refrigeration condenser 12 with free air circulation, filter-drier 11, expansion device 10 in view capillary tube and evaporator apparatus 7. Evaporator apparatus is connected with freeze-out device 5 which services to freeze out moisture evaporated from dried material. Frozen out moisture is periodically defrosted and poured out through valve 9 into condenser capacity 13. Refrigerating agent boils in serpentine pipe installed into inner tube of freeze-out device. At boiling a refrigerating agent takes away heat from coolant which circulates in tubular annulus. Circulation of coolant between evaporator apparatus and freeze-out device is carried out by the means of

fluid pump 6. Coolant (antifreeze A-40) is given into inner tube of freeze-out device. It removes heat of condensation and crystallization of evaporated steam from a product which is located in tubular annulus. External surface of these heat exchangers are covered by heat-insulation material - foamed polyurethane in order to prevent heat penetration from environment.

The drying installation is equipped by measuring devices to register indications of pressure and temperature in basic dryers' elements, electric potential and current intensity in electrical gauges and support devices. Atmosphere pressure in vacuum chamber is measured at low vacuum by pointer vacuum gauge 14 and at high vacuum – by ionization-thermocouple vacuum gage 15.

Temperature in chamber is measured by wiry resistance thermometer 23. Secondary instrument at indication vacuum chamber by temperature is universal measuring device 24. Temperature of condensation and crystallization moisture in freeze-out device and temperature of boiling of refrigerating agent in evaporator apparatus is measured by copper-constantan thermocouple 28 stacked up of corresponded heat exchanger. Ends of thermocouples are immersed in melted ice into glass thermos flask 26. All of thermocouples through position switch 27 are connected with digital millivoltmeter 25. Current intensity and electric potential indications are measured by the means of pointer amperemeter 20 and voltmeter 21. Automation system controls temperature of heating of chamber's body by the means of contact thermometer 17 and at given temperature it cuts off electrical heaters 16. Contact thermometer and electric transformer 19 are plugged in power lines through regulating starting arrangement 18.

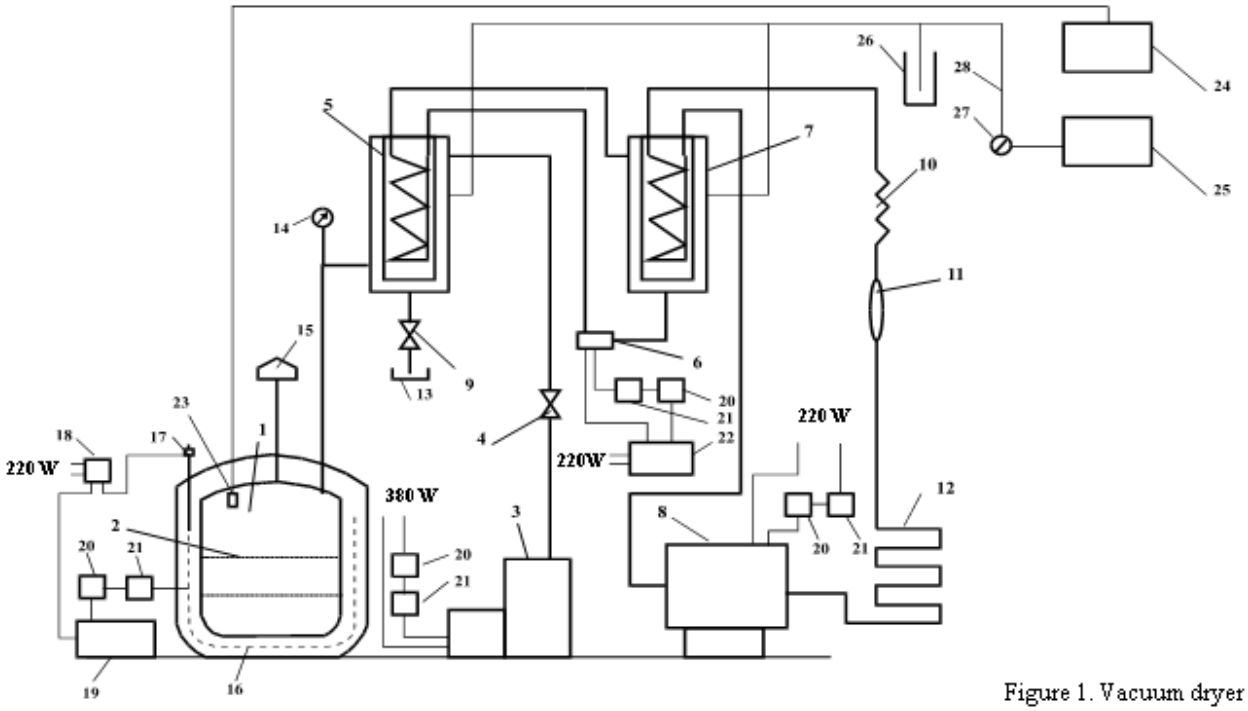


Figure 1. Vacuum dryer

Experimental investigations are carried out in the following order.

1. 30 minutes before starting experiment in order to prepare drying installation the compressor and electrical heaters are run. Necessary temperature of boiling of refrigerating agent (-15;-10;-4^{0}C) is set by regulation of expansion device. Atmosphere temperature in vacuum chamber is regulated in the limit (35÷45) ^{0}C by changing current intensity giving to electrical heaters by laboratory current transformer.

2. Prepared material (camel milk or Shubat) is put in preliminary dried glass capacities by the diameters 3-5 cm and height 12 cm. Material thickness of layer is 1.7-2.0 cm.

3. Mass of material is weighted on analytic balance with on accuracy 0.001g.

4. Capacities are placed on shelves into vacuum chamber. Lid is closed compactly.

5. Vacuum pump is gone on. Vacuum level in the chamber (2; 4; 6; 8; 10 kPa) is set up by expansion valve. Moment of beginning of an experiment is fixed after achieving necessary level of vacuum.

6. Time interval between measurements of mass of dried material is 60 minutes. At that amount of evaporated moisture is defined. At first by the means of expansion valve vacuum level in the chamber is decreased till 0.08 atm; then vacuum pump is switched off and lid is opened.

7. Moisture content in the material is calculated by the formula:

$$\omega = \frac{m_1 - m_2}{m_1} 100, \%,$$

where ω – material moisture content relative to its initial mass, %; m_1 and m_2 – initial and final material masses, g.

8. Weighted material is placed in vacuum chamber and dried again.

Camel milk of summer yield from camels of South Kazakhstan has been investigated in the work. Shubat is prepared from this milk. Initial moisture content in camel milk is 87.5%, Shubat – 88.5%. Final moisture content in camel milk and Shubat is 4%.

Results. At carrying out the investigations in contrast to vacuum-sublimation drying vacuum level in the chamber was in the limit (3-10 kPa) that is be classified as low and medium vacuum [Shumsky et al. 1967, Novikov et al. 1971]. It has been found that foaming and kicking off milk and Shubat from a capacity is observed at the moment of making vacuum and their heating. Therefore it was solved to not increase heating temperature above environment one and to maintain at the level $(18\text{-}20)^0$C. This temperature level allows not only keep vitamins but useful microorganisms of Shubat which at drying is transferred into anabiotic state.

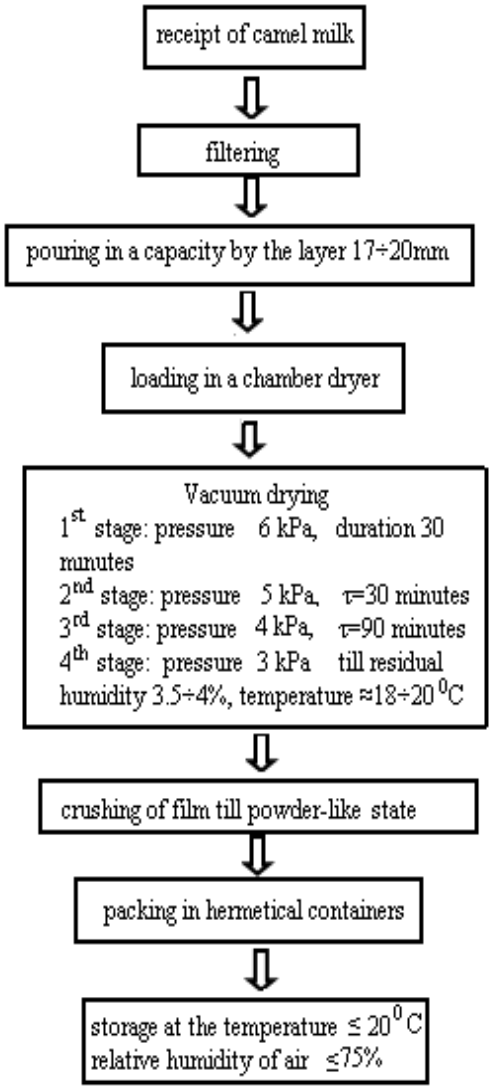


Figure 2. Technological scheme of camel milk stage vacuum drying

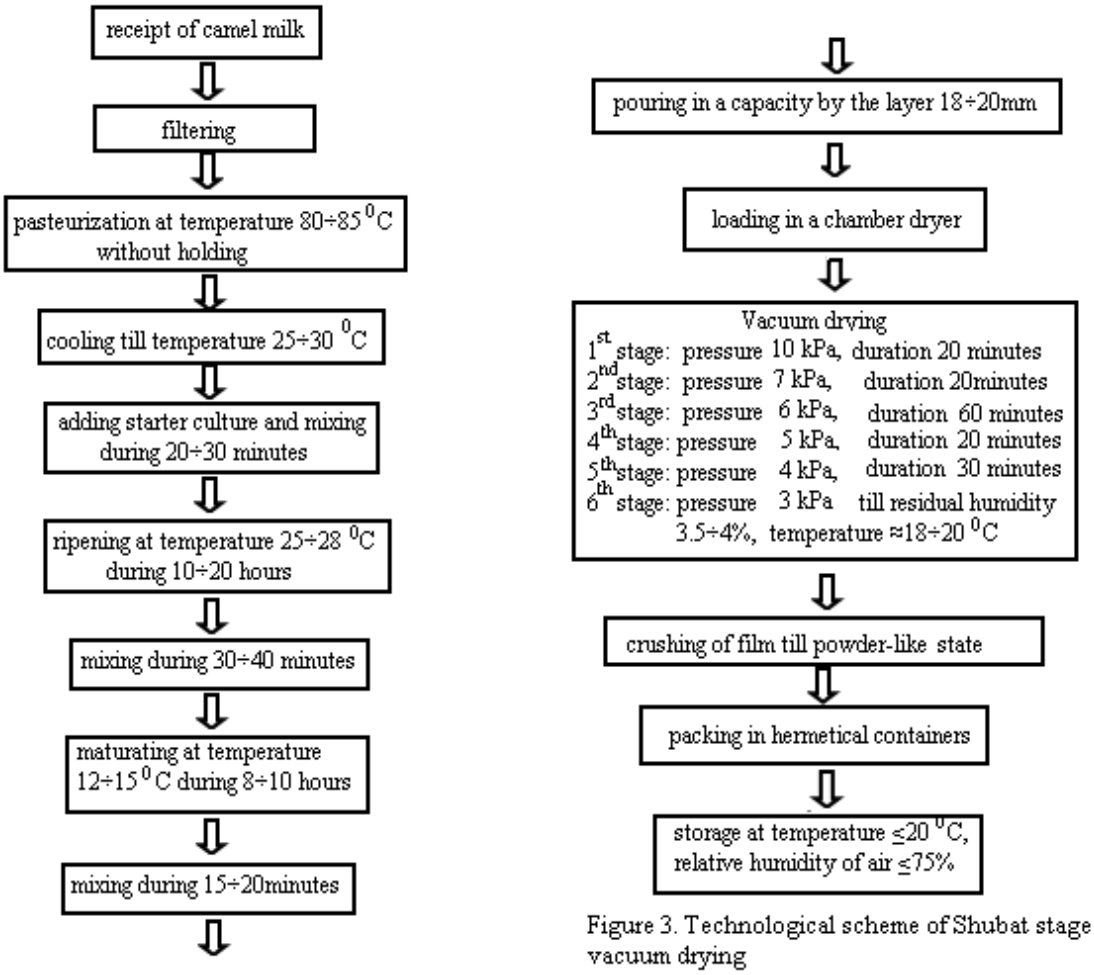


Figure 3. Technological scheme of Shubat stage vacuum drying

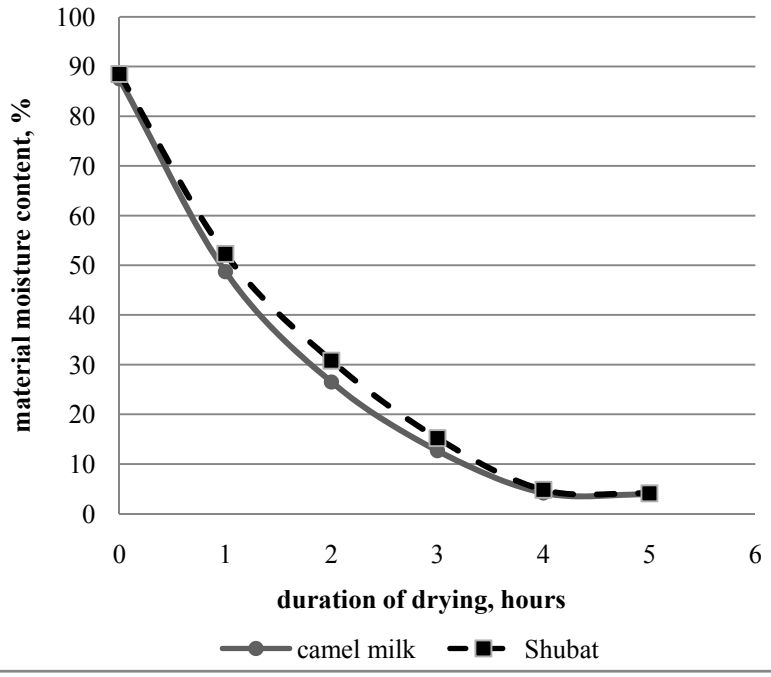
Discussion. It was defined that it is possible to control foaming and kicking of milk or Shubat by selecting temperature and changing pressure level. At this the mode of moderate "boiling" of milk is created. Similar method by excluding foaming of product has been developed by Komyakov et al. (1989) for sublimation drying of concentrated liquid food products. In order to intensify drying a pressure into a chamber is increased at the rate of 50-70 Pa/sec till 200-2500 Pa and following holding during 20-30 sec.

When during drying humidity of milk is decreased and at given vacuum level moderate "boiling" is stopped it is possible to increase vacuum level, achieving previous hydrodynamic mode of milk state. So, vacuum drying may be carried out in several stages. Every following stage is carried out at more high vacuum level then previous one. In comparison to constant vacuum meaning it is possible to intensify drying process by stage-by-stage increasing vacuum level. Cyclical increasing of vacuum level is used at drying of disperse materials (Labutin et al. 1987). There are technological schemes of stage vacuum drying of camel milk and Shubat developed on the base of investigation results (figures 2 and 3). Operations of milk and Shubat processing before and after drying are traditional ones and include such operations as receipt, filtering, pasteurization, ripening, mixing, packing in hermetical containers etc.

Mode of camel milk vacuum drying consists of four stages and is carried out at vacuum level (3-6) kPa and heating temperature (18-20) ^{0}C. Mode of Shubat vacuum drying is more complex because of presence of carbonic gas in it and consists of six stages, vacuum level (3-10) kPa and heating temperature is the same. The same vacuum level is used by Shabetnik (1999) at first period of cold vacuum drying of liquid-viscous materials.

It is found that duration of stage vacuum drying of camel milk and Shubat is about 4 hours (Khanzharov et al. 2011). Drying curves of camel milk and Shubat are shown on the figure 4. Ready powders of camel milk and Shubat have good organoleptic indicators and possess by good rehydration properties.

Figure 4. Curves of camel milk and Shubat stage vacuum drying



Stage technology of vacuum drying compare to existing analogs allows not only keep good quality of dried milk products but significantly intensify drying process and pull down energy consumption.

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Б. Т. Абдижаппарова[1], Н. С. Ханжаров[1], О. Б. Оспанов[1],
А. В. Бараненко[2], А. А. Досмаканбетова[1]

[1]Южно-Казахстанский государственный университет им. М. Ауэзова, Шымкент, Казахстан,
[2]Университет ИТМО, Санкт-Петербург, Россия

ЭТАП ВАКУУМНОЙ СУШКИ ВЕРБЛЮЖЬЕГО МОЛОКА И ШУБАТА

Аннотация. Переработка национальных напитков для получения продуктов длительного хранения с сохранением природных свойств является актуальной проблемой для пищевой промышленности Казахстана. В статье сообщается о составе и лечебных свойствах верблюжьего молока и национального молочного напитка шубат. Сушка до порошкообразного состояния является лучшим методом консервации.

При распылительной сушке возможны потери сухого продукта с отходящим сушильным агентом (т.е. горячим воздухом) и его перегрев. По сравнению с другими методами сушки вакуумная сублимация требует больших энергозатрат. При вакуумно-сублимационной сушке жидкий продукт предварительно подвергается замораживанию, так как считается, что сушка жидкого молока или молочного продукта в вакууме невозможна из-за его вспенивания и выброса над емкостью. Экспериментальные данные подтверждают, что при определенном уровне вакуума и температурах нагрева наблюдается явление, аналогичное кипению верблюжьего молока. Особенно сильно это явление наблюдается при сушке шубата, что объясняется присутствием в нем углекислого газа. Сушка молочных продуктов в вакуумной среде без предварительного замораживания повысит интенсивность процесса обезвоживания и снизит энергозатраты.

Разработана технология ступенчатой вакуумной сушки верблюжьего молока и шубата без их замораживания. Режим вакуумной сушки верблюжьего молока состоит из четырех этапов и осуществляется на уровне вакуума (3-6) кПа и температуры нагрева (18-20) ^{0}С. Режим вакуумной сушки шубата более сложен из-за наличия в нем углекислого газа и состоит из шести ступеней, уровень вакуума (3-10) кПа и аналогичная температура нагрева. Представлена конструкция экспериментальной вакуумной сушилки. Определены оптимальные режимы вакуумной сушки этих продуктов. Готовые порошки из верблюжьего молока и шубата обладают хорошими органолептическими показателями и регидратационными свойствами.

Ключевые слова: вакуум, сушка, стадия, сушилка, верблюжье молоко, шубат.

Б. Т. Абдижаппарова[1], Н. С. Ханжаров[1], О. Б. Оспанов[1],
А. В. Бараненко[2], А. А. Досмаканбетова[1]

[1]М. Әуезов атындағы Оңтүстік Қазақстан мемлекеттік университеті, Шымкент, Қазақстан,
[2]АТМО университеті, Санкт-Петербург, Ресей

ТҮЙЕ СҮТІ МЕН ШҰБАТТЫ ВАКУУМДЫҚ КЕПТІРУ КЕЗЕҢІ

Аннотация. Қазақстан тамақ өнеркәсібінің алдында тұрған басты мәселесі – ол ұлттық сусындарды өңдеу нәтижесәнде табиғи қасиеттері сақталынған және сақтау мерзімі ұзартылған өнімдерді алу болып

табылады. Мақалада түйе сүті мен шубат ұлттық сусынының құрамы мен емдік қасиеттері туралы айтылған. Ұнтақ түріне дейін кептіру консервілеудің ең тиімді тәсілі болып табылады.

Шашыратқыш кептіруде құрғақ өнімның біршамасы қайтарылатын кептіргіш агентпен (яғни, ыстық ауа) жоғалып, аса қызып кету мүмкін. Кептірудің басқа тәсілдеріне қарағанда вакуумдық сублимация жоғары энергия шығындарын қажет етеді. Вакуум-сублимациялық кептіруде сұйық өнім алдын-ала мұздатылады, себебі қайнау мен шашыраудың себебінен сұйық өнімді вакуумда кептіруге мүмкін емес деп есептелінеді. Тәжірибе мәліметтері бойынша, вакуум мен температураның белгілі деңгейінде түйе сүтінің қайнауына ұқсайтын құбылыс орын алады. Әсіресе, бұл құбылыс шубатты кептіруде қатты байқалады, себебі оның құрамында көмірқышқыл газы бар. Вакуум ортасында сүт өнімдерінің алдын ала мұздатпай кептірілуі ылғалсыздану процесінің қарқындылығын жоғарылатып, энергия шығындарын төмендетеді.

Түйе сүті мен шубаттың сатылы вакуумдық кептіру технологиясы құрастырылған. Түйе сүтінің вакуумдық кептіру режимі төрт сатыдан тұрады және (3-6) кПа вакуум деңгейінде (18-20) ^{0}С температурасында өтеді. Түйе сүтінің вакуумдық кептіру режимі көмірқышқыл газының барлығынан күрделі болып, ол алты сатыны құрайды және (3-10) кПа вакуум деңгейінде және ұқсас температурасында өтеді.

Вакуумдық кептіргіштің тәжірибе жүзінде қолданылатын құрылысы ұсынылады. Аталған өнімдердің тиімді вакуумдық кептіру режимдері анықталды. Түйе сүті мен шубаттың ұнтақтары жақсы органолептикалық және регидратациялық қасиеттеріне ие.

Түйін сөздер: вакуум, кептіру, кезең, кептіргіш, түйе сүті, шұбат.

Information about authors:

Abdizhapparova B. T. – M. Auezov South Kazakhstan State University, Shymkent, Kazakhstan; https://orcid.org/0000-0001-8277-8243

Khanzharov N. S. – M. Auezov South Kazakhstan State University, Shymkent, Kazakhstan; https://orcid.org/0000-0002-7406-0386

Ospanov B. O. – M. Auezov South Kazakhstan State University, Shymkent, Kazakhstan; https://orcid.org/0000-0002-6437-5579

Baranenko A. V. – ITMO University, Russia; https://orcid.org/0000-0001-7203-1760

Dosmakanbetova A. A. – M. Auezov South Kazakhstan State University, Shymkent, Kazakhstan; https://orcid.org/0000-0002-9385-6267

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N. B. Seidaliyev, E. K. Dalibayev, B. S. Zhamalov, Sh. B. Muka

Kazakh Scientific Research Institute of Animal Breeding and Fodder Production, Almaty, Kazakhstan

MONITORING DATA OF THE EXISTING SYSTEM OF ORGANIZATION OF THE SELECTIVE PROCESS IN THE DAIRY CATTLE BREEDING OF THE REPUBLIC OF KAZAKHSTAN

Abstract. Scientific research has been carried out to monitor the existing system of organizing the selective process in dairy cattle breeding in the Republic of Kazakhstan.

It is proposed to implement the following measures in the management system of the selective process: the development of an automated place of researcher and classificator in the information analytical system (IAS) so that they could not only enter the data, but also monitor the entire course of zootechnical events in the IAS; the development in IAS of the program of integration with dairy laboratories on automatic entering the analysis data directly to the IAS so that the data on productivity of animals contain indicators not only on milk, but also on its quality; the development of a mobile application for the linear evaluation of the body type with the automatic recording of these data in the IAS; the data entry into the IAS database on animal genealogy; the formation of groups of heifers and lactating first-calf cows during the first 3 months - this age of the breeding stock is justified by the creation of a new IAS database controlled by researchers, the milk yield is predetermined by the purpose of organizing breeding work with dairy cattle from ground zero; monthly check milking with milk sampling, analysis of its quality in independent dairy laboratories and all data entry into the IAS program - for selection of cows on the basis of the entered selection traits in the IAS; carrying out a linear estimation of the cows' appearances and assigning to each animal a classification rating for the body type - to complement the estimation of the breeding value of animals; formation of cattle-breeding groups - to select highly productive cows for the purpose of custom mating; drawing up a plan and conducting custom mating - to get the bull-calves, whose fathers will be outstanding servicing bulls with high genetic characteristics; to conduct a genomic estimation of bull-calves obtained from custom mating.

Keywords: dairy cattle breeding, monitoring, selective process, management, productivity.

Introduction. In dairy cattle breeding of the Republic of Kazakhstan, the main task is further intensification of the industry aimed at increasing the genetic potential of the productive qualities of domestic breeds and the extent of its implementation. The advancement of molecular biology, population genetics, biotechnology, the development and implementation of large-scale breeding, the use of computer programs for the analysis of breeding information enriched the arsenal of tools for studying biological patterns and management of animals heredity, and breed formation processes [1].

The research trend is the study of intrabreed structures, in particular breeding herds according to selective and genetic indicators in dynamics, on a certain ecological background will allow to evaluate the gene pool of the breed and to provide a theoretical justification for its qualitative improvement, to avoid the "selective plateau", to maintain the required level of variability of traits with simultaneous increase in the productivity of herds [2].

F.F. Eisner [3] considered individual selection in breeding herds as the most important element in the selective work. Recognizing the role of modern programs based on methods of population genetics, he repeatedly emphasized that the greatest effect in improving the inherited qualities of dairy cattle can be achieved with a reasonable combination of large-scale and in-depth individual selection.

Of the same opinion are L.K. Ernst et al. [4]. They consider it necessary to persevere further search for ways to speed up the selective process in accordance with the requirements of scientific and technological progress, the development of new high performance technologies that promote the greatest realization of the genetic potential of animals. The search should go both in the direction of increasing the effectiveness of individual methods of breeding and in the development of better organizational forms of breeding work. It is a work for the future, and it should be conducted on the basis of clear scientific developments and long-term forecasts.

The theoretical fundamental of modern breeding is population genetics, based on the combinative variability of traits and the knowledge of the patterns of their inheritance. Over the past decades, significant potential has been accumulated in this area, the use of which allows us to work in the right direction, to predict the effect of breeding programs, simulating them with an accurate calculation to the average for cows of the same age as a whole for the breed [5].

Aim of the research. To monitor the existing system of organizing the selective process in dairy cattle breeding. To form the groups of heifers and first-calf heifers (Alatau, Simmental, Holstein, and Black-and-motley) of basic farms with the study of their genealogy and productive qualities of ancestors.

Materials and methods. Objects of the research were breeding stock, as well as the servicing bulls-producers. Materials for the research were the documents of primary zootechnical and breeding accounting (from the IAS system), as well as the results of experimental studies, visual assessment, weighing, measurements, control milking of animals. In addition, biochemical studies of milk were carried out. For the analysis of dairy productivity, live weight and genealogy, the data of brood and zootechnical accounting of the economy were used. All animals were in the same conditions of feeding and maintenance. Cows were fed with the fodder taken in the farm.

Results of the research. In the light of current tasks on the accelerated improvement of breeds of agricultural animals, the breeder should not be limited to breeding work only with individual animals and their related groups. It is necessary to analyze the changes in the entire breeding herd and a fairly accurate assessment of its phenotypic and genetic parameters of the main breeding features. Estimation of the genetic indicators of stud stocks allows in a more substantiated way to plan the further improvement of the breed. Necessary conditions for fairly objective assessments are the reliability of the primary documentation and the accuracy of controlling the dairy productivity, especially milk and fat and protein content [6, 7].

Currently, in the Republic of Kazakhstan, the Republican Chamber for Dairy Cattle has been established, in which 7 breeds of dairy and dairy-meat directions of productivity are registered: Alatau, Aulieata, Black-and-motley, Red Steppe, Simmental breeds of domestic selection and Holstein Friesian breed with Swiss world selection. Also, the subjects of the selective process are breeding farms for cattle of the mentioned breeds, as well as scientific research organizations (SRO). Besides, in the breeding process, there are involved laboratories for determining the quality of milk, information-analytical system (IAS). The regional agricultural departments subordinated to the Ministry of Agriculture of the Republic of Kazakhstan should manage the entire selective process.

Therefore, for the profitable functioning, the subjects of the selective process must be integrated into a controllable system, which currently does not exist. For example, there are incorrect data on breeding or productive indicators of animals in the IAS database. Based on these incorrect data, the Republican Chamber for Dairy Cattle produces an unconfirmed pedigree status for these animals. In addition, to control zootechnical events in the IAS, researchers do not have constant access to the IAS database. In addition, the results of analysis of dairy laboratories must be entered manually in the IAS, which greatly hampers the work of breeders. Also in our country, there are no cattle farms for growing bull-calves of their own reproduction, which predetermines the import dependence on the genetic material of the world gene pool.

In order to develop a management system for the selection process, it is necessary to carry out the following measures:

- development in the IAS of an automated place for researcher and a classificator so that they could only enter the data, but also monitor the entire course of zootechnical events in the IAS;

- development in the IAS of the program of integration with dairy laboratories on automatic entering the analysis data directly into the IAS that the data on productivity of animals contain indicators not only on milk, but also on its quality;

Genealogical affiliation of formed first-calf heifers and ancestral productivity

The nickname and number of the servicing bull (fathers)	Number of first-calf heifers (daughters), heads	Productivity of the mother of the bull, kg	Average productivity of the mothers of the formed groups (by the highest one), kg
Mezhdurechensk-Agro LLP			
011HO08385 MR Minister	1	10372	8400
011HO09497 Glen-Toctin Altaomax-ET	5	11400	7366
137722550 Brandt-View Altacognati-ET	4	11850	6900
011HO09688 DE-SU ALTASOLO-ET	2	15973	7541
011HO09898 Pine-Tree Altaosofine	12	12131	7131
011HO00565 Sandy-Valley Altaxxx-Red-ET	1	16430	9611
NL385596512 RODERICK WH	2	14250	7813
USA 076HO00551 Solomon-ET	1	15720	7995
Mamed Farm			
8027 Chili	1	11180	5206
68108976 Niagra	2	12450	5880
181455 Kilian	5	10500	5832
7643 Vazhniy	2	9870	5006
1 Wunder	4	13120	5724
2641 Melnik	5	11410	5446
Kamyshinskoe Farm			
Benevola 66596063	21	12502	6320
HIDDEN-VALLEY-GARTHM100135646	28	16231	5960
Demokrat 100444050	24	14966	6085
Skaibak 100047673	38	9898	7015
Romanser 76HO0159	29	19227	6089
Lakemon 100490163	68	9835	5760
Rokin-red 133917657	34	12807	6096
Taylor-red 011HO00527	22	14449	6198
Integrated agricultural production company «Almaty breeding farm»			
181329 EMORI	2	10450	4950
192878 JAG *	6	11254	5206
193926 JACK *	4	11500	5880
197821 Teddy	20	10147	5832
197970 KURS	19	13232	5006
470210067 ADAPTIC	36	12007	5724
68108976 Niagra	10	12986	5446
USA000000198986 Roseledge Style ET	6	13542	6320
Fame 76BS0909	8	13535	5960
Bestman 000193763	5	12986	6085
Aidarbayev Farm			
470210067 ADAPTIC	1	12007	7015
197821 Teddy	1	10147	7632
193926 JACK	1	11500	7006
USA 076HO00551 Solomon-ET	5	15720	7463
Mozart 137668966	5	10623	7401
Lauraider	19	12455	6867
Kirova LLP			
Mazda 136722780	54	12062	5980
Skaibak 100047673	72	9898	6047
Lakemon 100490163	24	9835	5970

- development of the mobile application for conducting a linear assessment of the body type with the automatic entry of these data in the IAS;

- the data entry into the IAS database on animal genealogy;

- the formation of groups of heifers and lactating first-calf cows during the first 3 months - this age of the breeding stock is justified by the creation of a new IAS database controlled by researchers, the milk yield is predetermined by the purpose of organizing breeding work with dairy cattle from ground zero;

- monthly check milking with milk sampling, analysis of its quality in independent dairy laboratories and all data entry into the IAS program - for selection of cows on the basis of the entered selection traits in the IAS;

- carrying out a linear estimation of the cows' appearances and assigning to each animal a classification rating for the body type - to complement the estimation of the breeding value of animals;

- formation of cattle-breeding groups - to select highly productive cows for the purpose of custom mating;

- drawing up a plan and conducting custom mating - to get the bull-calves, whose fathers will be outstanding servicing bulls with high genetic characteristics;

- to conduct a genomic estimation of bull-calves obtained from custom mating.

When these measures are implemented in the IAS, the breeding value of animals will automatically be calculated, which will predetermine the attribution of an animal to a certain category of breeding animals, in addition, the bulls of domestic reproduction will have a genomic evaluation, and after the production of their daughters, they will be estimated for the quality of the offspring. Recognized as enhancers, they form an elite gene pool of both domestic selection and the world one, which neutralizes import dependence on the world gene pool and creates a competitive environment among dairy breeds.

Formation of groups of heifers and first-calf-heifers

From 2015 to the present, work is constantly being carried out to form groups of first-calf heifers in order to organize targeted breeding work with dairy cattle. Therefore, a monitoring of the breeding stock of the basic farms of the SRO was conducted.

Information on the formed groups of 6 basic farms is presented in table.

As can be seen from table, a total of 609 cows were formed from 3 regions.

The genealogical structure of cattle of the listed farms is presented in table.

It was established that the dairy productivity of mothers for lactation of the formed groups has significant fluctuations (4950...9611 kg), but the productivity of the mothers of their fathers is much higher (9835...16231 kg), which predetermines the genetic potential of the cows of the formed groups.

Conclusion. Groups of first-calf heifers of different breeds were formed in 6 basic farms. In these groups, bulls-fathers of all breeds have a sufficiently high genotype (12129...19,500 kg of milk from their mothers), hence it follows that in the basic farms there is a purposeful work to improve the dairy productivity of the herds. In addition, it was found that, in spite of the heterogeneity of the productivity of the mothers of the formed groups (4535...7678 kg at the highest lactation), their genotype on average corresponds to the growth in the dairy productivity of their daughters.

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Н. Б. Сейдалиев, Е. К. Далибаев, Б. С. Жамалов, Ш. Б. Муқа

Қазақ малшаруашылығы және жемшөп өндірісі ғылыми зерттеу институты,
Алматы, Қазақстан

ҚАЗАҚСТАН РЕСПУБЛИКАСЫНДА ҚОЛДАНЫСТАҒЫ СҮТТІ ІРІ ҚАРА МАЛ ШАРУАШЫЛЫҚТАРЫНДА АСЫЛДАНДЫРУ ҮДЕРІСІН БАҚЫЛАУ ҮШІН ҒЫЛЫМИ ЗЕРТТЕУЛЕР ЖҮРГІЗІЛДІ

Аннотация. Іріктеу үрдісін басқару жүйесінде келесі іс-шараларды жүзеге асыру ұсынылады: АТЖ-да (ақпаратты талдау орталығы) автоматтандырылған ғылыми қызметкер мен бонитердың орны, олар тек деректерді жазып қана қоймай, АТЖ-дағы зоотехникалық барлық оқиғаларын бақылап отырады; осы талдауды АТЖ-да тікелей автоматты түрде енгізу туралы сүт зертханаларымен интеграциялау бағдарламасының АТЖ-дағы жануарлардың өнімділігі туралы деректерде сүттің ғана емес, сондай-ақ сүт сапасының көрсеткіші де бар; АТЖ-да осы деректерді автоматты түрде сызықтық бағалау үшін мобильді қосымшаны әзірлеу; жануарлардың генеалогиясының деректерін АТЖ базасына енгізу; қашарлар мен бірінші сауымдағы сиырлардың (алғашқы үш айда) топтарын қалыптастыру, асыл тұқымды малдың осы жасы зерттеушілер бақылайтын АТЖ жаңа деректер базасын құру арқылы негізделген, сүт «нөлден» сүтті ірі қара малмен асыл тұқымды жұмыс ұйымдастыру мақсатында алдын-ала анықталған; ай сайын сүт іріктеуімен сүтпен қамтамасыз ету, тәуелсіз сүт зертханаларында оның сапасын талдау және АТЖ бағдарламасына барлық деректерді енгізу - АТЖ ішіне енгізілген іріктеу өлшемдерінің негізінде сиырларды таңдау үшін; сиырдың сыртқы түрлеріне сызықтық бағалау жүргізу және әрбір жануарға құрылыстың түрі бойынша жіктеу рейтингі - жануарлардың асыл тұқымды құндылығын бағалауды толықтыруға; өндіруші бұқа сиыр топтарын қалыптастыру - іріктелген жоғары өнімді сиырларды тапсырыспен шағылыстыру; бұқалар алу үшін - жоспарды құрастыру және тапсырыспен жұптастыру, әкелердің жоғары генетикалық сипаттамалары бар танымал бұқа өндірушілерге бұқалар алу үшін; тіркеуден өткен тапсырыспен шағылысудан алынған бұзаулардың геномдық бағасын жүргізу.

Түйін сөздер: сүтті мал шаруашылығы, мониторинг, асылдандыру үдерісі, басқару, өнімділік.

Н. Б. Сейдалиев, Е. К. Далибаев, Б. С. Жамалов, Ш. Б. Муқа

ТОО «Казахский научно-исследовательский институт животноводства и кормопроизводства»,
Алматы, Казахстан

РЕЗУЛЬТАТЫ МОНИТОРИНГА СУЩЕСТВУЮЩЕЙ СИСТЕМЫ ОРГАНИЗАЦИИ СЕЛЕКЦИОННОГО ПРОЦЕССА В МОЛОЧНОМ СКОТОВОДСТВЕ РЕСПУБЛИКИ КАЗАХСТАН

Аннотация. Проведены научные исследования по мониторингу существующей системы организации селекционного процесса в молочном скотоводстве Республики Казахстан. Предлагается в системе управления селекционным процессом осуществить следующие мероприятия: разработка в информационной аналитической системе (ИАС) автоматического места научного сотрудника и бонитера, чтобы они могли не только заносить данные, но и контролировать весь ход зоотехнических событий в ИАС; разработка в ИАС программы интегрирования с молочными лабораторями по автоматическому введению данных анализа непосредственно в ИАС, чтобы в данных по продуктивности животных были показатели не только по удою, но и качеству молока; разработка мобильного приложения по проведению линейной оценки типа телосложения с автоматическим занесением этих данных в ИАС; введение данных в базу ИАС данных по генеалогии животных; формирование групп нетелей и лактирующих коров-первотелок в первые 3 месяца– данный возраст маточного поголовья обоснован созданием контролируемой научными сотрудниками новой базы данных ИАС, удой предопределяется целью организации селекционной работы с молочным скотом с «нуля»; проведение ежемесячных контрольных доений с отбором проб молока, анализом его качества в независимых молочных лабораториях и внесением всех данных в программу ИАС – для осуществления отбора коров на основе занесенных признаков отбора в ИАС; проведение линейной оценки экстерьера коров и присвоение каждому животному классификационной оценки за тип телосложения – для дополнения оценки

племенной ценности животных; формирование быкопроизводящих групп коров – для отбора высокопродуктивных коров с целью проведения заказного спаривания; составление плана и проведение заказного спаривания – для получения бычков, отцами которых будут выдающиеся быки-производители с высокими генетическими характеристиками; провести геномную оценку бычков, полученных от заказного спаривания.

Ключевые слова: молочное скотоводство, мониторинг, селекционный процесс, управление, продуктивность.

About the authors:

Seidaliyev Nurzhan Beskempirovich, Candidate of Agricultural Sciences, Senior Researcher, Department of Breeding and Selection of Dairy Cattle, Kazakh Scientific Research Institute of Animal Breeding and Fodder Production, Almaty, Kazakhstan; s.nurzhan_b@mail.ru; https://orcid.org/0000-0002-2985-6967

Dalibayev Ermek Kurmanbaevich, Senior Researcher, Department of Breeding and Selection of Dairy Cattle, Kazakh Scientific Research Institute of Animal Breeding and Fodder Production, Almaty, Kazakhstan; erdal62@mail.ru; https://orcid.org/0000-0002-2712-7445

Zhamalov Bakbergen Seydakhanuly, Researcher, Department of Breeding and Selection of Dairy Cattle, Kazakh Scientific Research Institute of Animal Breeding and Fodder Production, Almaty, Kazakhstan; bakbergen.zhamalov@mail.ru; https://orcid.org/0000-0002-4026-5244

Muka Shynar Bakytkyzy, Master of Biological Sciences, Researcher, Department of Breeding and Selection of Dairy Cattle, Kazakh Scientific Research Institute of Animal Breeding and Fodder Production, Almaty, Kazakhstan; chika-1718@mail.ru; https://orcid.org/0000-0003-4891-5990

ЮЛДАШБАЕВУ Юсупжану Артыковичу – 60 лет

Коллектив ученых Товарищество с ограниченной ответственностью «Казахский научно-исследовательский институт животноводства и кормопроизводства», Товарищество с ограниченной ответственностью «Научно-инновационный центр животноводства и ветеринарии», Некоммерческое акционерное общество «Казахский национальный аграрный университет», Некоммерческое акционерное общество «Западно-Казахстанский аграрно-технический университет имени Жангир хана» сердечно поздравляют доктора сельскохозяйственных наук (1996), профессора (2001), член-корреспондента РАН (2016) Юсупжана Артыковича Юлдашбаева с 60 летием.

Юсупжан Артыкович родился 9 октября 1958 года, станция Чу Джамбулской области Республики Казахстан. В 1981 г. с отличием окончил зооинженерный факультет Московской сельскохозяйственной академии им. К.А.Тимирязева по специальности «зоотехния». Трудовую деятельность начал с должности зоотехника – технолога, младшего и старшего научного сотрудника отдела генетики и разведения каракульских овец Казахского НИИ каракулеводства (1981-1986 гг.), с 1987 г. по март 1989 г. старший научный сотрудник Джамбулского филиала ЦНИИ шерсти. В 1989 г. приглашен на работу в Узбекский НИИ животноводства и в декабре того же года прошел по конкурсу на должность старшего научного сотрудника кафедры овцеводства МСХА им. К.А.Тимирязева, с 1996 года ведущий научный сотрудник, с 1999 г. доцент, а с 2000 года профессор кафедры овцеводства, с 2003 по 2010 г.г. заместитель проректора по научной работе. С июля 2010 года по настоящее время декан факультета зоотехнии и биологии, по совместительству профессор кафедры частной зоотехнии.

Юлдашбаев Ю.А. видный ученый – аграрий в области зоотехнии, внесший большой вклад в развитие овцеводства и козоводства, создание новых селекционных достижений, разработку инновационных технологий производства и первичной переработке продукции овцеводства и козоводства, подготовку кадров для АПК.

Юлдашбаевым Ю.А. проделана большая работа по изучению и типизации шерсти овец разных пород, разводимых в Казахстане. Комплексные исследования, проведенные Юлдашбаевым Ю.А.,

по типизации шерсти тонкорунных овец, положены в основу создания крупных массивов овец с желательным типом шерстного покрова. На основе разработанных методов выведены два новых внутрипородных типа овец породы южноказахский меринос – меркенский и куюкский. Изучение физико-механических свойств однородной и неоднородной шерсти позволило впервые в СССР разработать ГОСТ с отделением частей руна, где учтены и полученные данные по зоне Юга Казахстана. Большое практическое значение имеют научные труды по совершенствованию технологии промывки шерсти; промышленной оценке и переработке тонкой шерсти чистопородных и помесных овец; системе аукционной продажи шерсти по сертификатам; технологии отбелки пожелтевшей шерсти и шерсти низших сортов и технологии химической депигментации цветной шерсти.

В настоящее время Ю.А. Юлдашбаев проводит научно-исследовательскую работу с учеными Калмыцкого НИИ сельского хозяйства по совершенствованию калмыцкой курдючной породы овец и созданию мясного типа коз; созданию новых внутрипородных типов каракульских овец. А также совместно с сотрудниками ВИЖа ведется селекционная работа по созданию нового внутрипородного типа эдильбаевской породы овец в условиях Нижнего Поволжья. В Республике Тыва проводится работа по совершенствованию продуктивных и племенных качеств тувинской короткожирнохвостых овец и коз советской шерстной и местной пород. Совместно с учеными Республики Казахстан продолжается работа по изучению хозяйственно-полезных признаков грубошерстных пород овец.

Селекционно-технологические аспекты научной деятельности Юлдашбаева Ю.А., реализованы в апробации селекционных достижений: куюкского внутрипородного типа; степного и горного типа овец тувинской короткожирнохвостой породы; калмыцкой курдючной породы; заводского типа каракульских овец черной окраски жакетного смушкового типа «Сейсенбайский».

Важная часть деятельности Ю.А. Юлдашбаева – подготовка кадров для АПК и издание учебников для студентов и аспирантов аграрных ВУЗов. В составе коллектива Юлдашбаев Ю.А. за создание комплекта учебников, учебных пособий и монографий для подготовки высококвалифицированных специалистов по технологии производства продуктов животноводства в системе аграрного образования удостоен премии Правительства Российской Федерации в области образования за 2008 год.

Научная школа профессора Юлдашбаева Ю.А. получила признание среди ученых и производственников в нашей стране и за рубежом. Под его руководством защищено 15 кандидатских, 3 докторские диссертации и одна докторская PhD.

Юсупжаном Артыковичем опубликовано 525 работ, в том числе 23 монографий, 35 учебников и учебных пособий, 20 учебно-методических пособий, 23 методических рекомендаций и указаний, 15 программ и рекомендаций. Автор 10 патентов, 4 авторских свидетельств и 17 Свидетельств на базу данных.

Ю. А. Юлдашбаев выполняет большую общественную работу, является заместителем председателя экспертного совета ВАК Минобрнауки РФ по зоотехническим и ветеринарным специальностям, председателем секции овцеводства отделения сельскохозяйственных наук РАН. Юсупжан Артыковичявляется членом НТС совета по селекционным достижениям в овцеводстве и козоводстве МСХ РФ, экспертной комиссии по оценке племенных овец МСХ РФ, Национального союза овцеводов, Комиссии по определению соответствия требованиям, предъявляемым к определенным видам организаций по племенному животноводству Правительства Москвы и Министерства сельского хозяйства и продовольствия Московской области.

Ю. А. Юлдашбаев является членом редакционной коллегии научно-производственных журналов, рекомендуемых ВАК Российской Федерации: «Известия Тимирязевской сельскохозяйственной академии», «Овцы, козы, шерстяное дело», «Аграрная наука», «Аграрная Россия», «Главный зоотехник», «Известия Оренбургского ГАУ», «Вестник Тувинского ГУ» и «Акмешіт хабаршысы», «Новости науки Казахстана», «Вестник национальной академии наук Республики Казахстан», «Известия Национальной академии наук Республики Казахстан: Серия аграрных наук», а также член двух диссертационных советов при РГАУ-МСХА имени К.А.Тимирязева, научно-технического совета «Шерсть» ГС РФ.

Юсупжан Артыкович Юлдашбаев Лауреат премии Правительства РФ в области образования (2009), Почётный работник образования Республики Казахстан (2010), Заслуженный деятель науки Республики Калмыкия (2014), Почётный доктор Кызылординского государственного университета имени Коркыт -Ата (2012).

Награжден медалью «За успехи в научно-техническом творчестве» (2009), медалью «400 лет добровольного присоединения Калмыкии к России» (2009), Почетной грамотой Министерства природных ресурсов и экологии РФ (2012), Почетной грамотой РАСХН (2005), Почетной грамотой Президента РФ (2016).

Уважаемый Юсупжан Артыкович! В день Вашего славного юбилея желаем Вам крепкого здоровья, счастья, процветания, всего наилучшего Вашим родным и близким, благополучия и творческого долголетия!

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