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A. T. Khusainov, G. T. Kyzdarbekova, R. K. Khusainova

Kokshetau State University named after Sh. Ualikhanov, Kokshetau, Kazakhstan.
E-mail: abil_tokan@mail.ru, gulmira_80_01@mail.ru, bizhamal55@bk.ru

INFLUENCE OF THE PREPARATION AGROBIONOV ON THE HYDROPHYSICAL PROPERTIES OF ORDINARY BLACK SOIL AND YIELD CAPACITY OF OIL FLAX

Abstract. The protection and preservation of soil fertility is becoming the most urgent task of modern global environmental policy. The accumulation of production waste is also a global and national environmental problem. Currently, the urgent issue is the use of secondary raw materials, including local fly ash wastes, as fertilizers in agriculture. The advantage of fly ash is in lower cost, in contrast to mineral fertilizers, which allows to reduce costs and increase production efficiency of agricultural crop.

Objects of study: ordinary black soil, oil flax of North grade. Subject of research: preparation Agrobionov in powder form, which includes coal's fly ash of Ekibastuz origin, carbon black. The chemical composition of coal fly ash from the Ekibastuz field: SiO_2 62,9%, Fe_2O_3 6,35%, Al_2O_3 26,35%, CaO 1,9% MgO 0,9%, SO_3 1,2%, Na_2O 0,23%. Soil of the experimental field is ordinary black soil, medium-power, low-humic, heavy loamy.

The experiments were conducted on the experimental field of the Academic and Research and Production Center "Elite" of Kokshetau State University named after Sh. Ualikhanov. According to the variants of the experiments, the following was determined: the aggregate composition of soil, the reserves of productive moisture in soil, the water stability of soil aggregate, the amount of water peptized slit in the arable layer of the soil, and the yield capacity of oil flax.

It has been established that the use of the Agrobion preparation as a fertilizer favorably affects the structure and water stability of soil aggregates, the reserves of productive moisture in ordinary black soil, and the yield capacity of oil flax.

Key words: preparation Agrobionov, oil flax, ordinary black soil, structure, water stability, soil moisture, yield capacity.

Soil is a non-renewable natural resource on a human time scale, as it is subject to degradation. The main processes of soil degradation include accelerated erosion, depletion of organic carbon in the soil, loss of soil fertility and imbalance of elements. Soil degradation trends can be reversed by switching to recovering land use and adopting recommended management practices. The strategy is to minimize soil erosion, create a positive balance of nutrients, and improve soil quality that is, improving the structure and water stability of soil aggregates, increasing soil fertility, which reduces the risk of soil degradation [1].

The long and intensive use of land without deep scientifically based farming systems, technologies, and the lack of assessment of the agroecological potential of the territory led to a significant decrease in the soil fertility. The problem of the soil fertility cannot be reduced to the humus content, forgetting about the physical state of the soil, water holding capacity, infiltration of water and its other indicators. The impact of agricultural machinery during the period of soil cultivation and harvesting of agricultural crops causes a deterioration in the agrophysical properties of the arable layer and the compaction of the subsurface horizon. The increased anthropogenic load on black soil led to a change in morphological, agrochemical, water-physical properties and other factors of diminishing of fertility [2].

V.V. Dokuchaev (1950) pointed to the need to take into account the water-physical properties of the soil (mechanical composition, the ratio of soils to heat and moisture) in his classic papers on land

valuation. Water-physical properties have a great influence on soil-forming processes and determine soil fertility, which, in turn, affects the crop productivity [3].

One of the possible directions of the secondary use of a number of wastes is their use as fertilizers. It must be emphasized here that, from a fundamental standpoint in agriculture, substances of both mineral and organic nature can be used. The use of waste as fertilizers should be accompanied by preliminary studies proving their nutritional value and safety, and be accompanied by the development of safe technology for their disposal [4].

As mentioned above, the preparation Agrobionov is based on fly ash. Paul S.C., Acharya G.C., Pradhan A.K. indicate that fly ash has great prospects for its use in agriculture, due to its characteristics and ability to change soil conditions and agricultural crops productivity. Various macro- and microelements in fly ash increase soil fertility and yield capacity of agricultural crops [5].

D.K. Szponder, K. Trybalski emphasize that fly ash has a significant negative impact on the environment, while its properties can be used in agriculture, as it has special physicochemical properties and contains almost all the nutrients necessary for normal growth and development of plants. First of all, fly ash is used as a mineral fertilizer that improves the physical, chemical and biological properties of soils. It can also be used as an ameliorant, which improves the growth and development of plants and increases the yield of agricultural crops. In addition, fly ash is used to reduce the amount of heavy metals accumulated in plants, and to limit the spread of diseases. Pointing out the many advantages of using fly ash in agriculture, the author also shows some disadvantages, for example, soil pollution with heavy metals and radionuclides. In addition, there is also a risk associated with the lack of information on the long-term consequences of fly ash application on soil quality and the environment [6]. Therefore, it is necessary to conduct research on this topic in specific bioclimatic conditions.

The program for the development of the agro-industrial complex of the Republic of Kazakhstan for 2017-2021 provides for the planting acreage expansion of oilseeds in Kazakhstan. By now, the planting acreage of oilseeds is 2.1 million hectares, and in comparison with 1995, it has grown by almost 40 times. This was also facilitated by the fact that the production of oilseeds is much more profitable for agricultural producers, in comparison with cereals, since the selling price of oilseeds is 3-5 times higher [7].

The use of fertilizers, in particular the preparation Agrobionov, is aimed at reproducing the fertility of ordinary black soil and the yield capacity of oil flax.

The aim of the study was the agroecological assessment of the preparation Agrobionov according to the water-physical properties of ordinary blacksoil and the yield capacity of oil flax in conditions of the steppe zone of Northern Kazakhstan.

The research objectives included:

– to establish the effect of the preparation Agrobionov on the aggregate composition, water stability of soil aggregates and reserves of productive moisture in ordinary blacksoil;

– to study the effect of the preparation Agrobionov on the yield capacity of oil flax.

Objects, conditions and research methodology. Objects of study: ordinary black soil, oil flax of North grade. Subject of study: the preparation Agrobionov in powder form, which includes coal's fly ash of Ekibastuz origin and carbon black. The chemical composition of coal fly ash from the Ekibastuz field: SiO2 62.9%, Fe2O3 6.35%, Al2O3 26.35%, CaO 1.9% MgO 0.9%, SO3 1.2%, Na2O 0.23%. Carbon black consists of more than 99% carbon (A. Sarsenova 2013).

Field studies were carried out on the experimental field of the Academic and Research and Production Center "Elite" of Kokshetau State University named after Sh. Ualikhanov.

The soil of the experimental field is ordinary black soil, medium-power, low-humic, heavy loamy with the following indicators: humus content of 3.8%, easily hydrolyzed nitrogen 46.0 mg/kg, mobile phosphorus 17.0 mg/kg and exchange potassium 582 mg/kg. The reaction of the soil solution is slightly alkaline (pH - 7.6). Based on the data, the doses of fertilizers for oil flax were calculated.

The experience was laid down in fourfold repetition according to the following scheme: control - without fertilizer application; P (1/10 of the calculated dose) - ground; on the mineral ground, the preparation Agrobionov was applied in doses of 100, 200, 300, 400, 500 kg/ ha under pre-seeding treatment of soil. Plot area is 125 m^2; discount area is 100 m^2.

The following observations were made in the experiments: the aggregate composition of the soil by Kachinsky's technique; soil moisture by thermostat-weight method according to GOST 28268-89; water

stability of soil aggregates by P.I. Andrianov's method; the amount of water-peptized slit by the methodology of the Omsk State Agrarian University. Harvest accounting by continuous method. Yield data was processed according to the method of Fisher in the presentation of B.A. Dospekhov. Statistical processing of the results was carried out using Microsoft Excel. The results of the study were processed using the Statistics 13.0 program.

Results and discussion. There are no specific data about the effect of a carbon-containing ashbased preparation on the water-physical properties of the soil in the literature. However, Sudha Jala, Dinesh Goyal indicate that fly ash is ameliorative preparation that improves the physical, chemical and biological properties of soils [8].

The results of our studies also showed that the use of the preparation Agrobionov has a positive effect on the aggregate composition of ordinary black soil. On average, over two years of laying on fertilized versions, the content of large aggregates (more than 10 mm) in the soil layer of 0-20 cm decreased to 15.77-25.96%, on the control it is 32.23%. The content of agronomically valuable soil aggregates with sizes of 10-0.25 mm increased to 63.81-76.32%, compared with the control - 57.4% (table 1).

Table 1 – The effect of the preparation Agrobionov on the structure of ordinary black soil under oil flax crops %, average for 2018-2019

Variant	Size of soil aggregate, mm								
	>10	5-10	2-5	1-2	0,5-1	0,25-0,5	**0,25-10**	0,1-0,25	**<0.1**
control	32,23	11,59	8,2	10,67	13,58	13,36	**57,4**	9,89	0,63
1\10 P_{10}-ground	25,96	10,65	8,77	13,23	14,80	16,36	**63,81**	9,63	0,22
Ground+100 kg\ha	21,83	11,75	9,75	11,87	19,86	16,39	**69,62**	9,01	0,26
Ground +200 kg\ha	19,90	8,80	9,90	13,57	17,14	15,48	**64,85**	9,98	0,25
Ground	15,77	11,77	10,89	12,94	20,29	20,43	**76,32**	8,16	0,20
Ground +400 kg\ha	20,89	8,90	10,99	11,92	19,21	19,25	**70,27**	9,27	0,15
Ground +500 kg\ha	18,28	9,26	11,81	13,50	19,36	16,73	**70,66**	10,98	0,10
$НСР_{0,05\%}$							**1,9**		

The fact of a decrease in the content of dusty particles (<0.1 mm), depending on the dose of the preparation, from 0.1 to 0.3% (on control 0.6%) indicates the ameliorative effect of the preparation. That is, on a scale for assessing the structural state of soil proposed by S.I. Dolov and P.U. Bakhtin, on fertilized versions, the physical state of soils improved from satisfactory (60–40%) to good (80–60), while on the control variant, it is satisfactory. The highest indicator of the physical state of the soil was obtained on the option ground + 300 kg/ha – 76.32% – good condition

According to the data from A.T. Khusainova, K.Kh. Seydalina (2011) as a result of prolonged intensive use of black soil (1956-2006), mainly for grain crops, there was a decrease in the thickness of the humus horizon by an average of 10 cm, the transition of the structure from lumpy soil to lumpy-powder-like soil. Violation of the structure contributed to the deterioration of the water stability of soil aggregates and elevation of the soil susceptibility to wind erosion [9].

In the conditions of the southern zone of meadow-black soil-like and brown forest soils of the Amur Region, to improve the agrochemical and water-physical properties of soils E.A. Grebenshchikova, N.A. Yust, M.A. Pykhteeva recommend to add fly ash in the amount of 60 t/ha, as an ameliorant. Moreover, the effect of fly ash persists for three years [10].

In our experiment with fertilized options, depending on the dose of the preparation, the water stability of soil aggregates in a soil layer of 0-20 cm was 44-70% in 2018, and 50-60% in 2019, 38 % and 34% on the control. The maximum effect was obtained with the variant ground + preparation 300 kg / ha, where the water stability of soil aggregates averaged 65% over 2 years. According to the grouping of soils of I.V. Kuznetsova (1979) on water stability on the control, the water stability of soil aggregates is characterized as satisfactory (30-40%), and on fertilized versions, depending on the dose of the preparation, it ranges from good condition (40-60%) to excellent one (60-75%). In the variant ground + preparation 300 kg/ha, the water stability of soil aggregates was excellent with 65% over 2 years on average (table 2).

In the experiments of Ivanov N.Y. the application of fly ash contributed to the improvement of water-physical and agrochemical properties of the soil: soil moisture in the 0-15 cm layer increased at the beginning of the vegetation by 7-27%, and at the end of the vegetation by 2-21%, depending on the

Table 2 – Water stability of soil aggregates depending on the doses of the preparation application under oil flax crops, %

№	Variants	2018	2019	Average	Increase in control
1	Control without fertilizers	38	34	36	–
2	1/10 P_{10} ground	44	54	49	13
3	ground + 100 kg\ha	50	56	53	17
4	ground + 200 kg\ha	54	50	52	16
5	ground + 300 kg\ha	70	60	65	29
6	ground + 400 kg\ha	56	58	57	21
7	ground + 500 kg\ha	58	56	57	21
HCP $_{0,95\%}$		**2,3**	**1,8**	**1,8**	

variant; water permeability of the soil increased from an unsatisfactory assessment (control - without fly ash) to good one (2500 t/ha); the temperature in the soil layer of 0-10 cm decreased by 2° C; and bulk soil mass by 7-18% in the 0-15 cm layer and soil hardness in the 0-15 cm layer by 8-20%, in the 15-30 cm layer by 2-28% contributed to a decrease in all types of soil acidity; the content of mobile phosphorus and exchangeable potassium increased. In this case, the increase in the amount of mobile phosphorus in the soil occurred with an increase in the dose of FAW application (by 1-19%). The most optimal conditions for the growth and development of potatoes and cabbage were formed with the addition of 62.5 tons of FAW/ha [11].

A significant improvement in the water regime of the soil was observed in our experiment in studying the doses of applying the preparation from fly ash and nanocarbon. The reserves of productive moisture on fertilized options in the meter layer did not differ significantly from each other 164.4 – 178.7 mm/m, 168.6 mm / m on the control before seeding in the spring of 2018. In 2019, the reserves of productive moisture in the spring amounted to 142.6 mm/m on the control, and on the fertilized variants, there was more moisture - 151.1-182.4 mm/m. In the summer period, high air temperature as well as intensive moisture consumption by plants contributed to a decrease in productive moisture reserves in general for all variants of the experiment. In 2018, the productive reserves on the control amounted to 150.3 mm/m, in the fertilized variants, the soil moisture was significantly higher, and it amounted, depending on the dose of the drug, to 155.8-169.1 mm/m. Since 2019 was a moderately arid year, humidity was lower than in 2018. The reserves of productive moisture in the summer amounted to 136.0 mm/m on the control, and on fertilized variants, there was more moisture - 145.1-161.4 mm/m. The largest moisture reserves in the meter layer were observed on the variant ground + preparation 300 kg/ha.

Precipitation in August and September had a great influence on the dynamics of soil moisture. In the autumn, the reserves of productive moisture in a meter soil layer in 2018 amounted to 165.7 mm/m on the control, on the fertilized variants, the soil moisture was higher, it amounted to 165.8-196.2 mm/m depending on the dose of the preparation. The reserves of productive moisture in 2019 amounted to 173.8 mm/m on the control, and on fertilized variants, there was more moisture - 177.1-216.5 mm/m (table 3).

Laboratory results confirmed a very low dispersion of the test soil. The amount of water-peptized slit was close to zero in all variants of the experiment.

In the experiments of K.C. Patraab, Tapash R. Rautraycd, P. Nayaka, the application of fly ash at a rate of 200 t/ha contributed to an increase in of corn yield capacity by 28% compared with the control variant. The results showed that fly ash is an ameliorant that can improve the physical and chemical properties of the soil and increase yield capacity of agricultural crops [12].

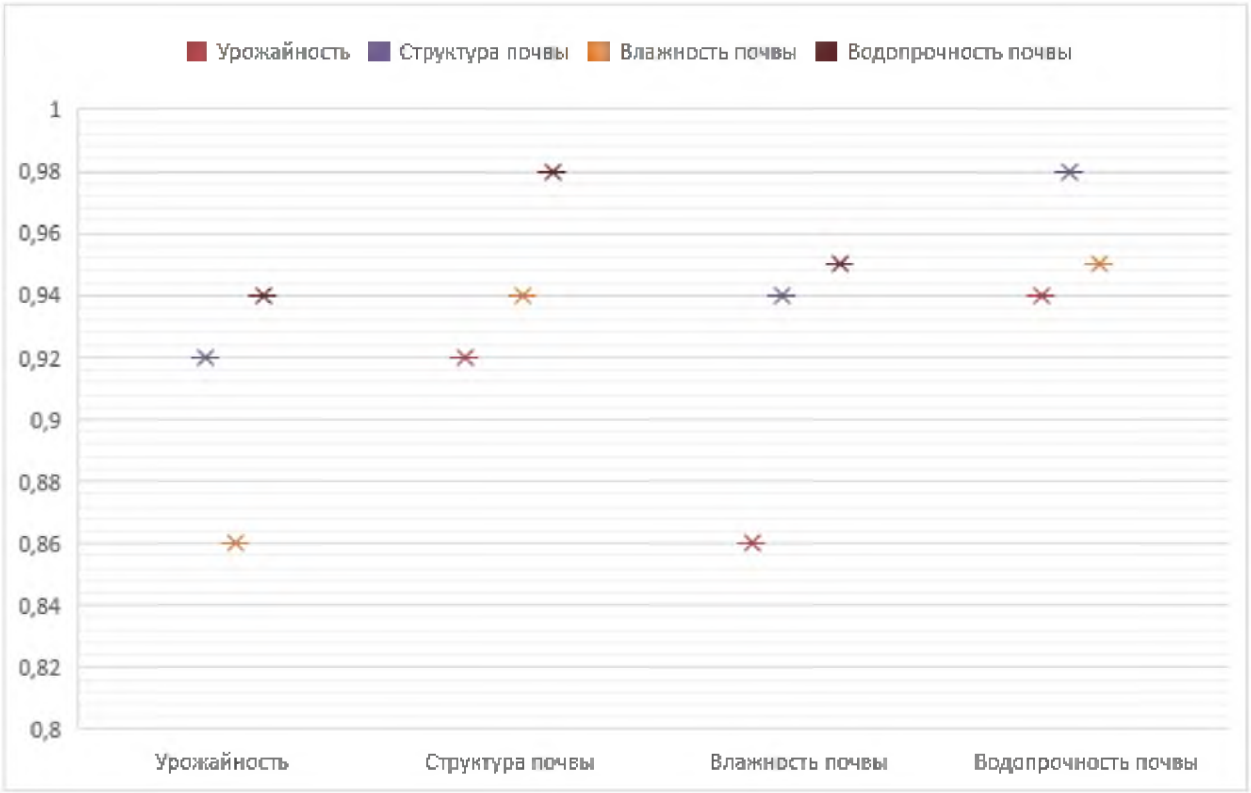
Table 3 – The effect of the preparation Agrobionov on the reserves of productive moisture in the soil, mm/m

№	Variants	Reserves of productive moisture in the soil, by years and seasons, mm/m					
		2018			2019		
		spring	summer	autumn	spring	summer	autumn
1	control	168,6	150,3	165,7	142,6	136,0	173,8
2	1/10 P_{10}-ground	164,7	155,8	167,2	151,1	145,1	177,1
3	ground + 100 kg\ha	164,9	168,8	196,2	160,9	152,4	186,7
4	ground + 200 kg\ha	168,4	161,4	165,8	163,4	150,6	189,7
5	ground + 300 kg\ha	164,4	169,1	167,7	182,4	161,0	216,5
6	ground + 400 kg\ha	168,0	166,0	170,4	175,8	160,8	196,3
7	ground + 500 kg\ha	178,7	162,8	174,4	179,2	161,4	197,1
HCP $_{0,95, mm}$		23,3	7,6	19,1	6,1	3,8	7,7

N.L.Ukwattage, P.G. Ranjith, M. Bouazza also note that fly ash is identified as a useful soil ameliorant with its properties that increase soil fertility and productivity. Fly ash has the potential to improve the physical, chemical and biological properties of the soil and is a source of macro- and microelements readily available for plants, especially for countries whose soils have poor structure and low availability of nutrients for cultivating crops. At minimal cost, fly ash can solve the problem of increasing yield capacity and food security [13].

In our experiment, the application of the preparation Agrobionov contributed to the improvement of the water-physical properties of ordinary black soil and increase the yield capacity of oil flax. On average, over two years, the yield capacity of oil flax on the variant ground + preparation 300 kg/ha was 1.01 t / ha, which exceeds the control variant by 0.67 t/ha or 50.5%. The use of pure phosphorus gave an increase to control of only 0.10 t/ha (15.5%). A reliable increase in yield was also provided by the variants ground + preparation 400-500 kg/ha, equal to 37.9% and 42.7%, however, in comparison with a dose of 300 kg/ha, their use is not profitable from an economic point of view.

A close direct correlation dependence of the yield capacity of oil flax on the physical properties of ordinary black soil has been established. In particular, a close correlation was established between the yield capacity of oil flax and soil structure (R^2 – 0,92), soil moisture (R^2 – 0,86) and the water stability of soil aggregates (R^2 – 0,94). Moreover, these indicators are also in close correlation with each other: the pair correlation coefficient of the structure of soil aggregates and soil moisture was (R^2- 0.94); structure and water stability of soil aggregates (R^2- 0.98); soil moisture and water stability of soil aggregates amounted to (R^2- 0.95) (figure).



Multiple correlation dependence of the yield capacity of oil flax and water-physical properties of ordinary black soil (урожайность – yield capacity, структура почвы – soil structure, влажность почвы – soil moisture, водопрочность почвы – water stability)

L.C. Ram, R.E. Masto (2014) also believe that the use of fly ash improves the physical, chemical and biological properties of the soil. However, the authors point out the heterogeneity of the chemical composition of the ash, agroclimatic conditions, and soil types. Therefore, it is quite rightly noted that it is difficult to draw an unambiguous conclusion about the effect of fly ash on plants and soil. For that reason, they carried out a number of studies of research on mixtures of fly ash with various organic and inorganic

materials, such as lime, gypsum, red mud, animal manure, bird droppings, sewage sludge, compost, press mud, biohumus, biochar, bioinoculants, etc. The combined use of fly ash with these materials has many advantages: increasing the availability of nutrients, reducing the bioavailability of toxic metals, buffering pH, adding organic matter, microbial stimulation, and overall improvement in systematic condition of soil, etc. The efficiency of fly ash application in mixtures with organic and inorganic materials is higher than with pure fly ash. Manure was recognized as the most promising supplement used with fly ash [14]. In our experiments, we studied the preparation "Agrobionov", which consists of ash and carbon black. According to A.A. Sarsenova, 1 kg of the preparation replaces 100 kg of humus [15].

Kaushal Kumara and other authors note that with the expansion of information about the negative impact of fly ash on the environment, the need for its disposal has become obvious. The properties of fly ash allow it to be used as fertilizer for enriching soils with nutrients. A number of studies confirm that fly ash is a potential ameliorant that can improve the physical, chemical, biological properties and nutritional status of the soil. However, recent studies have shown that the application of high doses of fly ash into the soil leads to soil contamination with toxic elements [16]. Therefore, monitoring is necessary in the fields where fly ash was used. In our experiments, we used relatively low doses of the preparation Agrobionov, which contains ash, which eliminates soil contamination with toxic elements. The studies have confirmed the environmental safety of the used doses of the preparation Agrobionov on ordinary blacksoil.

Conclusion. The water-physical properties of ordinary black soil improve under the influence of the preparation Agrobionov: the content of large aggregates (more than 10 mm) in the soil layer 0–20 cm decreases to 15.77–25.96% (32.23% on the control); the content of agronomically valuable soil aggregates increases (10-0.25 mm) to 63.81-76.32%, compared with the control - 57.4%; the water stability of soil aggregates in the soil layer of 0-20 cm increases to 49-65% (37.0% on the control), the maximum effect was obtained with the variant ground + preparation of 300 kg/ha – 65%. Soil moisture depends on weather conditions. In the summer of 2018, the reserves of productive moisture on the control amounted to 150.3 mm/m, on the fertilized versions the soil moisture was significantly higher – 155.8-169.1 mm/m; in 2019, humidity was 136.0 mm/m on the control, and on the fertilized variants – 145.1-161.4 mm/m. The largest moisture reserves were observed on the variant ground + preparation 300 kg/ha - 169 and 161 mm, respectively.

The maximum yield capacity of oil flax on average for two years was obtained on the variant ground + preparation 300 kg/ha - 1.01 t/ha, which exceeds the control variant by 0.67 t/ha or 50.5%. A very close direct correlation dependence of the yield capacity of oil flax on the physical properties of ordinary black soil has been established. The correlation coefficient between the yield capacity of the soil structure was R^2- 0.92, soil moisture R^2- 0.86 and the water stability of soil aggregates R^2- 0.94.

The use of the preparation Agrobionov has environmental and economic importance in terms of utilizing fly ash and carbon black and reducing the cost of oilseed flax production through the use of local cheap industrial waste for soil fertilization.

А. Т. Хусаинов, Г. Т. Кыздарбекова, Р. К. Хусаинова

Ш.Уәлиханов атындағы Көкшетау мемлекеттік университеті, Көкшетау, Қазақстан

АГРОБИОНОВ ПРЕПАРАТЫНЫҢ КӘДІМГІ ҚАРА ТОПЫРАҚТЫҢ СУЛЫ-ФИЗИКАЛЫҚ ҚАСИЕТТЕРІНЕ ЖӘНЕ МАЙЛЫ ЗЫГЫР ӨНІМДІЛІГІНЕ ӘСЕРІ

Аннотация. Топырақ құнарлығын қорғау және сақтау қазіргі заманғы әлемдік экологиялық саясаттың ең өткір міндетіне айналуда. Сонымен қатар, жаһандық және ұлттық экологиялық мәселе болып өндіріс қалдықтарының жинақталуы табылады. Қазірғі уақытта қайталама шикізатты, оның ішінде жергілікті күл күйіндісінің қалдықтарын ауыл шаруашылығында тыңайтқыш ретінде пайдалану сұрақтары өзекті болып табылады. Минералдық тыңайтқыштарға қарағанда күл күйіндісінің артықшылығы – өзіндік құнының төмендігінде, және бұл шығындарды азайтуға және ауыл шаруашылық дақылдар өндірісінің тиімділігін арттыруға мүмкіндік береді.

Зерттеу мақсаты болып Солтүстік Қазақстанның далалық аймағында кәдімгі қара топырақтың сулы-физикалық қасиеттеріне және майлы зығыр өнімділігіне Агробионов препаратын агроэкологиялық бағалау келеді.

Зерттеу объектілері: кәдімгі қара топырақ, майлы зығырдың Северный сорты. Зерттеу пәні: Агробионов препараты, ұнтақты түрде, оның құрамына Екібастұз кен орнынан шыққан тас көмір еннің төменкальцийлі күлі, техникалық көміртегі кіреді. Екібастұз кен орнынан шыққан көмір күлінің химиялық құрамы: SiO_2 62,9%, Fe_2O_3 6,35%, Al_2O_3 26,35%, CaO 1,9% MgO 0,9%, SO_3 1,2%, Na_2O 0,23%. Тәжірибе учаскісінің топырағы – кәдімгі қара топырақ, орташа қуатты, аз қарашірікті, ауыр балшықты.

Эксперименттер Ш. Уәлиханов атындағы Көкшетау мемлекеттік университетінің «Элит» оқу-гылыми-өндіріс орталығының тәжірибе танабында жүргізілді. Тәжірибе 4-реттік қайталау бойынша келесі нұсқалар арқылы жүргізілді: бақылау – тыңайтқышсыз; Р (1/10 есеп мөлшерінен) – фон; минералдық фонына Агробионов препараты 100, 200, 300, 400 және 500 кг/га мөлшерінде топырақты егіс алды өңдеумен бірге енгізілді. Мөлдек ауданы 125 $м^2$; есептік ауданы 100 $м^2$.

Тәжірибеде келесі бақылаулар жүргізілід: топырақтың агрегатты құрамы – Качинский әдістемесі бойынша; топырақ ылғалдылығы – ГОСТ 28268-89 бойынша термостатты-таразылық әдіс арқылы; топырақ агрегаттарының су беріктігі – П.И. Андрианов әдістемесі бойынша; сулы-пептизацияланатын тұнбаның мөлшері – Омбы мемлекеттік аграрлық университетінің әдістемесі бойынша. Өнімділік көрсеткіштері Б.А. Доспехов қосымшасындағы Фишер әдістемесі бойынша өңделді. Зерттеу нәтижелерінің статистикалық өңделуі Microsoft Excel бағдарламасы көмегімен жүргізілді. Алынган зерттеу нәтижелері Statistics 13.0. багдарламасында есептелді.

Агробионов препаратын тыңайтқыш ретінде қолданылуы топырақ агрегаттарының құрылымы мен су беріктігіне, сонымен қатар кәдімгі қара топырақтың өнімді ылғал қорына қолайлы әсер ететіні бекітілді. Майлы зығырдың орташа екі жыл ішінде максималды өнімділігі фон+ препарат 300 кг/га нұсқасында алынды – 1,01 т/га, бақылау нұсқасынан 0,67 т/га немесе 50,5% жогары. Майлы зығыр өнімділігінің кәдімгі қара топырақтың физикалық қасиеттерінен тура корреляциялық байланысы өте тығыз екені анықталды.

Агробионов препаратынын топырақтарды тыңайту үшін жергілікті арзан өнеркәсіп қалдықтарын пайдалану ретінде және майлы зығыр өндірісіне жұмсалатын шығындарды төмендетуде экологиялық және экономикалық маңызы зор.

Түйін сөздер: Агробионов препараты, майлы зығыр, кәдімгі қара топырақ, құрылым, су беріктігі, топырақ ылғалдылығы, өнімділік.

А. Т. Хусаинов, Г. Т. Кыздарбекова., Р. К.Хусаинова

Кокшетауский государственный университет им. Ш. Уалиханова, Кокшетау, Казахстан

ВЛИЯНИЕ ПРЕПАРАТА АГРОБИОНОВ НА ВОДНО-ФИЗИЧЕСКИЕ СВОЙСТВА ЧЕРНОЗЕМА ОБЫКНОВЕННОГО И УРОЖАЙНОСТЬ ЛЬНА МАСЛИЧНОГО

Аннотация. Защита и сохранение почвенного плодородия становится самой острой задачей современной мировой экологической политики. Глобальной и национальной экологической проблемой также является накопление отходов производства. В настоящее время актуальным является вопрос использования вторичного сырья, в том числе местных золошлаковых отходов в сельском хозяйстве в качестве удобрений. Преимущество золошлака, в отличие от минеральных удобрений, в более низкой себестоимости, что позволяет снизить затраты и повысить эффективность производства сельскохозяйственных культур.

Целью исследования явилась агроэкологическая оценка препарата Агробионов по водно-физическим свойствам чернозема обыкновенного и урожайности льна масличного в условиях степной зоны Северного Казахстана.

Объекты исследования: чернозем обыкновенный, лен масличный сорт Северный. Предмет исследования: препарат Агробионов в порошковом виде, в состав которого входит золашлаки каменных углей Экибастузского происхождения, технический углерод. Химический состав золы уноса углей Экибастузского месторождения: SiO_2 62,9%, Fe_2O_3 6,35%, Al_2O_3 26,35%, CaO 1,9% MgO 0,9%, SO_3 1,2%, Na_2O 0,23%. Почва опытного участка – чернозём обыкновенный, среднемощный, малогумусный, тяжелосуглинистый.

Эксперементы проводились на опытном поле Учебно-научно-производственного центра «Элит» Кокшетауского государственного университета имени Ш. Уалиханова. Опыт заложен в 4-х кратной повторности по следующей схеме: контроль - без применений удобрения; Р (1/10 от расчетной дозы) - фон; на минеральном фоне вносили препарат Агробионов в дозах 100, 200, 300, 400, 500 кг/га. под предпосевную обработку почвы. Площадь делянки 125 $м^2$; учетная площадь 100$м^2$.

В опытах проведены следующие наблюдения: агрегатный состав почвы – по методике Качинского; влажность почвы – термостатно-весовым методом по ГОСТу 28268-89; водопрочность почвенных агрегатов – методом П.И. Андрианова; количество воднопептизируемого ила – по методике Омского государственного аграрного университета. Учёт урожая – сплошным методом. Урожайные данные обрабатывали по методике

Фишера в изложении Б.А. Доспехова. Статистическая обработка результатов проводилась при помощи программы Microsoft Excel. Полученные результаты исследований были обработаны по программе Statistics 13.0.

Установлено, что применение препарата Агробионов в качестве удобрения благоприятно воздействует на структуру и водопрочность почвенных агрегатов, на запасы продуктивной влаги в черноземе обыкновенном. Максимальная урожайность льна масличного в среднем за два года получена на варианте фон + препарат 300 кг/га - 1,01 т/га, что превышает контрольный вариант на 0,67 т/га или 50,5%. Установлена очень тесная прямая корреляционная зависимость урожайности льна масличного от физических свойств чернозема обыкновенного.

Применение препарата Агробионов имеет экологическую и экономическую значимость в плане утилизации золошлака и технического углерода и снижения затрат на производство льна масличного за счет использования местных дешевых отходов промышленности для удобрения почв.

Ключевые слова: препарат Агробионов, лен масличный, чернозем обыкновенный, структура, водопрочность, влажность почвы, урожайность.

Information about authors:

Khusainov A., Doctor of Biological Sciences, Professor of Sh. Ualikhanov Koshetau University, Kokshetau, Kazakhstan; abil_tokan@mail.ru; https://orcid.org/0000-0001-6328-4133

Kyzdarbekova G., 3-year doctoral student of the specialty 6D060800 "Ecology", Kokshetau, Kazakhstan; gulmira_80_01@mail.ru; https://orcid.org/0000-0001-9982-9027

Khusainova R., Candidate of Agricultural Sciences, Professor of Sh. Ualikhanov Koshetau University, Kokshetau, Kazakhstan; bizhamal55@bk.ru; https://orcid.org/0000-0001-6970-9243

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