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THE EFFECT OF ORGANO-MINERAL FERTILIZERS ON THE PRODUCTIVITY OF CROPS ON IRRIGATED AGRICULTURAL LANDS IN CENTRAL FERGANA.

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Abstract: The efficiency of the use of irrigated lands and increasing the productivity of sustainable agriculture in central Ferghana. Implementation of a set of measures to increase soil fertility for this purpose. The introduction of intensive technologies for the cultivation of agricultural crops, to determine the content and dynamics of mobile forms of nitrogen, phosphorus and potassium, are important for the correct, differentiated application of fertilizers and on sands.

Keywords: sands, bumpy-velvety, productivity, cotton, fertilizers, agriculture, agriculture, soil protection, method, sowing, nutrient regime.

Introduction: Each of us should be aware that Uzbekistan today is an integral part of the global space and the global financial and economic market. Over the past period, a fairly solid foundation has been formed for the economic and financial management of the financial and banking infrastructure. In agriculture, the planned increase in the average annual volume of gross output will be achieved mainly due to intensive development factors, the introduction of the latest achievements of science, technology and best practices, and the effective use of the created production potential. The consistent development of scientifically based farming systems, the expansion of the use of soil protection methods of land cultivation and anti-erosion measures

will ensure a significant increase in productivity and sustainability of agriculture, the implementation of a set of measures to increase soil fertility, the introduction of intensive crop cultivation technologies for these purposes.

The agriculture of the Republic of Uzbekistan is faced with the following tasks: to increase the efficiency of the use of irrigated lands, to achieve project yields on these lands; to raise the technical level and quality of water management construction; to develop and implement measures to accelerate the transition to water-saving irrigation technologies, to the economical use of water resources and land; to comprehensively address issues of land reclamation and their agricultural development.

Materials and methods: In terms of land reclamation, convenient soils have already been developed. A significant part of the newly developed lands of Uzbekistan is represented by soils of light mechanical composition. Currently, along with infertile soils, in the republic and, in particular, in Central Ferghana, bumpy, barkhanist, ridge sands and their complexes are being developed for agricultural sowing. The sands have a huge (sinkhole) permeability. When growing crops on them, very frequent watering is required, and mineral fertilizers introduced as top dressing are washed out to groundwater and go away irrevocably. Therefore, special measures are needed here to obtain relatively high yields. Sands are poor in organic matter, which causes their unfavorable physical and chemical properties. Due to the rapid mineralization of organic matter and the leaching of nutrients from the arable horizon into deeper layers, the positive effect and aftereffect of fertilizers on such soils is limited. To increase the fertility of the sands of sandy and sandy loam soils, first of all it is necessary to improve their water, nutrient regime, increase moisture capacity and absorption capacity. In the Belarusian, Ukrainian, Lithuanian agricultural Research institutes, as well as scientific institutions in Hungary, Germany, Poland and Israel, new methods of radical improvement of sandy and sandy loam soils are being studied by deep layering of peat–manure fertilizers into the soil. Similar works were carried out in Uzbekistan by Mirzazhanov K., Nurmatov Sh., Akbarova S., Zakirova S. Under conditions of intense wind conditions, the sands are subject to wind erosion. According to Mirzazhonov, the misuse of these lands dramatically reduces their productive capacity.

There is a lot of information in the literature about various methods and methods of protecting soils from wind erosion. However, there are very few works devoted to the study of the protection of fluttering planned bumpy, barkhanist and ridge sands for the cultivation of agricultural crops, the possibilities of improving the nutrient and water regime of sandy soils and sands of Uzbekistan with simultaneous protection by sowing cotton and other arable crops on the stubble of intermediate crops, creating natural and artificial screens regulating water and nutrient modes. In addition, the urgency of the problem lies in the fact that in the conditions of Central Asia and, in particular, in Uzbekistan, in such conditions (planned sands), their fertility improvement and at the same time the fight against deflation were extremely insufficiently engaged. Without the development of special measures to increase the fertility of the sands and the struggle to spread them, it is impossible to cultivate agricultural crops and get the intended harvests, said Mirzazhanov K., Nurmatov Sh.

The results obtained. To assess the effective fertility, the actual ability of the soil to provide high yields of agricultural crops, the content of nutrients in it in forms accessible to plants is very important. Therefore, agrochemical analyses of the soil, allowing to determine the

content and dynamics of mobile forms of nitrogen, phosphorus and potassium, are important for the correct, differentiated application of fertilizers and on sands.

Dynamics of nitrate nitrogen in sand. The soils of Central Asia are characterized by high biological activity, as a result of which they undergo rapid mineralization of humic substances and accumulation of nitrogen forms assimilated for plants. Organic and ammonia nitrogen of fertilizers in the conditions of Central Asia is rapidly oxidized into nitrate salts. The mobile forms of nitrogen in these soils are mainly represented by nitrates, which is due to the pronounced nitrification process. It has been established that in the summer months, the ammonia nitrogen of mineral fertilizers usually transforms into nitrate compounds within a few days after their application to the soil. Nitrates are not absorbed by the soil, they dissolve well in soil moisture and move along the soil profile under the influence of precipitation and irrigation water. In the autumn-winter and early spring periods, the washing of nitrate nitrogen into the underlying horizons can reach up to 1.5-2.0 m or more. In the case of the proximity of groundwater, the possibility of its loss and contamination of the latter is not excluded. In summer, as a result of strong evaporation of moisture from the soil surface, a rapid rise of indented nitrates into the surface dried soil layer occurs.

The systematic use of mineral fertilizers increases the content of gross and mobile forms of nutrients in the soil and increases their solubility. By reducing the content of organic matter and destroying it, erosion suppresses microbiological processes in the soil, reduces its nitrification ability, as well as the content of nitrates in it and thereby worsens the conditions of nitrogen nutrition of plants. Despite the extensive research on the dynamics of mobile forms of nitrogen depending on the norms of fertilizers in various soil and climatic zones, the study of this issue on the deflated bumpy-barkhanist sands of Central Ferghana was conducted for the first time by us. The obtained data on the dynamics of mobile forms of nitrogen on deflated sands are of great importance in establishing optimal norms of nitrogen fertilizers to increase the productivity of agricultural use of these lands and environmental protection. The results of our research on the dependence of the dynamics of nitrate nitrogen on the norms of fertilizers.

The content of nitrate nitrogen in the sand on the fertilized variants is directly dependent on the applied fertilizer standards. Nitrogen at the rates of 150, 200 and 250 kg/ha against the background of phosphorus and potash fertilizers creates a significant difference in the content of nitrate nitrogen in a meter layer of sand. This difference is noted in all phases of plant development. Thus, at the norms N – 250, P_2O_5 – 175, K_2O – 125 kg / ha, the content of nitrate nitrogen in a meter layer of sand with 2-4 real leaves was 15.1, at budding – 11.8, at flowering – 15.7, and at the end of the growing season – 8.6 mg / kg of sand. When using N – 200, P_2O_5 – 140, K_2O – 100 kg/ha+40 tons of manure, the content of nitrate nitrogen in the sand at the specified time was 15.4; 11.7; 17.2 and 9.0, respectively.

The content of nitrate nitrogen in the sand, depending on the norms of fertilizers

Experience options	Annual rates of mineral fertilizers, kg/ha	Norms of manure and lignin,	Sand horizons, cm	Nitrate nitrogen content, mg/kg of sand

	N	P_2O_5	K_2O	t/ha		2-4 наст. лист.	budding	blossom	the end of the growing season
1	150	105	75	-	0-30 30-50 0-100	2,9 2,7 12,3	1,5 1,6 7,6	3,0 2,5 13,2	1,3 1,0 6,5
2	200	140	100	-	0-30 30-50 0-100	2,0 1,9 6,9	1,6 1,5 5,4	1,8 1,8 6,8	1,3 1,1 3,8
3	250	175	125	-	0-30 30-50 0-100	4,0 2,9 15,1	3,0 2,5 11,8	4,5 3,1 15,7	1,9 1,6 8,6
4	200	140	100	40 т навоз	0-30 30-50 0-100	3,2 2,5 15,4	1,8 1,7 11,7	5,0 3,0 17,2	1,7 1,4 9,0

The highest content of nitrate nitrogen in a meter layer of sand was noted when applied against the background of mineral fertilizers (N – 200, P2O5 – 140, K2O – 100 kg/ha) + 40 t/ha of manure.Studies of the seasonal dynamics of nitrate nitrogen in experimental variants have allowed us to establish that, regardless of the norms of mineral fertilizer application, the process of nitrate accumulation is activated from spring to summer, reaching a maximum of 2-4 real leaves and in the flowering of cotton. At the end of the growing season, the nitrate content in the soil decreases, which is explained by temperature factors, a decrease in microbiological activity and the general removal of nitrates by plants.

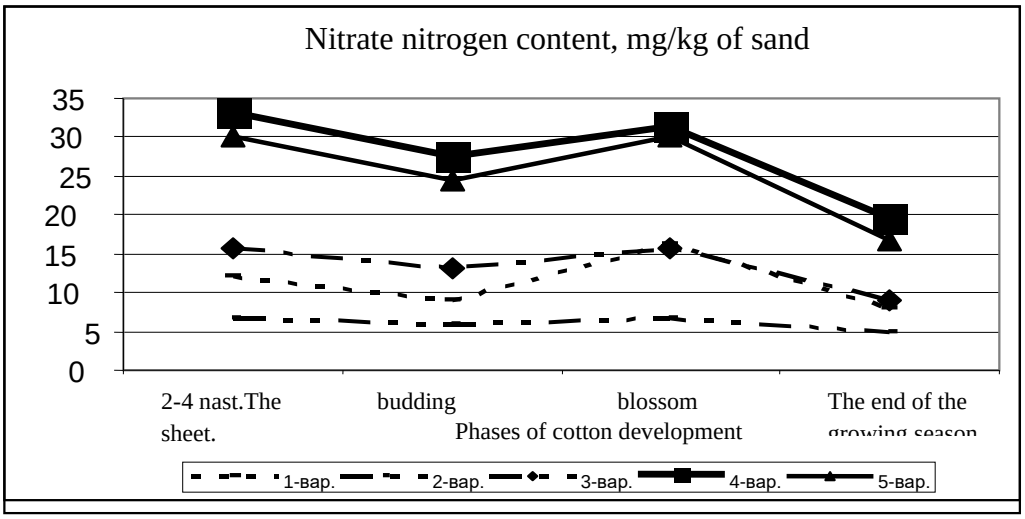

Fig.1. Dynamics of nitrate nitrogen in sand depending on fertilizer standards

Dynamics of mobile forms of phosphorus in sand. Phosphorus fertilizers introduced into the carbonate soils of Central Asia undergo significant transformations, as a result of which their digestibility and solubility change. This occurs as a result of a variety of chemical, physical, physico-climatic and microbiological processes occurring in the soil during fertilization. Phosphorus fixation in the soil occurs mainly with calcium and magnesium, to a lesser extent

with aluminum and iron. In addition, phosphorus is fixed by microorganisms that use it in the process of vital activity. Microorganisms convert mineral phosphorus into organic phosphorus, which is inaccessible to plants. After the death of microorganisms, organic phosphorus again passes into mineral forms available to plants.

The total phosphorus content in the soil cannot serve as a decisive criterion for soil fertility. To assess it, it is not the absolute values of the phosphorus content that matter, but the forms of compounds in which it is found, the degree of their mobility and accessibility to cotton.

For normal growth and development, it is important not only the content of nutrients in general, but also the nature of the seasonal dynamics of these elements in the soil, since the need for nutrients varies in different periods of plant life. The dynamics of soil phosphates may depend on a number of factors, including the concentration of electrolytes in the soil solution. The amount of phosphates can be determined by the nature of the surface of soil colloids and their electrokinetic properties, which can change not only over a long time, but also over a short period, especially in summer, when the vital activity of microorganisms is most intense in the soil, physico-chemical processes and chemical reactions occur rapidly due to changes in the water and thermal regimes of the soil.

Water-soluble forms of phosphorus fertilizers are strongly absorbed by the soil when they are applied to the soil. The fixation of phosphates depends on the type of soil, the temperature and degree of its moisture and the forms of phosphorus fertilizers. The application of phosphorus fertilizers and phosphorus-containing fertilizers significantly increases the content of digestible phosphorus in the soil, thereby dramatically improving the phosphorus nutrition of plants. The systematic use of mineral fertilizers increases the content of gross and mobile forms of nutrients in the soil and increases their solubility. Erosion has a strong effect on the phosphorus content in the soil. Phosphorus losses due to erosion are usually proportional to soil losses per unit area. Phosphorus losses are especially significant during erosion of finely dispersed mineral and organo-mineral particles and organic matter, which contain the bulk of compounds of this element. Studies have found that the total phosphorus content varies in the soil profile to a lesser extent than humus and nitrogen. Therefore, unlike organic matter and soil nitrogen, the difference in the content of common and mobile forms of phosphorus due to the degree of erosion of the soil cover in the arable layer in the entire soil column is less pronounced.

The lower content of mobile phosphates in eroded soils explains the well-known fact of the high efficiency of increased doses of phosphorus fertilizers on most washed and blown soil differences of all major types and subtypes of soils and agricultural zones, G.A.Cheremisinov. Phosphorus is the most scarce nutrient element for plants and therefore agrochemical control is especially important when using phosphorus fertilizers, and the study of techniques for the differentiated use of phosphorus fertilizers, taking into account the availability of soil, deserves the most serious attention.

The determination of the dynamics of mobile phosphates in planned bumpy-barkhanist sands, depending on the norms of fertilizers, is of great importance for their correct and most effective use. These studies have not been conducted in the conditions of the sands of Central Ferghana before. The results of agrochemical studies on the seasonal dynamics of mobile phosphates in sand show that in conditions of planned bumpy-barkhanist sands, with an increase in the rate of phosphorus fertilizers used, the content of mobile phosphorus in the 0-30 cm sand layer increases. In the spring, when cotton had 2-4 real leaves, after applying phosphorus

fertilizers at the rates of 105, 140, 175 kg /ha, the content of mobile phosphorus in the sand at a depth of 0-50 cm increased accordingly to the applied norms of phosphorus fertilizers to 1,4; 1,7; 11,0; 13,3; 14,3; 9,9; 10,3; 14,7; 14,0; 9,1; 13.5; 17.5; 16.4; 10.3 and 11.8; 13.5; 12.0; 10.0 mg/kg of sand.

The largest amount of mobile phosphorus in the soil was recorded in variants with application against the background of mineral fertilizer, where 40 tons/ha of manure were used. By the end of the growing season, its content decreases sharply, which is explained by the removal of phosphorus by plants, the temperature factor and a decrease in the biological activity of microorganisms.

The use of 40 t/ha of manure (var.4) (var. 12) against the background of N – 350, P2O5 – 250, K2O – 170 kg/ha increases the content of mobile phosphorus in the sand in comparison with the option where only mineral fertilizers applied in the same standards (var. 10) were used. Thus, the content of mobile phosphorus in sand in variant 10 was 18.0 mg/kg of sand at the beginning of the growing season and 16.3 mg/kg of sand at the end of the growing season. The use of 40 t/ha of manure increased these indicators to 21.4-19.5 mg/kg of sand and to 24.2-20.4 mg/kg of sand, respectively.

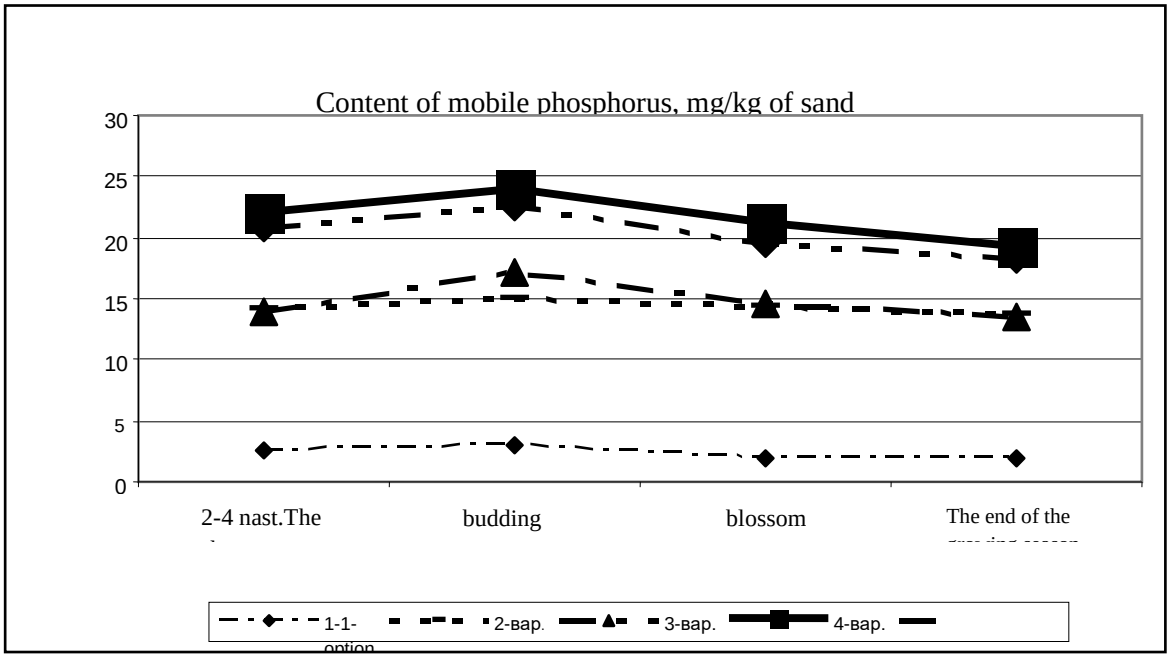

Figure 2. Dynamics of mobile phosphorus in sand depending on fertilizer standards

Dynamics of potassium exchange in sand. In connection with the study of the conditions for the effectiveness of the use of potash fertilizers, determining the availability of potassium for plants is of great importance. When applying potash fertilizers in the soil, easily mobile forms of potassium are fixed. The amount of fixed potassium depends on a number of factors: the norms of fertilizers, the time of interaction with the soil, the mechanical composition of the soil, the anion accompanying potassium, and the fertilizers applied.

The content of mobile potassium in the soil depends on its humidity, temperature, etc. An increase in humidity and temperature contributes to an increase in the amount of exchangeable potassium in the soil. Periodic drying of the soil leads to potassium fixation. The study of the

dynamics of potassium exchange on the deflated bumpy-barkhanist sands of Central Ferghana has not been carried out before. The results of studying the seasonal dynamics of potassium exchange in sand. The content of exchangeable potassium in the sand of the variants fertilized with potassium fertilizers is proportional to the norms of the fertilizers used, so if, when applied from the sands, 75 kg/ha of K2O against the background of N+150, P2O-105 kg/ha, the content of exchangeable potassium in the sand (0-30 cm) with 2-4 real leaves was 60, in budding – 55, in flowering – 50 and at the end of the growing season – 40 mg/kg of sand, then when applying K2O – 100 kg/ha against a background of 200 kg/ha of nitrogen and 140 kg/ha of phosphorus, the content of exchangeable potassium in the same time was already equal to 55, 50, 55 and 50 mg/kg of sand, respectively.

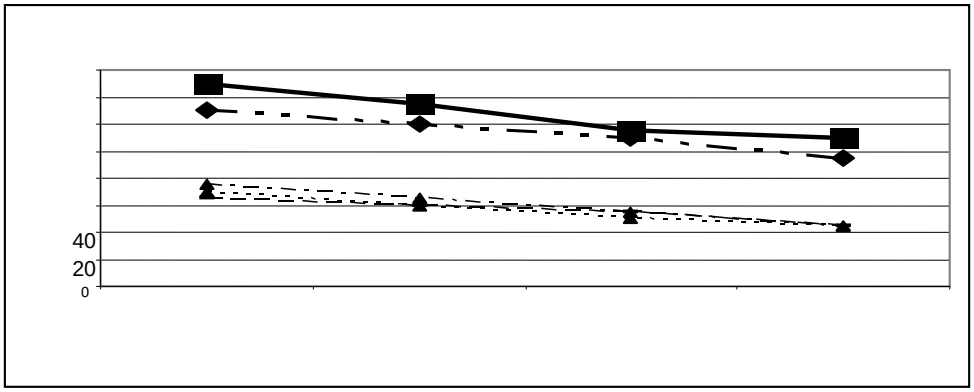

Fig. 3. Dynamics of potassium exchange in sand depending on fertilizer norms.

Discussion: It should be noted that with an increase in the applied phosphorus nitrogen norms against the background of an unchanged potassium norm, the content of exchangeable potassium in the sand in the stage 2-4 of these leaves increases slightly. So, when applying N – 250, P_2O_5 – 175, K_2O – 125 kg / ha, the content of exchangeable potassium in sand with 2-4 real leaves is 60, in budding – 50, in flowering 40 and at the end of the growing season – 35 mg / kg of sand, further decreases, the potassium content in sand increases when manure is applied. The results of further observations on the growth and development of cotton are presented. The analysis of the data obtained shows that in both field and vegetation experiments, in all years of research, the best growth and development of cotton with increasing fertilizer rates are observed especially where organic fertilizers are used against the background of mineral fertilizers.

The application of only phosphorus fertilizers from field experience in all years of research, with practically no effect on the height of the main stem, increased the number of sympodial branches and pods compared with small doses of fertilizers.The use of potassium against nitrogen (var.4) led to an increase in the height of the main stem by almost 1.2 times, and the number of boxes by 1.4-3 pcs. compared with option 2, where only nitrogen was introduced.

Conclusion: The geography of origin and genesis of the bumpy, sand dunes and ridge sands of Central Ferghana have been clarified, and binomial genetic horizons consisting of sand in the upper layer and heavier in mechanical composition in the lower one have been determined.

With the creation of an artificial screen, the moisture content of the sand along the entire profile increases significantly, as well as the lowest moisture capacity. If, in the control, the humidity in the 0-30 cm layer was 4.3%, and in 30-40 cm – 5.8%, then when creating a screen of 1000 t/ha of fine earth, the humidity increases sharply – to 8.4 and 22.5%, respectively.

The introduction of fine earth in order to create an artificial screen to a depth of 75 cm contributes to the better growth and development of cotton. With an increase in the norm of fine-grained soil, its growth and development are noticeably improved.

In the experimental area with a natural occurrence of the screen, cotton had advantages in growth and development in variants with increased rates of mineral fertilizers and lower sand capacity. A higher yield is observed in the variant with a screen at a depth of 50 (75) cm and norms of mineral fertilizers of nitrogen 350, phosphorus 250, potassium 170 kg/ha.

With the creation of an artificial screen, the yield of raw cotton increases significantly, especially noticeable where an artificial screen is created from 1000 tons/ha of fine earth at a depth of 75 cm. The increase in yield compared to the control averaged 17.1 c/ha. The maximum yield of raw cotton in the area with a natural occurrence of the screen was obtained at a depth of 50 (75) cm and fertilizer rates of nitrogen 350, phosphorus 250, potassium 170 kg/ha - 38.8 c/ha with a yield of 18.4 c/ha under control. The creation of an artificial screen makes the production of raw cotton on planned bumpy-velvety sands not cost-effective in all variants. When creating an artificial screen at a depth of 75 cm (1000 t/ha), the loss ranged from 334425 to 577145 soums/ha from a natural screen to a depth of 50-75 cm using N-250, P-200, K-170 kg/ha, net profit amounted to 286741.55 soums/ha, profitability-26.8%.

The content of nitrate nitrogen (0.6 mg/kg), mobile phosphorus (1.40 mg/kg) and exchangeable potassium (133 mg/kg) in the planned bumpy-velvety sands is very low. Consequently, the nutrient regime of these sands is significantly influenced by the use of fertilizers.

The highest content of nitrate nitrogen, mobile phosphorus and exchangeable potassium of sand was noted when applying norms N-200, P_2O_5 – 140, K_2O – 100 kg/ha + 40 t/ha of manure. The best growth and development of cotton on planned bumpy-velvety sands was noted in the variant with the joint introduction of norms N – 200, P_2O_5 – 140, K_2O – 100 kg/ha + 40 t/ha of manure.

The largest dry weight – 106.4 g per plant-was accumulated by cotton at the introduced norms N – 200, P_2O_5 -140, K_2O – 100 kg/ha + 40 t/ha of manure. The content of total nitrogen, phosphorus and potassium in cotton plants is directly dependent on the norms of fertilizers used, while the highest content was noted at 2-4 true leaves, and the lowest at the end of the growing season. The largest mass of raw cotton per box - 6.2 g was obtained when applying fertilizers in the norms N -200, P_2O_5 -140, K_2O – 100 kg / ha + 40 t/ha of manure and 60 t/ha of lignin. The highest content of total nitrogen per dry substance was observed with 2-4 real leaves when applying N -200, P_2O_5 -140, K_2O – 100 kg/ha + 40 t/ha of manure. The most effective norms of mineral fertilizers that positively affect the yield of raw cotton on the planned bumpy-barkhanist sands of Central Ferghana are: N -200, P_2O_5 -140, K_2O – 100 kg/ha. Against this background, the use of mineral fertilizers, 60 t/ha of lignin or 40 t/ha of manure increases the average yield of raw cotton by 2.9-5.2 c/ha, respectively.

The use of optimal fertilizer standards N -200, P_2O_5 -140, K_2O – 100 kg/ha plus 40 t/ha of manure, along with an increase in the yield of raw cotton, improves the technological properties of the fiber. Changes in the norms of applied fertilizers in one direction or another have a negative effect on these properties. The largest conditional net income in 185817 soums/ha with 17.9% profitability was obtained using N–200, P_2O_5–140, K_2O–100 kg/ha + 40 t/ha of manure. The humidity and the lowest moisture content of the upper sandy layer increases

as the depth of the location decreases. The highest humidity (18.3%) of the upper sandy layer was observed at a depth with a sand thickness of 50 (75) cm.

Experiments conducted on this site with winter wheat confirmed that the best option was the one in which the sand thickness on solid ground was 50-75 cm. In the experimental area with wheat sowing, an advantage in growth and development was noted in variants with increased rates of mineral fertilizers and lower sand capacity. The optimal option is with the screen lying at a depth of 50 (75) cm and the norms of mineral fertilizers nitrogen-160, phosphorus-160 and potassium-80 kg /ha.

Recommendations for production: Horizons of heavier mechanical composition lie under the bumpy, velvety and ridge sands. When leveling, the thickness of the sands above the solid horizon should not exceed 50-75 cm. At the same time, 250 kg/ha of nitrogen, 200 kg/ha of phosphorus and 170 kg/ha of potassium should be used for growing cotton and obtaining a normal harvest of raw cotton with good technological properties.

In order to increase the productivity of cotton on planned sands, depending on the norms of fertilizers, it is recommended against the background of a natural screen and top dressing of cotton 200 kg/ha of nitrogen, 140 kg/ha of phosphorus, 100 kg/ha of potassium to apply 40 tons/ha of manure for basic plowing. Under plowing, add 100 kg / ha of phosphorus, 50 kg / ha of potassium, with sowing 30 kg / ha of nitrogen, 20 kg / ha of phosphorus, with 2-3 real leaves 50 kg / ha of nitrogen, in budding 60 kg / ha, at the beginning of flowering 60 kg / ha of nitrogen, 20 kg / ha of phosphorus and 50 kg/ha of potassium. Such an agro-reclamation event is profitable.

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