Academicia Globe:
Inderscience Research

ISSN: 2776-1010 Volume 3, Issue 9, Sep., 2022

RATES OF APPLICATION OF MINERAL FERTILIZERS ON IRRIGATED TYPICAL SERIOZEMS WITH DIFFERENT LEVEL OF FERTILITY IN COTTON AND WINTER WHEAT GROWING

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Abstract

The studies were carried out on old-irrigated typical sierozems formed on loess deposits of the II-III terrace of the upper part of the Gejigen River.

Field and laboratory studies were carried out on the basis of uniform, generally accepted methodological manuals and recommendations.

The soils of the pilot plots, regardless of the level of fertility, are depleted to varying degrees in humus, mobile forms of nitrogen, phosphorus and exchangeable potassium. In order to increase the fertility of these soils and obtain high yields of cultivated crops on them, the lack of these elements must be compensated by the application of appropriate mineral and organic fertilizers. The obtained research results indicate the need to introduce differentiated norms of mineral fertilizers on the studied pilot plots, taking into account the provision of each section of the field with mobile forms of nutrients - nitrogen, phosphorus and potassium based on a system of probabilistic static models.

When establishing annual norms for the application of mineral, organic fertilizers, it is important to take into account the need of agricultural plants for nutrients cultivated in various soil and climatic conditions and, thereby, create a positive balance of nutrients for the planned crop.

Studies have established that when cultivating cotton on highly fertile, medium fertile and low fertile soils, a positive nitrogen balance is created in them, respectively: 78.3 kg/ha; 63.3 kg/ha; 58.2 kg/ha, phosphorus - negative, respectively, 11.4 kg/ha; 16.1 kg/ha; 22.4 kg/ha. For potassium, a negative balance has also developed in accordance with the level of fertility of the studied soils - 4.2 kg/ha; 20.2 kg/ha and 33.5 kg/ha.

Our calculations showed that in order to obtain the planned cotton crop, the average annual rate of application of nitrogen fertilizers in highly fertile pilot plots should be 325 kg/ha; phosphoric - 288 kg/ha; potash fertilizers - 251 kg/ha.

On medium fertile soils of the pilot plot, fertilizer rates are: nitrogen - 250 kg/ha; phosphoric - 222 kg/ha; potash - 193 kg / ha, on low fertile soils for cotton, it is necessary to apply 225 kg / ha - nitrogen; 200 kg/ha of phosphorus and 173 kg/ha of potash fertilizers.

For winter wheat cultivated on highly fertile soils, the application rates for nitrogen fertilizers are: nitrogen - 370 kg/ha, phosphorus - 310 kg/ha and potassium 182 kg/ha.

On medium fertile soils, the application of 231 kg of nitrogen, 194 kg of phosphorus and 114 kg of potash fertilizers per hectare makes it possible to obtain the planned harvest of winter wheat.

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ISSN: 2776-1010 Volume 3, Issue 9, Sep., 2022

Low fertile soils require the application of 241 kg/ha of nitrogen fertilizers for winter wheat, 202 kg/ha of phosphate and 118 kg/ha of potash fertilizers.

Key words: old-irrigated typical seozem soils, fertility level, mineral fertilizers, norms, stocks, mobile forms, nutrients, precision farming, cotton, winter wheat, productivity, balance, calculations, agrochemical cartograms.

Introduction

Preserving and increasing the fertility of irrigated soils and increasing the yield of cultivated crops is the most important task of today and is not economically feasible without the use of differentiated rates of various fertilizers, taking into account soil fertility, soil and climatic conditions of the territory, the type of cultivated crops, etc. [1].

As Muravin E.A., Titova V.I. [2] Intensive technologies of cultivation of crops based on the active chemicalization of agriculture have become widespread in agricultural production. The introduction of intensive technologies has shown that high yields of agricultural crops can be obtained not only in experimental fields, but also in production. Crops grown using intensive technologies provide the necessary amount of mineral fertilizers. The doses of mineral fertilizers for the planned yield are set taking into account the agrochemical properties of the soil, the application of organic fertilizers, etc. It is absolutely true that for the implementation of intensive technologies, very high doses of mineral fertilizers are required, however, they should not be excessive. Excessively high doses, especially with an unbalanced application of mineral nutrients, reduce the payback of fertilizers and can lead to a crop shortage rather than an increase.

As noted by Truflyak E.V., Trubilin E.I. [3] Great importance is currently being paid to the development of innovative technologies of the future, the concept of agriculture of which is based on the management of soil fertility using automated systems in agriculture. These technological solutions can increase the yield of cultivated crops and better manage soil fertility through the principles of precision farming. Precision farming is a crop productivity management system based on the use of modern satellites and computer technology.

Yakushev V.P. [4] states that instead of plowing, sowing, fertilizing “by eye”, as was done throughout the previous history of agriculture, today farmers can accurately calculate the amount of seeds, fertilizers and other inputs applied for each plot of the field with accuracy up to a meter and the management of agrotechnological operations is carried out with the maximum consideration of the variability of the soil cover, the condition of crops, the degree of damage to them by pests, as well as the identification and study of the distribution of spatial heterogeneity of agrochemical, agrophysical and other conditions of crop cultivation.

In recent years, much attention has been paid in Uzbekistan to the development and implementation of modern agricultural technologies in agricultural production and the state and prospects for the development of a smart system in Uzbekistan are considered [5].

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ISSN: 2776-1010 Volume 3, Issue 9, Sep., 2022

In this regard, we have studied the availability of soils in pilot plots, on old-irrigated typical gray soils with humus, basic nutrients and differing in terms of fertility in order to introduce modern technology of fertilizer application rates for cotton and winter wheat.

Methodology: The studies used genetic-geographical, chemical-analytical and calculation methods, which were carried out according to generally accepted guidelines: soil sampling and agrochemical analyzes were carried out on the basis of "Methods of agrochemical, agrophysical and microbiological studies in irrigated cotton areas" [6], "Guidelines for the chemical analysis of soils" [7], mathematical-statistical analysis of the obtained data according to B. A. Dospekhov [8]. The fertility of the studied soils was assessed according to the 100-point system adopted in the Republic [9].

The objects of research were old-irrigated typical serozems, common in the massif named after. G.Azamatova in the Buka district of the Tashkent region:

Highly fertile - contour 292; - medium fertile - contour - 309; - low-fertility - contour - 310.

In these farms, the main sections were laid and mixed soil samples were taken from each pilot plot to study their agrochemical properties and compile agrochemical cartograms according to their supply with mobile forms of nitrogen, phosphorus and exchangeable potassium.

Results and discussion: We started the implementation of the goals of our research from the first stage, where the availability of the selected pilot plots with basic nutrients, as well as their reserves in soils, was studied.

To obtain high and high-quality yields of cultivated crops, it is important to properly manage the nutrient regime of soils, since they contain a different amount of gross and mobile forms of nutrients and the lack of mobile forms, such as nitrogen, phosphorus, potassium, is partially compensated by the application of mineral fertilizers. When setting annual norms for applying mineral and organic fertilizers, it is important to take into account many factors, such as soil and climatic conditions, the content of nutrients in soils, the need for each crop, creating their positive balance, as well as the planned harvest.

Old-irrigated typical gray soils are common in the Buka district of the Tashkent region and are formed on loess deposits II-III of the upper part of the Gejigen River.

The genetic horizons of highly - and medium-fertile soils of the pilot plots are mainly medium loamy in terms of mechanical composition. The low-fertile soils of the pilot area are characterized as medium and heavy loamy.

Despite the fact that irrigated typical serozems differ little from each other in terms of mechanical composition, as a result of long-term anthropogenic impact on soils of various agrotechnical and agro-ameliorative measures, they have undergone significant changes and currently differ in terms of fertility. Ground years lie at a depth of <10 meters.

The pilot plot with a high level of fertility (contour 292) was rated at 76 points. Studies have established that the humus content in the upper soil horizon is average and amounts to 1.264% and decreases down the soil profile to 0.165%, gross nitrogen - 0.101%, the C:N ratio corresponds to 7.7. The ratio of carbon to nitrogen in typical gray soils, according to Kh.T.Riskieva [10], ranges from 7 to 9, but a low ratio

ISSN: 2776-1010 Volume 3, Issue 9, Sep., 2022

indicates a weak activity of biological processes occurring in soils. The amount of total phosphorus in the plow horizon of soils is within 0.179%, and total potassium is 1.02%.

Soils are depleted in mobile forms of nitrogen, phosphorus and exchangeable potassium. Thus, the amount of the nitrate form of nitrogen fluctuates in the plow horizon of the pilot plot from 19.5 to 24.3 mg/kg and decreases in the underlying horizons to 3.7-5.4 mg/kg. In irrigated agriculture, in soils with high nitrification capacity, increased nitrogen migration is noted.

According to N.I. Ibragimov [11], under the soil conditions of the Republic, 40% of nitrogen fertilizers are absorbed by plants, 20% remain in the soil, and 40% are lost in various ways, mainly in the process of denitrification. To reduce the loss of nitrogen fertilizers, as well as phosphorus and potash, to increase their efficiency, it is necessary to comply with the recommended norms and terms of their application, taking into account the irrigation regime. The content of mobile phosphorus in soils is from 16.3 to 19.8 mg/kg, the amount of exchangeable potassium is in the range of 180-235 mg/kg of soil.

The average fertile pilot plot (contour 309) on old-irrigated typical gray soils was estimated at 65 points. The upper soil horizons are moderately supplied with humus and its amount is 1.027-1.126%, down the soil profile it decreases to 0.124-0.415%. Accordingly, humus and the amount of gross nitrogen - from 0.079 to 0.084%. The C:N ratio is 6-7. Gross phosphorus in the upper soil horizons contains from 0.153 to 0.169%, in the underlying soil horizons it decreases to 0.089-0.104%. Potassium - 0.71-0.92% in the arable horizon and almost half as much - 0.41-0.58%, in the soil-forming rock.

The studied soils are very depleted in mobile forms of nitrogen and phosphorus. The content of exchangeable potassium in the upper soil horizons is within the lower limit of supply - 186-214 mg/kg.

A low-fertile plot on old-irrigated typical gray soils is characterized by a low content of humus (contour 310). Thus, the plow horizon of the soil contains 0.893-0.936% humus and it decreases in the subplow horizon to 0.124-0.178%. The amount of gross nitrogen corresponds to the content of humus and, according to soil horizons, is, respectively: 0.079-0.089; and 0.011-0.017%. C:N ratio from 6.1 to 6.5. In the upper soil horizons, the amount of gross phosphorus is low - within 0.169-0.181%, in the lower horizons it decreases to 0.097-0.118%. Soils are very depleted in mobile forms of nutrients: for example, in the upper horizons of soils, the content of nitrates ranges from 12.8-16.9 mg/kg; mobile phosphorus - 13.2-14.9 mg/kg and exchangeable potassium - 124-136 mg/kg. Down the soil profile there is a sharp decrease in the content of these nutrients.

Thus, it was found that the research of the studied territories is very low -

(0-15 mg/kg) and low (16-30 mg/kg) are provided with mobile phosphorus, as well as exchangeable potassium: very low - (0-100 mg / kg), low - (100-200 mg / kg), there are areas moderately supplied with potassium - (201-300 mg / kg. The low supply of the studied soils with mobile forms of nutrients causes an urgent need for agrotechnical measures to enrich them with nutrients based on a modern and automated system for applying fertilizers.

Based on the data obtained on the content of humus, gross forms of nitrogen, phosphorus, potassium in the soils of the studied pilot plots, their reserves were determined taking into account their content in soils, bulk mass in soil horizons0-30 cm; 0-50 cm and 0-100 cm.

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The reserves of humus, gross forms of nitrogen, phosphorus and potassium in the studied soils with high, medium and low levels of fertility. Soils with different levels of fertility differ among themselves in terms of humus and nutrient reserves: the lower the soil fertility, the lower their reserves. The largest reserves are noted in the 0-100 cm horizons of all soils.

We have compiled agrochemical cartograms of the content of mobile forms of nitrogen, phosphorus and exchangeable potassium in the soils of the pilot plots along the contours.

The results indicate that in these farms, nitrogen, phosphorus and potash fertilizers are used without taking into account the properties and characteristics of the soil, the expected harvest, which leads to a deterioration in their fertility, a decrease in the yield of crops cultivated here. Despite the fact that the soils of these pilot plots are rated as highly and moderately fertile, their availability of mobile forms of nitrogen, phosphorus and potassium is low, and differentiated norms of mineral fertilizers are required here. Having studied the availability of soils in pilot plots with basic nutrients, we calculated the annual norms for applying mineral fertilizers for cotton and winter wheat.

On a highly fertile pilot plot, estimated at 76 points, due to the natural fertility of the soil, the yield was 30.4 c/ha. The norms of mineral fertilizers introduced according to our calculations were for nitrogen - 325 kg/ha; phosphoric - 288 kg/ha; potash - 251 kg/ha and allowed to increase the yield to 40 c/ha, which is 9.6 c/ha more.

On a medium-fertile field with 65 points, yields are 26 centers/ha. The introduction of nitrogen fertilizers calculated by us at 250 kg/ha, phosphorus - 222 kg/ha and potash - 193 kg/ha contributed to the production of raw cotton in this field at 34 centners/ha, i.e. 8 s/ha more.

On a low-fertility pilot plot, 55 points, a raw cotton crop of 22 kg/ha is obtained, and the use of the norms of mineral fertilizers calculated by us: nitrogen - 225 kg/ha, phosphorus - 200 kg/ha, potash - 173 kg/ha made it possible to obtain yield of 28 s/ha, which is more by 6 s/ha.

According to the soil bonitet score, on a highly fertile field of 76 points under conditions of natural fertility, it is planned to obtain a winter wheat crop of 45.6 centers per hectare. The application of calculated annual norms of mineral fertilizers, taking into account the availability of soil nutrients, amounted to: for nitrogen fertilizers - 370 kg/ha, phosphorus - 310 kg/ha and potash - 182 kg/ha, which made it possible to obtain a winter wheat crop of 60 centners/ha , where the increase in yield was 14.4 s/ha.

The pilot plot with medium soil fertility occupies 13.2 hectares and rated at 65 points. According to the score, the yield of winter wheat is 39 s/ha. The application of mineral fertilizers based on agrochemical cartograms: nitrogen - 231 kg/ha, phosphorus - 194 kg/ha, potash - 114 kg/ha, the yield of winter wheat was 45 s/ha, which is 6 s/ha more.

The low-fertility pilot plot on old-irrigated typical gray soils occupies 9.5 hectares and is estimated at 55 points. Based on the score, a winter wheat crop of 33 centners/ha was obtained here and, based on the developed annual fertilizer application rates, which were introduced differentially on the basis of agrochemical cartograms, the annual rates of nitrogen fertilizers for winter wheat amounted to 241 kg/ha, phosphorus - 202 kg/ha, potash - 118 kg/ha, and a winter wheat crop of 40 centners/ha, which is more by 7 centners/ha.

ISSN: 2776-1010 Volume 3, Issue 9, Sep., 2022

Conclusion. The application of the developed norms for the application of mineral fertilizers on pilot plots, differing in the level of fertility on old-irrigated typical gray soils for cotton and winter wheat, improved soil fertility and increased the yield of cultivated crops.

It has been established that meeting the needs of cultivated crops for nutrients is possible with the use of innovative technologies of the future, which are based on soil fertility management using automated systems in agriculture.

To do this, it is necessary to develop a system of probabilistic-statistical models for each field separately, which will allow to take into account spatial heterogeneity to the maximum extent.

Based on data on the content of mobile forms of nutrients in the studied soils, an accurate map of the field was compiled indicating the characteristics of each of its plots, and the farmer has the opportunity to more rationally distribute mineral fertilizers and other resources in order to avoid their overexpenditure and increase the productivity of those sections of the field where they were not used. fertilizers.

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