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The role of organic matter and green manure in increasing the fertility of typical grey soils and cotton yields

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Abstract. In conditions of soil degradation and reduction of organic matter during intensive cotton cultivation, the search for environmentally sustainable ways to restore soil fertility and increase crop yields is becoming particularly relevant. The aim of this study was to assess the effect of various organic fertilisers and green manure crops on the fertility indicators of typical grey soils in the southern regions of the Kyrgyz Republic and on cotton yields. Field studies were conducted with two cotton varieties, 'Fergana-3' and 'K 43', including the application of manure, winter rye as green manure, and crushed cotton stalks (guzapai). The results showed a significant improvement in the agrochemical indicators of the soil, expressed in an increase in the content of humus, total nitrogen, gross phosphorus and potassium. The most effective method of increasing yield was the application of manure at a dose of 30 t/ha, which ensured a yield increase of up to 107.2% for the 'Fergana-3' variety and 98.3% for the 'K 43' variety. The use of green manure also contributed to a significant increase in yield (up to 73.8%) and the accumulation of organic matter and nutrients in the soil. The use of crushed cotton stalks had a positive but less pronounced effect, increasing the yield by 50-59%. It was found that both varieties respond positively to the application of organic fertilisers, with the 'K 43' variety characterised by higher absolute productivity. The results confirm the advisability of the systematic use of organic fertilisers and soil-conserving technologies in cotton production in southern Kyrgyzstan and are of practical importance for the development of effective agronomic recommendations aimed at improving the environmental sustainability and economic efficiency of cotton production

Keywords: organic fertilisers; manure; winter rye; soil fertility; sustainable agriculture

Introduction

Cotton remains one of the key technical crops in countries with irrigated agriculture due to the high demand for cotton fibre and sustained demand from the textile industry. In the southern part of the Kyrgyz Republic, cotton cultivation has traditionally developed on typical serozems, which, with favourable thermal resources and irrigation, provide the potential for high yields. At the same time, long-term cultivation of cotton in a monoculture is accompanied by increased anthropogenic pressure on the soil cover, which leads to a gradual decline in its fertility.

Modern research shows that in intensive agriculture, the content and quality of soil organic matter becomes a key limiting factor for the sustainability of

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agrocenoses. Accelerated humus mineralisation due to regular soil cultivation, the use of mineral fertilisers and irrigation leads to a deterioration in agrophysical properties, a decrease in biological activity and an imbalance of nutrients (Wei *et al.*, 2025). This problem is particularly acute for serozems in arid and semi-arid regions, as natural humus accumulation processes are extremely slow. A number of studies in recent years have emphasised that the restoration and maintenance of soil fertility in cotton-growing regions is impossible without the systematic return of organic matter. Thus, A. Makhkamova & B. Kamilov (2023) found that the prolonged absence of organic fertilisers in the cotton production system leads to a 25-40% decrease in humus content and deterioration of soil structure. Similar results were obtained by H. Oruj *et al*. (2021), who showed that irrigated cotton monoculture increases soil compaction and reduces microbiological activity, especially in the upper arable horizon.

In this regard, particular attention is paid to the use of organic fertilisers and green manure crops as tools for the biologisation of agriculture. M. Cheng *et al*. (2021) noted that the systematic removal of plant residues in cotton cultivation contributes to a decrease in organic carbon content and a deterioration in the agrophysical properties of the soil. Studies conducted in China and Central Asian countries have shown that the use of cereal green manure in cotton crop rotations contributes to humus accumulation, nitrogen loss reduction, and improvement of the agrophysical properties of serozems (Saleem *et al.*, 2010). At the same time, the effectiveness of green manure is largely determined by the timing of phytomass incorporation and its biochemical composition. A separate area of modern research is related to the use of cotton plant residues as a source of organic matter (Ma *et al.*, 2021). At the same time, S. Isaev *et al*. (2021) pointed to the limited rate of mineralisation of coarse cotton plant residues and a possible temporary deficiency of available nitrogen, which requires scientific justification of doses and methods of application.

Despite the availability of a significant number of international studies, the impact of long-term systematic application of various forms of organic matter and green manure crops in irrigated cotton cultivation in the southern Kyrgyz Republic remains insufficiently studied. The lack of long-term field experiments adapted to the conditions of typical serozems limits the possibility of developing practical recommendations aimed at a sustainable increase in soil fertility and stable crop yields. The aim of this study was to determine the comparative effectiveness of various sources of organic matter in irrigated cotton cultivation and to establish their impact on the agrochemical indicators of typical serozems and cotton productivity in the southern Kyrgyz Republic.

Materials and Methods

Field studies were conducted in 2021-2023 at an experimental site in the Aravan district of the Osh region of the Kyrgyz Republic. The study area is located in an irrigated agriculture zone and is characterised by typical serozems formed in arid climatic conditions. The soils of the experimental site had a medium loamy granulometric composition, a slightly alkaline soil solution reaction and a low organic matter content, characteristic of serozems in cotton-growing areas. The objects of the study were two cotton varieties – 'Fergana-3' and 'K 43'. The experiment was designed as a single-factor field trial with randomised block design. Each variant had three replicates. The area of one plot was 50 m^2, and the total area of the experiment was 1,050 m^2. Cotton was sown in the first ten days of April and harvested in September-October at the stage of full technical ripeness.

A variant without organic and mineral fertilisers was used as a control. The study focused on organic sources of nutrients, and therefore mineral variants were excluded from the analysis of results. The following variants were studied in the experiment: control (without fertilisers); manure at a dose of 30 t/ha; green manure; crushed cotton stalks. Manure was applied in autumn during primary soil cultivation at a dose of 30 t/ha in terms of wet weight. Well-rotted cattle manure with an average organic matter content of 20-22%, total nitrogen – 0.45-0.55%, phosphorus (P_2O_5) – 0.20-0.25% and potassium (K_2O) – 0.50-0.60% was used. Winter rye was used as a green manure crop (Zhi *et al.*, 2016). Rye was sown in the second decade of October after cotton harvesting at a sowing rate of 180 kg/ha. By the beginning of April of the following year, the green manure mass had reached the tillering stage – the beginning of stem elongation. The average above-ground biomass was 22-25 t/ha in wet weight. Green manure was incorporated by ploughing to a depth of 20-22 cm 10-12 days before cotton sowing. In the variant using cotton plant residues, about 250 cwt/ha of chopped stems (guzapai) were applied annually. The stems were mechanically chopped to a fraction of 5-7 cm and evenly distributed over the soil surface. The incorporation was carried out during the main soil cultivation to a depth of 18-20 cm. The dry mass of plant residues was used. Irrigation was carried out according to the scheme accepted for the cotton-growing zone, ensuring the maintenance of optimal soil moisture during the growing season. Plant density was 90-100 thousand plants/ha. All agrotechnical methods, with the exception of the factors under study, were the same for all experimental variants.

Soil samples were taken from the arable layer (0-30 cm) at the beginning and end of the growing season. Laboratory analyses were carried out in the agrochemical laboratory of the Kyrgyz National Agrarian

University named after K.I. Skryabin. The humus content was determined using the Tyurin method in the modification GOST 26213-91 (1993), total nitrogen – using the method of J. Ping *et al.* (2004), GOST 26107-84 (1985), gross phosphorus and potassium according to GOST 26205-91 (1993). Sample selection and preparation were carried out in accordance with GOST 17.4.4.02-84 (1986). Cotton yield was recorded separately for each plot and then converted to hectares. Statistical processing of the results was performed using Microsoft Excel and Statistica 10.0 software. The reliability of the differences between the variants was assessed using analysis of variance (ANOVA) with a significance level of $p < 0.05$. The results are presented as mean values with standard deviation (SD). The study was conducted in accordance with generally accepted ethical standards for scientific research (CBD, 1992), without the use of objects requiring special bioethical permission.

Results and Discussion

The results of field studies on the effect of organic fertilisers such as manure, intermediate winter green manure crops (winter rye) and the use of crushed cotton stalks (guzapai) on raw cotton yield are shown in Table 1.

Table 1. Raw cotton yield by variant

Variants	Variety 'Fergana-3'					Variety 'K 43'				
	Repetitions					Repetitions				
	1	2	3	Average	Yield increase, %	1	2	3	Average	Yield increase, %
Control (without fertilisers)	16.6	16.7	15.9	16.4		18.6	16.7	18.8	18	
Manure at a dose of 30 t/ha	33.4	34.8	33.7	34	107.2	35.6	35.7	35.9	35.7	98.3
Green manure crop	28.1	27.7	29.1	28.5	73.6	30.1	31.6	32.3	31.3	73.8
Cotton stalks, shredded	25.4	25.3	26.4	25.7	56.7	27.4	28.8	29.9	28.7	59.1

Source: compiled by the authors

The data in Table 1 show that the highest yields were achieved when manure was applied at a rate of 30 t/ha. The manure application option is undoubtedly the most effective organic fertiliser for both cotton varieties, providing the maximum yield increase in both absolute and relative terms. For the 'Fergana-3' variety, the increase was 107.2%, and for the 'K 43' variety, it was 98.3%. This indicates that manure is a multifunctional fertiliser, improving not only the supply of nutrients (nitrogen, phosphorus, potassium) to the plant, but also the soil structure, increasing the humus content, promoting the activation of soil microbiota and moisture retention.

Green manure crops proved to be the second most effective option, providing a yield increase of up to 73.8%. Interestingly, the Chinese variety 'K 43' yielded 2.8 cwt/ha more than 'Fergana-3', which may indicate better adaptation to the use of green manure and the ability to use nitrogen formed as a result of green mass mineralisation more efficiently. The option with chopped cotton stalks (guzapai) provided a yield increase of more than 50%. The use of guzapai as a fertiliser provides a closed cycle: plant residues are returned to the soil, reducing its depletion. However, unlike manure or green manure, guzapai decomposes slowly and is poorer in mobile forms of nitrogen, which limits its effect. The higher result of the Chinese variety (by 3 cwt/ha) again demonstrates its better adaptation to different types of organic matter. The results of the effect of various forms of organic matter on the yield of raw cotton for the studied variants and varieties are presented in Figure 1.

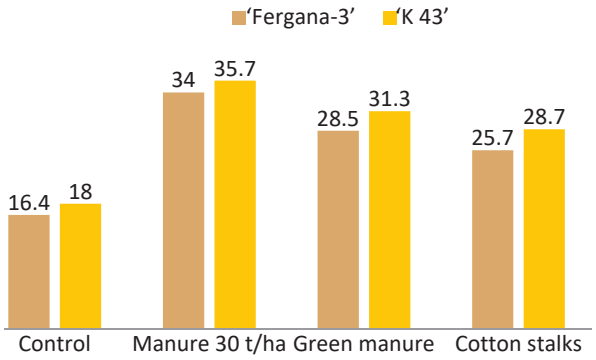

Figure 1. Raw cotton yield by variant

Source: compiled by the authors

Figure 1 illustrates the clear positive response of both cotton varieties to the application of organic fertilisers compared to the control variant. The highest yield was recorded when manure was applied at a dose of 30 t/ha. The use of green manure also provided a significant increase in yield compared to the control, but the effect was less pronounced than with manure. The variant with the incorporation of chopped cotton stalks was characterised by intermediate yield values. In all variants of the experiments, the 'K 43' variety demonstrated a higher absolute yield compared to the 'Fergana-3' variety, which indicates its greater productivity in irrigated agriculture. At the same time, the response of both varieties to the studied agrotechnical methods was similar, which indicates the universality of organic fertilisers for increasing cotton yields regardless of varietal characteristics. The results of

the assessment of the effectiveness of various forms of organic matter and green manure in improving the fertility of serozems in southern Kyrgyzstan are presented in Table 2.

Table 2. Effect of winter green manure (winter rye) on soil fertility indicators

Variety 'Fergana-3'				Variety 'K 43'			
Variants				Variants			
Control	Manure, 30 t/ha	Green manure	Cotton stalks	Control	Manure, 30 t/ha	Green manure	Cotton stalks
Humus, %							
0.88	1.11	1.32	1.28	0.98	1.16	1.21	1.05
Total nitrogen, %							
0.098	0.126	0.14	0.126	0.098	0.154	0.154	0.112
Gross phosphorus, %							
0.184	0.264	0.216	0.248	0.176	0.26	0.248	0.248
Gross potassium, %							
2.25	2.18	2.25	2.187	2.25	1.875	2.375	2.187

Source: compiled by the authors

The data presented in Table 2 characterise the influence of various forms of organic matter on the agrochemical indicators of fertility of typical serozems when cultivating cotton. The results obtained indicate a positive effect of all the organic methods studied on the content of humus and nutrients compared to the control variant. The most pronounced increase in humus content was observed in the variant with green manure, where the maximum accumulation of organic matter in the arable layer was recorded (1.32% for the 'Fergana-3' variety and 1.21% for the 'K 43' variety). This indicates the high efficiency of winter rye as a source of easily degradable biomass, which contributes to the activation of humus-forming processes. The application of manure also provided a significant increase in humus content (1.11% and 1.16%, respectively), which is associated with its complex effect on the physical and biochemical properties of the soil. The use of crushed cotton stalks led to an increase in humus content compared to the control (1.28% and 1.05%), but the effect was less pronounced, which is probably due to the slower mineralisation of coarse plant residues.

The total nitrogen content in the soil increased in all variants with the use of organic fertilisers. The highest values were observed in variants with manure and green manure, which reflects the active involvement of nitrogen in the biological cycle and improved nitrogen nutrition of plants. The application of cotton plant residues also contributed to nitrogen accumulation, but to a lesser extent, which may be due to the temporary immobilisation of nitrogen by microorganisms during the decomposition of organic matter. Analysis of gross phosphorus showed that its highest accumulation was characteristic of the variant with manure application (0.264% for 'Fergana-3' and 0.26% for 'K 43'), which is due to the supply of phosphorus in available and organically bound forms. The variants with green manure and cotton stalks also provided an increase in phosphorus content compared to the control, which indicates the role of organic matter in the mobilisation of soil phosphorus compounds. Changes in gross potassium content were less pronounced, but the use of green manure crops contributed to an increase in its content, especially in the 'K 43' variety (2.375%). This may be due to the biological mobilisation of potassium from poorly soluble compounds under the influence of root exudates from green manure crops and the activation of soil microflora.

The results obtained convincingly demonstrate the need for the systematic return of organic matter to the soil when cultivating cotton. One of the key problems of modern cotton growing in the region is the practice of completely removing above-ground phytomass after harvesting. After cotton harvesting, stems, leaves and bolls are traditionally removed from the field and used for economic purposes, which significantly limits the amount of plant residues entering the soil. Along with the above-ground part, a significant part of the root system is removed from the arable layer, as a result of which only a small amount of cotton roots remain in the soil. This practice leads to a sharp reduction in the return of organic matter and the formation of conditions for accelerated humus mineralisation. As noted by C. Bednarz *et al.* (2000), the use of manure in cotton cultivation contributes to an increase in organic carbon content and improvement of the water-resistant structure of the soil, which has a positive effect on plant productivity. M. Elms *et al.* (2001) note that organic fertilisers have a complex effect, combining direct plant nutrition with the activation of soil microflora and increased availability of phosphorus and potassium.

The data obtained in this study confirm that with the existing cotton cultivation technology, the supply of fresh organic matter to the soil remains minimal, which negatively affects fertility indicators. S. Liu *et al.* (2013) showed that with cotton monoculture and the absence of organic fertilisers, the intensity of organic matter mineralisation exceeds its supply, leading to degradation of the arable horizon. D. Saini *et al.* (2023) point out that the lack of plant residues in the farming system is

accompanied by a decrease in microbiological activity and deterioration of soil structure, especially under irrigation conditions. In addition, in the cotton-growing regions of southern Kyrgyzstan, the fertilisation system in a number of farms is characterised by a predominance of mineral fertilisers with the dominant use of nitrogen forms and limited or complete absence of organic plant nutrient sources. This one-sided approach to mineral nutrition leads to an imbalance of nutrients in the soil and accelerates the degradation of irrigated arable land. As noted by Y. Yang *et al.* (2014), the prolonged use of predominantly nitrogen fertilisers without compensation for organic matter contributes to a decrease in humus content, deterioration of soil structure and an increase in soil density. According to G. Yang *et al.* (2012), excess mineral nitrogen under irrigation conditions enhances the mineralisation of organic matter and reduces soil biological activity, which negatively affects the sustainability of agroecosystems. Similar conclusions are presented in the work of J. Zhang & F. Zhang (2024), which shows that the unbalanced use of mineral fertilisers in cotton cultivation is accompanied by a deterioration in the physicochemical and microbiological properties of serozems. As a result, conditions are created for an increase in the environmental load on irrigated agricultural landscapes and a decrease in the long-term productivity of cotton crops.

The increase in humus content observed in this study when manure and green manure are applied confirms the key role of organic carbon sources in stabilising the humus status of serozems, as previously reported by W. Lu *et al.* (2025). In particular, the authors noted that the systematic application of organic fertilisers in irrigated agriculture compensates for the loss of organic matter resulting from intensive mineralisation. The high efficiency of green manure crops in humus accumulation is consistent with the results of studies by I. Rochester (2011), which showed that cereal green manure crops incorporated during the active growth phase form a significant influx of easily degradable organic matter and stimulate the microbiological processes of humus formation. M. Saleem *et al.* (2010) emphasise that green manure crops are particularly effective on soils with an initially low organic matter content, which includes the typical serozems of southern Kyrgyzstan.

The increase in total nitrogen content in the manure and green manure variants is consistent with the findings of B. Huang *et al.* (2023), according to which organic fertilisers contribute not only to the direct supply of nitrogen but also to the activation of soil microflora, which ensures its more uniform incorporation into the biological cycle. The authors showed that the use of microbial organic fertilisers significantly enhances the metabolism of rhizosphere microorganisms, promotes the absorption of nutrients by roots and the colonisation of beneficial microbial communities, which ultimately improves the microbiological health of the soil. The higher responsiveness of the 'K 43' variety to nitrogen observed in this study is also consistent with the observations of S. Neemisha & N. Rani (2022), which indicate varietal differences in the use of organically bound nitrogen. The data obtained on gross phosphorus confirm the conclusions of J. Ping *et al.* (2004), according to which manure is one of the most effective sources of phosphorus in cotton cultivation, providing it in available and organically bound forms. The changes in potassium content recorded in the green manure variants are consistent with the data of A. Sparta *et al.* (2025), indicating the ability of green manure crops to activate the release of potassium from poorly soluble soil minerals. This is especially important for serozems, where potassium is often present in poorly available forms.

Increasing and maintaining soil fertility is considered one of the key factors for sustainable growth in cotton yields in irrigated agriculture. According to a number of researchers, the efficiency of cotton production is largely determined by the balance of organic matter in the soil, which is formed under the influence of fertilisation systems and agricultural techniques (Hulugalle, 2005). Insufficient supply of organic residues leads to accelerated humus mineralisation and a decrease in soil productivity. Serozems in arid regions are characterised by an initially low organic matter content and high sensitivity to degradation processes under intensive use. Research by K. Macnunlu *et al.* (2025) shows that in arid climates and under irrigation, a reduction in the proportion of organic fertilisers in the farming system is accompanied by a deterioration in the agrophysical properties of the soil, an increase in its density and a decrease in its water-holding capacity.

Thus, the results of this study confirm and complement existing scientific ideas about the positive effect of organic fertilisers and green manure crops on the agrochemical fertility of soils. The data obtained indicate the advisability of the comprehensive use of manure, green manure and cotton plant residues as the basis for a sustainable farming system in cotton-growing areas in the south of the Kyrgyz Republic.

Conclusions

The studies conducted have shown that the systematic use of organic fertilisers has a pronounced positive effect on the agrochemical condition of typical serozems and cotton productivity in irrigated agriculture in the south of the Kyrgyz Republic. It has been established that the application of organic nutrients contributes to an increase in the content of humus, total nitrogen, phosphorus and potassium in the soil, thereby creating more favourable conditions for the growth and development of cotton plants. The highest efficiency was recorded when manure was applied at a dose of 30 t/ha, which ensured the maximum improvement in soil fertility indicators and the greatest increase in raw cotton yield. The yield increase reached 107.2% for the 'Fergana-3'

variety and 98.3% for the 'K 43' variety, which indicates the high agronomic value of this technique. Manure proved to be a multifunctional organic fertiliser, providing not only nutrients, but also improving the physical condition of the soil and activating biological processes.

The use of green manure crops (winter rye) also showed high efficiency, ensuring a sustainable increase in cotton yields (up to 73.8%) and a significant accumulation of humus and total nitrogen in the soil. This confirms the advisability of using green manure as an environmentally friendly and resource-saving method of increasing the fertility of serozems, especially in conditions of a shortage of organic fertilisers of animal origin. The use of chopped cotton stalks (guzapai) provided a smaller but stable positive effect, increasing yields by 50-59%. Returning plant residues to the soil contributes to the partial replenishment of organic matter and the formation of a closed cycle of substances in the agricultural system, which is especially important when farm resources are limited. Both cotton varieties studied responded positively to the application of organic fertilisers. At the same time, the 'K 43' variety was characterised by a higher absolute yield, while the 'Fergana-3' variety showed a more pronounced response to organic methods in relative terms. The results confirm that restoring and maintaining soil fertility is impossible without the systematic return of organic matter, especially in conditions of prolonged cotton monoculture and increasing soil degradation processes. Prospects for further research are related to the study of the long-term impact of organic fertilisers and green manure crops on soil biological activity, carbon and nutrient balance, as well as the assessment of the economic efficiency of various organic farming systems in cotton production, taking into account climate change.

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Conflict of Interest

The authors declare that there is no conflict of interest that could influence the interpretation of the research results or the presentation of data in this article.

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Типтүү боз топурактардын күрдүүлүгүн жана пахтанын түшүмүн жогорулатууда органикалык заттар менен сидераттардын ролу

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Аннотация. Топурактын деградациясы жана пахтаны интенсивдүү өстүрүүдөн улам органикалык заттардын азайышы шартында топурактын асылдуулугун калыбына келтирүүнүн жана түшүмдүүлүгүн жогорулатуунун экологиялык жактан туруктуу жолдорун издөө өзгөчө актуалдуу. Бул изилдөөнүн максаты ар кандай органикалык жер семирткичтердин жана жашыл кык өсүмдүктөрүнүн Кыргыз Республикасынын түштүк аймактарындагы типтүү сиерозем топурактарынын асылдуулугуна жана пахтанын түшүмдүүлүгүнө тийгизген таасирин баалоо болгон. Талаа изилдөөлөрү эки пахта сорту, ‘Фергана-3’ жана ‘К 43’ менен жүргүзүлдү, анын ичинде кык, кышкы кара буудайды жашыл кык катары колдонуу жана майдаланган пахта сабактарын (гуза-пай) колдонуу. Жыйынтыктар топурактын агрохимиялык параметрлеринин бир кыйла жакшырганын көрсөттү, бул гумустун, жалпы азоттун, жалпы фосфордун жана калийдин курамынын жогорулашынан көрүндү. Түшүмдүүлүктү жогорулатуунун эң натыйжалуу ыкмасы кыкты гектарына 30 т өлчөмүндө чачуу болду, натыйжада ‘Фергана-3’ сорту үчүн түшүмдүүлүк 107,2 %га чейин жана ‘К 43’ сорту үчүн 98,3 %га чейин жогорулады. Жашыл кыкты колдонуу да түшүмдүүлүктүн бир кыйла жогорулашына (73,8 %га чейин) жана топуракта органикалык заттардын жана азык заттардын топтолушуна салым кошту. Майдаланган пахта сабактарын колдонуу оң, бирок анча байкалбаган таасир тийгизип, түшүмдүүлүктү 50-59 %га жогорулатты. Эки сорт тең органикалык жер семирткичтерди колдонууга жакшы жооп берери, ал эми ‘К 43’ сорту жогорку абсолюттук түшүмдүүлүктү көрсөтөрү аныкталды. Жыйынтыктар Түштүк Кыргызстандын пахта өндүрүүсүндө органикалык жер семирткичтерди жана топуракты үнөмдөөчү технологияларды системалуу түрдө колдонуунун мүмкүнчүлүгүн тастыктайт жана пахта өндүрүүнүн экологиялык туруктуулугун жана экономикалык натыйжалуулугун жогорулатууга багытталган натыйжалуу айыл чарба сунуштарын иштеп чыгуу үчүн практикалык мааниге ээ

Негизги сөздөр: органикалык жер семирткичтер; кык; кышкы кара буудай; топурактын асылдуулугу; туруктуу айыл чарбасы

Роль органического вещества и сидератов в повышении плодородия типичных сероземов и урожайности хлопчатника

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Аннотация. В условиях деградации почв и снижения их органического вещества при интенсивном возделывании хлопчатника особую актуальность приобретает поиск экологически устойчивых способов восстановления плодородия почв и повышения урожайности сельскохозяйственных культур. Целью настоящего исследования являлась оценка влияния различных органических удобрений и сидератов на показатели плодородия типичных сероземов южных регионов Кыргызской Республики и урожайность хлопчатника. Проведены полевые исследования с двумя сортами хлопчатника – ‘Фергана-3’ и ‘К 43’, включающие применение навоза, озимой ржи в качестве сидерата и измельченных стеблей хлопчатника (гуза-паи). Результаты показали значительное улучшение агрохимических показателей почвы, выражающееся в увеличении содержания гумуса, общего азота, валового фосфора и калия. Наиболее эффективным приемом повышения урожайности оказалось внесение навоза в дозе 30 т/га, обеспечившее прибавку урожая до 107,2 % у сорта ‘Фергана-3’ и 98,3 % у сорта ‘К 43’. Применение сидератов также способствовало существенному росту урожайности (до 73,8 %) и накоплению органического вещества и элементов питания в почве. Использование измельченных стеблей хлопчатника оказало положительное, но менее выраженное воздействие, обеспечив увеличение урожая на 50-59 %. Установлено, что оба сорта положительно реагируют на внесение органических удобрений, при этом сорт ‘К 43’ характеризуется более высокой абсолютной продуктивностью. Полученные результаты подтверждают целесообразность систематического применения органических удобрений и почвосберегающих технологий в хлопководстве юга Кыргызстана и имеют практическую значимость для разработки эффективных агротехнических рекомендаций, направленных на повышение экологической устойчивости и экономической эффективности производства хлопка

Ключевые слова: органические удобрения; навоз; озимая рожь; плодородие почвы; устойчивое земледелие