UDC: 631.582:633.51:631.524.82

INFLUENCE OF MAIN, REPEATED, AND INTERMEDIATE CROPS ON INCREASING COTTON YIELD IN SHORT-ROTATION CROP SYSTEMS

Mahmudov Utkir Haydarovich
Tashkent Branch of Samarkand State University of Veterinary Medicine, Animal Husbandry and Biotechnology, Tashkent, Uzbekistan
E-mail: mahmudov.utkir@bk.ru
ORCID: https://orcid.org/0000-0001-6140-2052
Khalikov Bahodir Meylikovich
Cotton Breeding, Seed Production and Growing Agrotechnologies Research Institute
ORCID: https://orcid.org/0000-0002-7323-4516

https://doi.org/10.5281/zenodo.19383478

Abstract: The article presents the results of long-term (2022-2025) experiments on the influence of main and repeated crops of crotalaria (crotalaria juncea), intermediate crops of safflower (trifolium alexandrinum) and bermuda grass (trifolium resupinatum), and winter wheat on increasing cotton yields in short-term crop rotations under the conditions of typical sierozem soils of the Tashkent region. The results showed that when sowing crotalaria for one year with subsequent sowing of the intermediate crop shabdar + bersim, when sowing cotton for the second year and sowing winter wheat for the first year with subsequent sowing of the repeated crop crotaly, when sowing the intermediate crop shabdar + bersim, when sowing cotton for the second year and sowing winter wheat for the first year with subsequent sowing of the repeated crotaly, when sowing winter wheat for the second year with subsequent sowing of the repeated crotalaria with subsequent sowing of the intermediate crop shabdar + bersim, the yield was 49.0-48.3-49.4 c/ha compared to the long-term and control variants.

Keywords: short-rotation crop rotation, intermediate crop, repeated crop, crotalaria juncea, shabdar (trifolium alexandrinum), bersim (trifolium resupinatum), winter wheat, long-term experience, sedirate crop, soil fertility, cotton, yield, additional crop, boll, cotton, fiber, rotation, repeats, research, combined sowing (+), sowing keta ketttk, agrotechnology, irrigation, fertilization, inter-row cultivation, weather, temperature, beneficial microorganisms in the soil.

ҚИСҚА НАВБАТЛИ АЛМАШЛАБ ЭКИШ ТИЗИМЛАРИДА ҒЎЗА ҲОСИЛДОРЛИГИНИ ОШИРИШДА ОСОСИЙ ВА ТАКРОРИЙ ҲАМДА ОРАЛИҚ ЭКИНЛАРИНИНГ ТАЪСИРИ

Mahmudov O‘tkir Haydarovich
Samarqand davlat veterinariya meditsinasi, chorvachilik va biotexnologiyalar universiteti Toshkent filiali, Toshkent, O‘zbekiston
E-mail: mahmudov.utkir@bk.ru
ORCID: https://orcid.org/0000-0001-6140-2052
Xoliqov Bahodir Meylikovich
Paxta seleksiyasi, urug‘chiligi va yetishtirish agrotexnologiyalari ilmiy-tadqiqot instituti
ORCID: https://orcid.org/0000-0002-7323-4516

Annotatsiya: Мақолада Тошкент вилоятининг типик бўз тупроқлари шароитида, қисқа навбатли алмашлаб экиш тизимларида ғўза ҳосилдорлигини оширишга асосий ва такрорий экин кроталария (crotalaria juncea), оралиқ экинлар шабдор (trifolium alexandrinum) ва берсим (trifolium resupinatum), кузги буғдой экинларининг таъсири бўйича

кўп йиллик (2022-2025 йй) тажриба натижалари келтирилган. Натижаларга кўра, бир йил кроталария экиб, ундан сўнг оралиқ экин шабдор+берсим экилиб, 2 йил ғўза экилганда ва 1 йил кузги буғдой экиб, ундан сўнг такрорий экин кроталария экиб, ундан сўнг оралиқ экин шабдор+берсим экилиб, 2 йил ғўза экилганда ҳамда 1 йил кузги буғдой экиб, ундан сўнг такрорий кроталария экилиб, 2 йили эса кузги буғдой экиб, ундан сўнг такрорий кроталария экилиб, оралиқ экин шабдор+берсим экилганда кўп йилликга ва назорат вариантига нисбатан 49,0-48,3-49,4 ц/га ҳосил олишга эришилди.

Kalit so‘zlar: қисқа навбатли алмашлаб экиш, оралиқ экин, такрорий экин, кроталария (crotalaria juncea), шабдор (trifolium alexandrinum), берсим (trifolium resupinatum), кузги буғдой, кўп йиллик тажриба, седират экин, тупроқ унумдорлиги, пахта, ҳосилдорлик, қўшимча ҳосил, кўсак, ғўза, тола, алмашлаб экиш, такрорланишлар, тадқиқот, экинларни қўшиб экиш (+), кета кетлткда экиш, агротехника, суғориш, ўғитлаш, қатор орасига ишлов, об-ҳаво, ҳарорат, тупроқда фойдали микроарганизм.

ВЛИЯНИЕ ОСНОВНЫХ, ПОВТОРНЫХ И ПРОМЕЖУТОЧНЫХ КУЛЬТУР НА ПОВЫШЕНИЕ УРОЖАЙНОСТИ ХЛОПЧАТНИКА В СИСТЕМАХ КОРОТКОСРОЧНОГО СЕВООБОРОТА

Махмудов Уткир Хайдарович
Ташкентский филиал Самаркандского государственного университета ветеринарной медицины, животноводства и биотехнологий, Ташкент, Узбекистан
E-mail: mahmudov.utkir@bk.ru
ORCID: https://orcid.org/0000-0001-6140-2052
Халиков Баходир Мейликович
Научно-исследовательский институт агротехнологий селекции, семеноводства и выращивания хлопчатника
ORCID: https://orcid.org/0000-0002-7323-4516

Аннотация: В статье представлены результаты многолетних (2022-2025 гг.) экспериментов по влиянию основных и повторных культур кроталярии (crotalaria juncea), промежуточных культур шафдара (trifolium alexandrinum) и берсима (trifolium resupinatum), озимой пшеницы на повышение урожайности хлопчатника в краткосрочных севооборотах в условиях типичных сероземных почв Ташкентской области. Результаты показали, что при посеве кроталярии в течение одного года с последующим посевом промежуточной культуры шабдор+берсим, посеве хлопчатника в течение 2-го года и посеве озимой пшеницы в течение 1-го года с последующим посевом повторной культуры кроталярии, посеве промежуточной культуры шабдор+берсим, посеве хлопчатника в течение 2-го года и посеве озимой пшеницы в течение 1-го года с последующим посевом повторной кроталярии, посеве озимой пшеницы в течение 2-го года с последующим посевом повторной кроталярии с последующим посевом промежуточной культуры шабдор+берсим, урожайность составила 49,0-48,3-49,4 ц/га по сравнению с многолетним и контрольным вариантом.

Ключевые слова: короткоротационный севооборот, промежуточная культура, повторная культура, кроталярия (crotalaria juncea), шабдар (trifolium alexandrinum), берсим (trifolium resupinatum), озимая пшеница, многолетний опыт, седиратная культура, плодородие почвы, хлопок, урожайность, дополнительный урожай, коробочка, хлопок, волокно, севооборот, повторения, исследование, совмещенный посев (+), посев кета кетлтк,

агротехника, полив, удобрение, междурядная обработка, погода, температура, полезные микроорганизмы в почве.

INTRODUCTION

Today, cotton is grown in 84 countries of the world on an area of 33-34 million hectares, and more than 25 million tons of cotton fiber are grown annually. In particular, in our republic, cotton is grown annually on an area of 1050-1060 thousand hectares and produces 3.3-3.4 million tons of raw cotton. The crop of crotalaria was also grown in more than 50 countries and was grown on an area of 400,000-500,000 hectares, producing from 80,000 to 100,000 tons of fiber. In our republic, fully satisfying the population's needs for agricultural products and industry's needs for raw materials is one of the urgent tasks facing the agricultural sector. It should be noted that the weight of raw cotton from one boll and the number of bolls from one plant are among the main factors determining cotton yield. The size of the bolls varies depending on the varietal characteristics, environmental conditions, and soil fertility. In this experiment, the inclusion of non-traditional and intermediate.

Literature review. According to B.M. Khalikov, strict adherence to existing laws and regulations concerning soil fertility and land reclamation, regular monitoring of the general condition of lands and their efficient use, conducting scientific analysis, adopting a law "On Soil Fertility" and its widespread implementation into practice, and enhancing the scientific and practical potential of farmers, clusters, and other land users are crucial [1].

According to H.M.Bozorov, B.M.Khalikov, F.Yakubov, O.Sharifov, with a short-rotation grain:cotton (1:1) crop rotation scheme, when cultivating repeated crops with subsequent cultivation of intermediate crops, along with efficient land use, it is possible to obtain high yields of intermediate crops [2] M.Mirzajanov [3] A.M.Ergashev [1-2].

According to S.Ling., Zesheng.Zhu, high crop yields have been achieved in rice and cotton rotation fields [4]. P.J.Bauer., Todd.Sempbell [4-5]

In the research of PJ.Bauer., Todd.Sempbell, croticaria (Crotolaria juncea) is a fast-growing tropical leguminous plant that can accumulate a large amount of biomass and N in a relatively short time during summer in the southeastern United States. Crotalaria has significant biomass and potential to provide N for crop cultivation systems in soils with low organic matter content in the southeastern United States[4]. D. Ismailov [5] A. Ravshanov., B. Niyazaliyev., F. Hasanova [5] Sh. Nurmatov., A. Rahimov., R. Rahmonov [7] K. Komilov [8] B. Khalikov F. Hasanov [9-10] Sh. [12] A. Iminov, B. Khalikov [11]

In the research conducted by H. Bozorov, when soben was grown as a repeated crop and clover (red clover) as an intermediate crop separately or mixed with sainfoin in the grain-cotton rotation system, the cotton yield was 3.2-3.4 c/ha higher compared to the control without sowing repeated crops and 8.6 c/ha higher compared to the control without sowing repeated and intermediate crops after winter wheat. Harvesting intermediate crops with 15-20 cm spacing also serves to strengthen the fodder base in livestock farming. [13]; H. Zokirov, O. Normuratov [14]; B. Khalikov, S. Negmatova [15]

In the studies of B. Khalikov, A. Iminov, it was noted that as a result of sowing repeated intermediate and green manure crops in short-rotation crop rotations, 5-6 tons of organic residue accumulates per hectare per season; the amount of humus increases by 80-85 kg/ha, nitrogen by 55-60 kg, phosphorus by 15-20 kg, potassium by 55-60 kg, which allows reducing the annual amount of nitrogen spent on growing crops in the next season by 25-30%, potassium by 45-50%.

It was noted that with a short-rotation cotton crop rotation system, winter wheat yield increased by 15-20%, and cotton yield by 10-12%. [16]; these ideas and research by B. Khalikov., A. Iminov., F. Namozov [17]; B. Khalikov [17]; F.Namozov, A.Iminov [7-8]; Kh. Bozorov [3]; A.Iminov, B.Khalikov, Sh.Mirzaev [18]; B. Khalikov., F. Namozov [19]; also conducted.

Also, according to Z. Jumaboev, regardless of the types of repeated crops, they have a favorable effect on soil fertility, resulting in increased cotton yield and improved technological fiber quality indicators. When sowing annual repeated leguminous crops, optimal effects were established on soil fertility, improvement of agrophysical, agrochemical properties, increase in cotton yield after them by 2.1-3.9 c/ha, improvement of technological quality indicators of cotton fiber. [20];

Currently, the main task of research conducted in agriculture, namely in cotton growing, is to scientifically substantiate the factors influencing the preservation and enhancement of soil fertility, resulting in increased cotton yields.

The yield of cotton depends on the biological characteristics of the plant, the external environment, and the soil fertility. One of the important factors in obtaining high yields is the use of non-traditional crops that accumulate biological nitrogen in the roots and soil-beneficial intermediate crops to preserve organic residues in the soil layers where cotton roots are located, thereby increasing moisture and beneficial microorganisms underground.

MATERIALS AND METHODS

The experiment was conducted during 2022-2025 at the Central Experimental Farm of the Cotton Breeding, Seed Production, and Growing Research Institute. The experiment was conducted in time and space and consisted of 12 variants. In the research work, field and production experiments, phenological observations, and biometric measurements were conducted according to the "Methods of Conducting Field Experiments."

In scientific research, the establishment of laboratory, field, and production experiments, sampling of plant and soil samples and conducting analyses, phenological observations, and biometric measurements were determined based on the guidelines "Methods of Conducting Field Experiments," .

"Methods of State Variety Testing of Agricultural Crops," "Methods of Agrochemical, Agrophysical, and Microbiological Research in Irrigated Cotton Regions," "Methods of Research with Legume Crops," and "Basic Provisions for Determining the Economic Efficiency of Use in Agriculture."

RESULTS

According to the results of long-term experiments on cotton yields in short-rotation crop rotations, when analyzing cotton yields in the 1st experimental field, the average yield in the control 1st variant in 2022 was 36.1 c/ha. According to the 2023 results, the highest yield was observed among the variants when sowing crotalaria for one year, followed by the intermediate crop shabdor+bersim, sowing cotton for 2 years and sowing winter wheat for 1 year, after sowing the repeated crop crotalaria, after sowing the intermediate crop shabdor+bersim, sowing cotton for 2 years in the 8th and 9th variants, where the average yield was 49.0-48.3 c/ha.

According to the research conducted in 2024, in the 8th variant of the short-rotation crop rotation with crotalaria for one year followed by the intermediate crop of shabdor + bersim and cotton for 2 years (1:2, crotalaria + shabdor + bersim: cotton: cotton), the average yield was 13.0 c/ha higher compared to the control variant.

Also, with a short-rotation crop rotation scheme of winter wheat sown in the first year, followed by repeated crop crotalaria, followed by intermediate crop shabdor+bersim, followed by cotton sowing (1:2, winter wheat + crotalaria + shabdor + bersim: cotton: cotton), the yield was 13.3 c/ha higher compared to the control. Thus, in the short-rotation crop rotate on scheme, the highest yield was obtained in the 12th variant with winter wheat sown in the first year, followed by repeated crotalaria, and in the second year with winter wheat sown, followed by repeated crotalaria, and intermediate crop shabdar+bersim (2:1, winter wheat+ crotalaria +winter wheat+ crotalaria +shabdar+bersim:cotton) sown, where the average yield was 49.4 c/ha, and compared to the control variant, an additional yield of 15.1 c/ha was obtained.

Table 1. Cotton yield in short-term crop rotations, 2022–2024 (Experiment 1, field 1)

No Var	**Crop rotation systems**	**2022 year**	**2022 year**	**2022 year**	**2022 year**	**2023 year**	**2023 year**	**2023 year**	**2023 year**	**2023 year**	**2024 year**	**2024 year**	**2024 year**	**2024 year**
No Var	**Crop rotation systems**	**Repeatability**	**Repeatability**	**Repeatability**	**average**	**Repeatability**	**Repeatability**	**Repeatability**	**Repeatability**	**average**	**Repeatability**	**Repeatability**	**Repeatability**	**average**
No Var	**Crop rotation systems**	**I**	**II**	**III**	**average**	**I**	**II**	**II**	**III**	**average**	**I**	**II**	**III**	**average**
1	cotton (control)	36,3	38,0	34,0	36,1	35,1	38,1	38,1	33,8	35,7	33,7	36,0	33,1	34,3
3	1:1, crotalaria : cotton	-	-	-	-	41,7	43,3	43,3	43,4	43,1	-	-	-	-
4	1:1, crotalaria + shabdar: cotton	-	-	-	-	45,2	47,63	47,63	46,2	46,2	-	-	-	-
5	1:1, crotalaria + shabdar + bersim: cotton	-	-	-	-	46,8	48,6	48,6	48,2	47,8	-	-	-	-
6	1:2, crotalaria : cotton: cotton	-	-	-	-	41,8	44,6	44,6	43,3	43,2	38,3	42,8	42,1	41,1
7	1:2, crotalaria + shabdar:	-	-	-	-	45,3	47,5	47,5	45,6	46,1	42,7	45,3	44,3	44,1

	cotton: cotton													
8	1:2, crotalaria + shabdar + bersim: cotton: cotton	-	-	-	-	48,3	49,8	49,8	48,8	49,0	46,6	47,9	46,5	47,3
9	1:2, winter wheat + crotalaria : cotton: cotton	-	-	-	-	43,8	46,4	46,4	45,4	45,2	42,7	43,7	41,8	43,0
10	1:2, winter wheat + crotalaria + safflower + bersim: cotton: cotton	-	-	-	-	47,6	48,9	48,9	48,5	48,3	46,2	48,8	48,0	47,6
11	2:1, winter wheat + crotalaria : winter wheat + crotalaria + safflower : cotton	-	-	-	-	-	-	-	-	-	47,8	49,8	48,8	48,8
12	2:1, winter wheat + crotalaria : winter wheat + crotalaria + shabdar + bersim: cotton	-	-	-	-	-	-	-	-	-	48,4	50,1	49,7	49,4

Table 2. Cotton yield in short-term crop rotations, 2023–2025 (Experiment 1, field 2)

No Var	Crop rotation systems	2023 year	2023 year	2023 year	2023 year	2024 year	2024 year	2024 year	2024 year	2024 year	2025 year	2025 year	2025 year	2025 year	2025 year	2025 year
No Var	Crop rotation systems	Repeatability	Repeatability	Repeatability	average	Repeatability	Repeatability	Repeatability	average	average	Repeatability	Repeatability	Repeatability	Repeatability	average	average
No Var	Crop rotation systems	I	II	III	average	I	II	III	average	average	I	II	II	III	average	average
1	cotton (control)	35,2	36,9	32,9	35,0	32,6	35,6	31,3	33,2	33,2	32,2	34,5	34,5	31,6	31,9	31,9
3	1:1, crotalaria: cotton	-	-	-	-	39,3	41,9	41,0	40,7	40,7	-	-	-	-	-	-
4	1:1, crotalaria + shabdar: cotton	-	-	-	-	42,7	44,8	43,7	43,7	43,7	-	-	-	-	-	-
5	1:1, crotalaria + shabdar + bersim: cotton	-	-	-	-	45,5	47,3	46,9	46,6	46,6	-	-	-	-	-	-
6	1:2, crotalaria: cotton: cotton	-	-	-	-	39,3	42,1	40,8	40,7	40,7	37,0	37,0	41,5	40,8	40,8	39,8
7	1:2, crotalaria + shabdar: cotton: cotton	-	-	-	-	43,0	45,2	43,3	43,8	43,8	40	40	42,6	41,6	41,6	41,4
8	1:2, crotalaria + shabdar + bersim: cotton: cotton	-	-	-	-	47,9	49,4	48,4	48,6	48,6	43,5	43,5	44,8	44,4	44,4	44,2
9	1:2, winter wheat + crotalaria: cotton: cotton	-	-	-	-	42,6	45,2	44,2	44,0	44,0	41,8	41,8	43,8	40,6	40,6	42,1
10	1:2, winter wheat + crotalaria + safflower + bersim:	-	-	-	-	45,6	46,9	46,5	46,3	46,3	42,7	42,7	45,3	44,5	44,5	44,2

	cotton: cotton															
11	2:1, winter wheat + crotalaria: winter wheat + crotalaria + safflower: cotton	-	-	-	-	-	-	-	-	-	45,0	45,0	47,0	46,0	46,0	46,0
12	2:1, winter wheat + crotalaria: winter wheat + crotalaria + shabdar + bersim: cotton	-	-	-	-	-	-	-	-	-	46,2	46,2	47,9	47,5	47,5	47,2

DISCUSSION

Similar patterns were observed in the 2nd experimental field for cotton yield in the studied short-term crop rotations.

Complete information is provided in Tables 1-2 of the articles.

CONCLUSION

When sowing crotaly for one year with subsequent sowing of the intermediate crop shabdor+bersim with subsequent sowing of cotton for the 2nd year and winter wheat for the 1st year with subsequent sowing of the repeated crotalaria for the 2nd year with subsequent sowing of the intermediate crop shabdor+bersim with subsequent sowing of cotton for the 2nd year and winter wheat for the 1st year with subsequent sowing of the repeated crotalaria for the 2nd year with subsequent sowing of the repeated crotalaria for the 2nd year with subsequent sowing of the intermediate crop shabdor+bersim, an additional yield of 13.0-13.3-15.1 c/ha was obtained compared to the long-term and control variants.

References

1. Khalikov B. Soil and fertility. // Agro ilm - Scientific Appendix of the Journal of Agriculture and Water Management of Uzbekistan No2. 2021. pp. 63-64.
2. Bozorov H.M. Khalikov B.M. Yakubov F. Sharifov O. Growth, development and yield of intermediate crops in crop rotation systems. // Bulletin of Agrarian Science of Uzbekistan No 5 (5) 2022 year. P. 8
3. Mirzajanova M. Effects of calcium- and magnesium-containing nitrogen fertilizers on the growth, development of cotton and changes in the weight of one boll of cotton // International scientific-practical conference actual issues of agricultural development: problems and solutions June 6-7, Tashkent 2023. P. 338.
4. Lin Sun, Zhechen Zhu. Testing cotton using natural experiments when alternating cotton with rice and other crops. // Series of Conferences. 2nd International Conference on Earth and Environmental Sciences, Materials Science, Energy Technology and Environmental Engineering 28-30 April 2017, Zhuhai, China 81 p.

5. Namozov F., Ismailov D. Influence of repeated and intermediate crops on cotton yield. // Agro ilm - Scientific Appendix of the Journal of Agriculture and Water Management of Uzbekistan No3. 2020. pp. 18-19.
6. Ravshanov A., Niyozaliyev B., Hasanova F. Factfulness - the main criterion for a cotton grower. // Journal of Agriculture and Water Management of Uzbekistan No. 6, 2022, p. 13.
7. Nurmatov Sh., Rakhimov A., Rakhmonov R. Influence of organo-mineral composts on the stubble and root residues of repeated soybean and potato crops in typical sierozem soils subject to irrigation erosion. // Journal of Agriculture and Water Management of Uzbekistan. 2020, No. 12, pp. 40-41;
8. Komilov K. Influence of mineral fertilizer rates and irrigation regimes on the accumulation of dry mass of cotton against the background of preceding crops. // Journal of Agriculture and Water Management of Uzbekistan. Special number[1]. 2023, pp. 4-5
9. Khalikov B., Yakubov F. Influence of continuous crop rotation of cotton and alfalfa on cotton yield. // Special Issue[2]. Agro ilm - Scientific Appendix to the Journal "Agriculture and Water Management of Uzbekistan" 2023. p. 6-7
10. Khalikov B., Hasanova F. High Cotton Yield. // Journal of Agriculture of Uzbekistan. No9 2013.
11. Iminov A., Khalikov B. Influence of leguminous crops on soil fertility and cotton yield. // Agro ilm - Scientific Appendix 5 (37) of the Journal of Agriculture and Water Management of Uzbekistan, 2015. P. 17-18.
12. Abdualimov Sh., Abdullayev F. Effectiveness of applying humic stimulants to cotton. // Tashkent - 2019.
13. Bozorov Kh. Influence of repeated and intermediate crops on cotton yield in crop rotation systems. // Journal of Agriculture and Water Management of Uzbekistan. No12 2023 44-45-46 b
14. Zokirov Kh., Normuratov O. Soil fertility and crop yields (on the example of Surkhandarya region soils). // Agro ilm - a special issue of the scientific application of the journal "Agriculture and Water Management of Uzbekistan" [2]. 2022. P. 77-78-79.
15. Khalikov B., Negmatova S. The importance of intermediate crops in short-term crop rotations. // Tashkent 2020. 6-1373-75-83-88-94-121 p.
16. Khalikov B., Iminov A., Namozov F. Repeated crops bring double aroma. // Journal of Agriculture and Water Management of Uzbekistan. No. 6, pp. 10-11, 2020.
17. Khalikov B. Soil and Fertility. // Agro ilm - Scientific Appendix of the Journal of Agriculture and Water Management of Uzbekistan No2. 2021. pp. 63-64.
18. Iminov A., Khalikov B., Mirzayev Sh. Importance of growing repeated and intermediate crops after winter grain crops in short-term crop rotations and their cultivation agrotechnology. // Journal of Agriculture and Water Management of Uzbekistan. Special number[1]. 9-10-11 p. 2023.
19. Khalikov B., Iminov A., Namozov F. Repeated crops bring double income. // Journal of Agriculture and Water Resources of Uzbekistan No6. 2020. P. 10-11.
20. Jumaboev Z. Influence of repeated crops on cotton yield and technological properties of fiber. // Journal of Agriculture and Water Management of Uzbekistan. Special number. 2019. P. 6-7.