APPLICATION OF AGROTECHNOLOGIES TO INCREASE FERTILITY OF TAKYR - MEADOW SOILS OF THE DESERT ZONE AND YIELD OF CROPS

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Annotation. Based on the research carried out in previous years on non-saline soils of the serozem zone of the republic, agrotechnology has been developed, aimed at enriching the soil with organic matter, improving its chemical, physico-chemical properties, increasing fertility and crop yields of the cotton complex. Between the years 2009-2011 research conducted on low saline takyr meadow soils of desert zone on the use of the agricultural technology. The essence of this agrotechnology is, when growing the main crops - cotton and winter wheat, alternating them and sowing repeated, intermediate crops so that the soil surface is covered with plants throughout the year, which helps to prevent secondary salinization, erosion, etc. It should also be noted , according to the given agrotechnology, it is obligatory to bring high norms of organic fertilizers in the amount of 20 t/ha and more for two to three years for each basic crop, with a decrease in the norm of mineral fertilizers. The results of three-year studies on this technology in 0-50 cm soil layer showed an increase in the organic matter content depending on the experiment variant from 1.2 and 3.68 tons/ha. At the same time, cotton yields increase by 4.3 and 5.6 centner/ha, wheat - 8.8 and 13.5 centner/ha, mash - 1.6 and 2.3 centner/ha, and net profit was 592.6 thousand soums, profitability by 50 percent.

Key words: irrigated soils, humus, bioproduct, soil fertility, cotton-autumn wheat-repeated and intermediate crops, green manure, organic, organic-mineral, biologically activated fertilizer, biohumus.

Аннотация. На основе проведенных в предыдущие годы исследований применительно незасоленным почвам сероземной зоны республики разработана агротехнология, направленная на обогащение почвы органическим веществом, улучшение ее химических, физико-химических свойств, повышение плодородия и урожайности культур хлопкового комплекса. Нами в период 2009-2011 годов на слабозасоленных такырно-луговых почвах пустынной зоны проводились исследования по применению этой агротехнологии. Сущность данной агротехнологии заключается в том, что при чередовании основных культур – хлопчатника и озимой пшеницы, необходимо выращивание повторных и промежуточных культур, при этом, за счет круглогодичного покрытия поверхности почв растительностью, предотвращаются процессы вторичного засоления, эрозии и других процессов. Следует также учитывать, что при применении данной агротехнологии, необходимо внесение высоких норм органических удобрений в количестве 20 т/га и более в течение двух-трех лет, при снижении нормы минеральных удобрений на 35-40% и более. В результате проведенных трехлетних исследований по данной технологии в 0-50 см слое почвы отмечено увеличение содержания органического вещества в зависимости от варианта опыта от 7,1 до 9,6 т/га, что больше на 1,2 и 3,68 т/га контрольного варианта, с внесением минеральных удобрений в полном объеме. В результате получен 4,3 и 5,6 ц/га дополнительного урожая хлопчатника, пшеницы – 8,8 и 13,5 ц/га, маша – 1,6 и 2,3 ц/га, а чистая прибыль составила 592,6 тысяча сум, рентабельность увеличилась на 50 процента.

Ключевые слова: орошаемые почвы, гумус, биопродукт, плодородие почвы, хлопчатник-озимая пшеница-повторные и промежуточные культуры, сидерация, органическое, оргономнеральное, биологически активированное удобрение, биогумус.

Аннотация. Аввалги йиллардаги олиб борилган изланишларимиз асосида республикани бўз тупроқлар минтақаси шўрланмаган тупроқлари учун тупроқни органик моддага бойитиш, уни кимёвий, физик-кимёвий хоссаларини яхшилаш, тупроқ унумдорлиги, ғўза мажмуасидаги зироатларни ҳосилдорлигини оширишга доир агротехнологиялар ишлаб чиқилган. Бўлим томондан 2009 - 2011 йилларда саҳро зонаси кучсиз шўрланган тақир-ўтлоқи тупроқларида ушбу агротехнологияни қўллашга доир изланишлар олиб борилди. Ушбу агротехнлогияни моҳияти шундан иборатки, асосий экинлар – пахта ва кузги буғдойни навбатлаб етиштириш борасида такрорий ва оралиқ экинлар экилиши зарур ва бунда тупроқ юзаси йил давомида экинлар билан қопланиб туриши ҳисобига, унда кетадиган иккиламчи шўрланиш, эрозияга учраши ва

бошқа жараёнларни олди олинади. Шуни ҳисобга олиш керакки, бу агротехнологияни қўллашда, икки-уч йил давомида 20 т/га ва ундан ортиқ миқдорда органик ўғитларни минерал ўғитлар меъёрини 35 - 40% ва ундан кўпроқ камайтирилган ҳолда қўллаш зарур. Ушбу агротехнология бўйича уч йиллик изланишлар натижасида тажриба вариантига боғлиқ ҳолда, тупроқни 0 - 50 см ли қатламида органик модда 7,1 дан 9,6 т/га миқдорга ошган, бу эса тўлиқ меъёрда минерал ўғитлар қўлланилган назорат вариантидан 1,2 ва 3,68 т/га кўпдир. Натижада пахтадан 4,3 ва 5,6 ц/га, буғдойдан 8.8 ва 13,5 ц/га, мошдан 1,6 ва 3,2 ц/га қўшимча ҳосил олиниб, соф даромад 592,6 минг сўм ташкил этган, рентабеллик 50 фоизга ошган.

Калит сўзлар: суғориладиган тупроқлар, гумус, биомаҳсулот, тупроқ унумдорлиги, пахта-кузги буғдой – такрорий ва оралиқ экинлар, сидерация, органик, оргономинерал, биологик фаол ўғит, биогумус.

Introduction: In recent years, in the main irrigated lands of the republic, there has been a tendency to reduce the content of humus, nutrients available to plants, the manifestation of negative phenomena such as degradation, dehumification, erosion, salinization, compaction, etc., which ultimately leads to deterioration of soil quality. To prevent these negative phenomena is possible by improving the land reclamation state and introducing agrotechnologies aimed at improving all basic soil properties, enriching it with organic matter and plant nutrients.

Based on the conducted in the period 2009-2015 yy. studies, we to soils of the serozem and desert zones of the republic developed agrotechnology aimed at enriching the soil with organic matter, increasing its fertility and productivity of cultivated crops [1,2,3].

This agrotechnology includes, in the system of growing the main crops, «cotton-winter wheat», their successive alternation with re-crops - corn combined with legumes (mung beans, soybeans) and intermediate crops (oats, rapeseed), with obligatory introduction of high rates of organic fertilizer-manure of different origin, organomineral fertilizers, composts from local raw materials on the basis of manure. At the same time, the norm of applied mineral fertilizers is reduced by 1.5-2.

The paper presents the results of research on the effect of applied agrotechnology on individual fertility indicators of irrigated takyr-meadow soil and yields of cultivated crops (cotton, winter wheat, mung bean) carried out in 2009-2012 on the territory of the Angor region of the Surkhandarya region.

Objects and methods of the research: Field experiments with the cultivation of basic, repeated and intermediate cultures were carried out according to the method of SoyuzNIKhI [4]. Soil analyzes were carried out according to the generally accepted methods described in the SoyuzNIHI manuals [5].

Experiments with cotton, winter wheat and other crops were put in 5 variants, the repetition is 3-fold. The plot size is 72 m^2, the total area is 1080 m^2.

The experiments were set according to the following scheme:

1. $N_0P_0\ K_0$ - control, without fertilizers;
2. $N_{200}P_{140}\ K_{100}$ - control with fertilizer;
3. $N_{135}\ P_{95}\ K_{65}$ + 20 t / ha manure;
4. $N_{100}P_{70}\ K_{50}$ + 40 t / ha manure;
5. $N_{135}\ P_{95}\ K_{65}$ + microbiological preparation 100 ml \ ha;

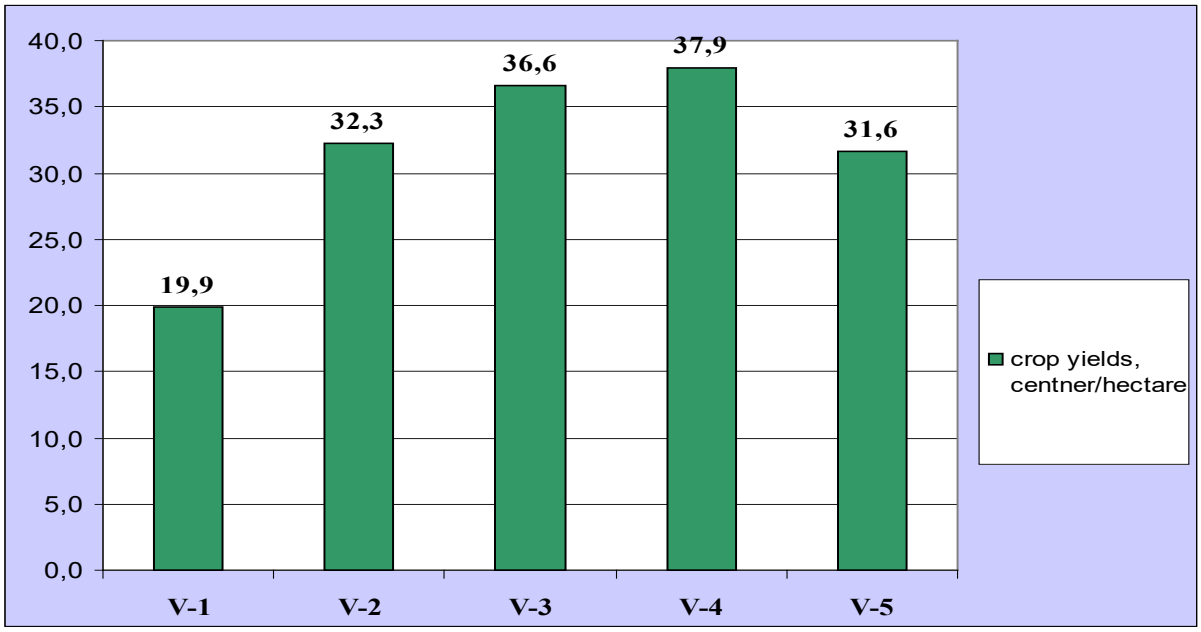
The research results: The results of the soil analysis over the three years of the experiment on the change of the total humus content in cotton cultivation (spring-autumn 2009), winter wheat (autumn 2009-summer 2010), re-seeding (summer-autumn 2010), intermediate (autumn 2010-spring 2011) and again cotton (spring-autumn 2011) showed a significant increase in its number in the variants where the proposed agrotechnology was applied with the introduction of different norms of manure with the lower norms of mineral fertilizers by 1.5-2 times, as well as the microbiological preparation (MERC).

Thus, in the control variant without fertilizers, from the spring of 2009 to autumn 2011, the humus content in the upper arable (0-30 cm) and sub (30-50 cm) soil horizons is reduced by 0.095%, which is 3.88 t / ha. A version where full norms of only mineral fertilizers were applied, during this period an increase in the carbon content of organic matter by 0.097% and 0.050%, respectively, was observed in these soil layers. This is for 0-50 cm soil layer is 5.88 t / ha. Such an increase in the carbon content of organic matter was due to better development of plants from the introduced mineral fertilizers and more decomposed root and stubble residues.

In the variants of the experiment, where the proposed agrotechnology was applied with the application of organic fertilizers (manure) at the rate of 20 and 40 t / ha per year for three years with a 1.5 and 2 times lower rate of mineral fertilizers, at 0-50 cm soil layer amount of organic matter is 0.177% and 0.239%, which is 7.08 and 9.56 t / ha, respectively. These values exceed the control variant with mineral fertilizers by 1.2 and 3.68 t / ha. In a variation of the experiment, where a microbiological preparation was applied at a rate of 100 ml / ha with a 1.5-fold lower rate of mineral fertilizers, the increase in the amount of organic matter in the 0-50 cm layer was 0.132% or 5.28t / ha, which is close to the control variant, Where the full rate of mineral fertilizers was applied. Similar positive results were obtained in the variants where agrotechnologies were applied, with respect to the dynamics of the content in 0-30 and 30-50 cm of soil layers of phosphorus and potassium forms available to plants [6].

These positive aspects of the applied agrotechnology on soil fertility indicators affected the productivity of

the cultivated main crops-cotton, winter wheat and repeated, intermediate crops.



Picture 1. Cotton productivity in the application of agricultural technology, 2009.

In the first year of agrotechnology, where cotton was grown on takyr-meadow soil in a variant without fertilizers, the yield was 22.6 centner / ha. Also high rates are explained by the agrotechnical measures carried out in previous years and applied fertilizers (Fig. 1).

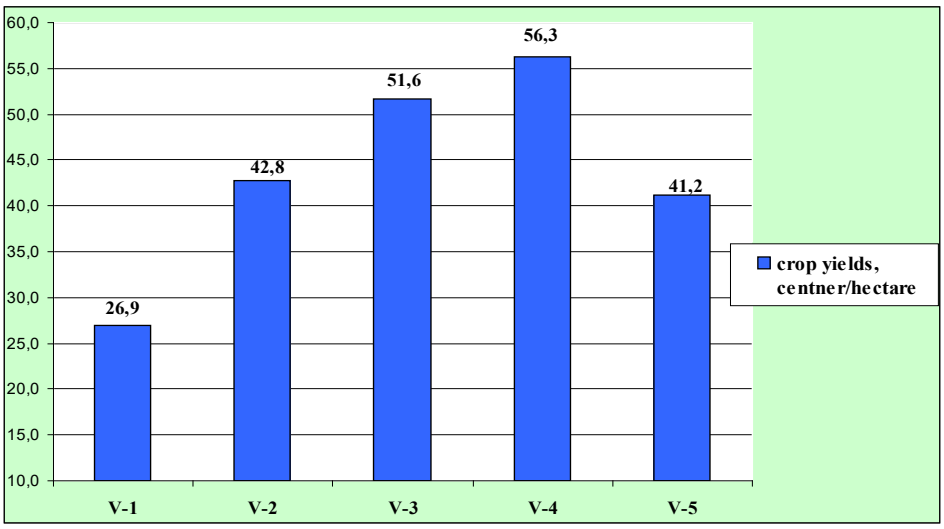
In variant 3, where agrotechnologies were applied with application of 20 t / ha of organic fertilizers in the form of manure, with a decrease in the rate of mineral fertilizers by 1.5 times, the increment was 3.8 centner / ha. The highest cotton yield of about 37 centner / hectare was obtained in the version where manure was applied at a rate of 40 tons per hectare with a decrease in the rate of mineral fertilizers by 2, which exceeds the control variant with a full rate of application of mineral fertilizers by 5.2 centner per hectare. Consequently, in takyr-meadow soils, when agrotechnologies were used to enrich the soil with organic matter, increasing the productivity of cultivated crops, for the first year of research, allowed to reduce the norms of mineral fertilizers by 1.5 and 2 times when using organic fertilizers (manure) in the norms of 20 and 40 t / ha. At the same time, in comparison with the control variant - 2, where the full norm of mineral fertilizers was applied, the increment in the yield of raw cotton amounted to 3.8 and 5.2 centner / ha.

In the autumn of 2009, after harvesting cotton, agrotechnical measures were taken to grow autumn wheat and re-crops on the same options. From autumn of this year to July 2010, research was carried out on the cultivation of winter wheat: agrotechnical measures, fertilization, soil analysis in dynamics, phenological observations of plant development and crop yields.

The recorded data on the productivity of winter wheat in the maturation phase revealed an overall plant weight in the area of 1 m^2 in variants 3 and 4, where they were introduced with mineral fertilizers mixed in 1.5 - 2 times together with organic fertilizers at the rate of 20 and 40 t / ha higher at 149 and 359 grams. Respectively, in comparison with control variant 2, where the full norm of mineral fertilizers was applied (Fig. 2). Moreover, in the version - 5, where a microbiological preparation with a 1.5 - fold lower rate of mineral fertilizers was used, similar results were obtained with the control variant -2. Also, positive results were obtained in variants 3 and 4, where organic fertilizers were applied in comparison with the control variant-2, in terms of the weights of the individual organs of one plant, the number of grains in one ear and the weight of 1000 pieces of grain.

In comparison with the control variant -2, where the full norm of mineral fertilizers was introduced in variants 3 and 4 with organic fertilizers with mineral fertilizers reduced 1.5 - 2 times, the yield of wheat grain was increased by 8.8 and 13.5 centner per hectare. And in version - 5, where a microbiological preparation was introduced, with a 1.5 - fold lower rate of mineral fertilizers, less than 1.6 centner / ha of wheat grain yield was obtained, compared to the control version with a full rate of mineral fertilizers.

The important indicators of the experiment are crop yields, as shown in figure-2.



Picture 2. Yield of winter wheat in the application of agricultural technology

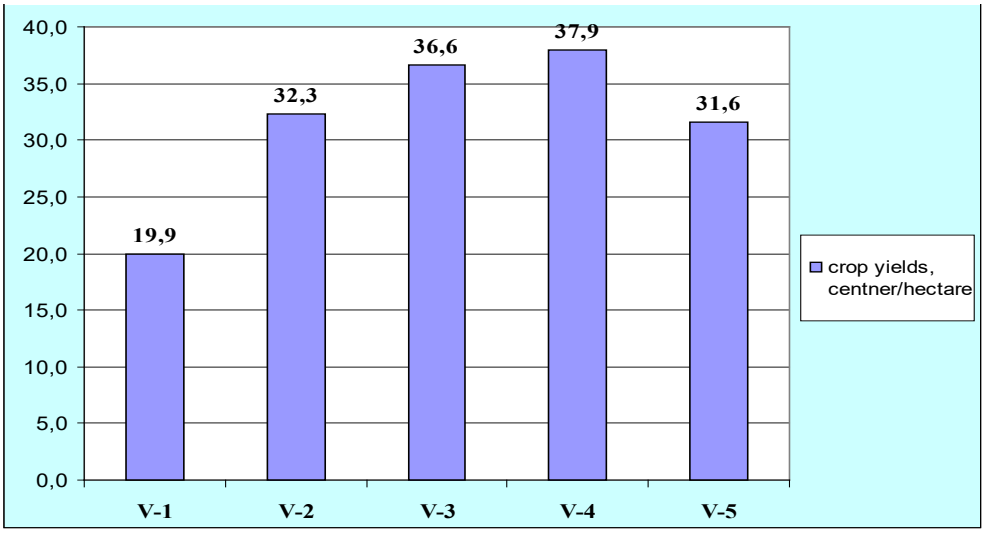
In accordance with the description and content of agricultural technology, for the second year after harvesting the wheat was re-cultivated - mung beans without fertilizers. In these variants of the experiment, during the vegetative period, the forms of nutrient elements were determined in the soil for the available plants, phenological observations were made and the yield of the re-culture was taken into account.

Mung beet varieties «Uzbekistan» are cultivated. The yield of grain of the mash in control variants 1 and 2 was 12.3 and 17.0 centner / ha, respectively, and in version 5, where the microbiological preparation was used, 16.8 centner / ha. The highest yield was obtained in option 3 and 4 with organic fertilizers, on the order of 18.6 and 19.3 centner / ha, respectively, which exceeds the control option - 2 with mineral fertilizers of 1.6 and 2.3 centner per hectare.

After harvesting in autumn on these variants of the experience for growing cotton for the third year of 2011, they introduced a full rate of organic fertilizers and phosphorus, potassium fertilizers, in accordance with the recommendations. In the spring, cottonseed was sown, during the growing season, appropriate agrotechnical measures were carried out, soil analyzes were carried out in dynamics, as well as phenological observations and accounting of cotton yield.

The obtained data on cotton yield for the third year of the study, including sequential crop rotation, fertilization according to the proposed agrotechnology, are shown in figure -3.

It can be seen from the figure that in variants 3-4, where agrotechnologies were applied and different norms of organic fertilizers were introduced together with lower rate of mineral fertilizers by 1.5-2 times, the yield of cotton was 36.6 and 37.9 centner / ha, and the increment was 4,3-5.6 centner per hectare in comparison with the control variant-2, where the full norm of mineral fertilizers was applied.



Picture 3. Yield of cotton on irrigated takyr-meadow soil for the third year of agrotechnology application, 2011

Moreover, in version 5, where a microbiological preparation was used with a 1.5 - fold lower rate of mineral fertilizers, yields compared to the control variant - 2 were slightly reduced by 0.7 c / ha.

The obtained results make it possible to note that the proposed agrotechnology, including sequential alternation of basic crops with repeated and intermediate crops, with mandatory annual introduction of high rates of organic fertilizers of the order of 20 and 40 tons / ha, together with 1.5 - 2 times lower mineral, in conditions of serozem and desert zone soils, for a short period (2.5-3years) allows to increase the content of organic matter in the soil, as well as the forms of nutritive elements available to plants and, at the same time, the cotton yield raises by 4.3 - 5.6 centner / ha, winter wheat - 8.8 and 13.5 c / ha, re-culture, mash - 1.6 - 2.3 c / ha.

Indicators of economic evaluation of promising options for agrotechnology: Economic evaluation indicators are divided into basic and additional. The main indicators include profit, relative economic efficiency; Additional indicators are labor costs, costs of diesel fuel.

Calculations on the economic efficiency of the application of the proposed agrotechnology show that the best technology is the variant - 4, which differs both in terms of high yield, and in terms of accounting of costs and profits. This is achieved by introducing organic fertilizers in the form of manure, as well as by the sideration of intermediate crops. In the production conditions, cotton yield was 28.7 centner per hectare, winter wheat was 48.5 centner per hectare, and with the new technology the productivity of these crops was 37 centner / ha and 56.3 centner / ha, respectively. This ultimately led to an increase in the results.

Indicators of economic efficiency revealed the prospects of applying the proposed agricultural technology in growing crops. The use of agrotechnology made it possible to obtain four crops-cotton, wheat, mung bean and green mass (haylage) from the intermediate rye crop for 2 years. With the usual technology for this period, two crops are obtained: cotton and winter wheat. To estimate the economic efficiency, the prime cost and profit from cultivation of agricultural crops are calculated. The difference in cost is due to the costs of changing prices for mineral fertilizers. In a comparative economic evaluation, a conventional technology is adopted as a basic technology.

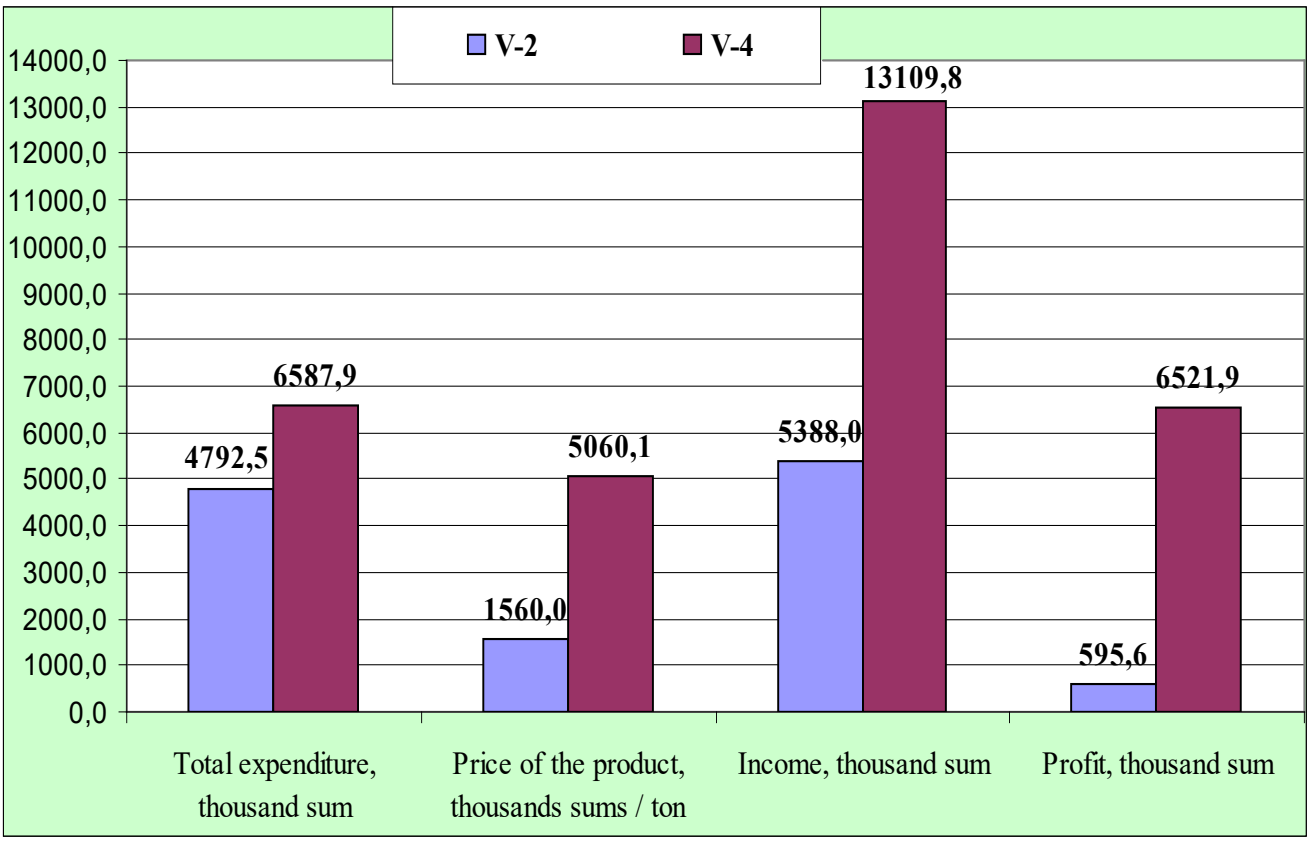
«Growth of profit», as an indicator of economic efficiency in the application of new agrotechnology is determined by:

$P_g = P_n - P_c = 6521910 - 595580 = 5926330$ sum,

Where: P_g – growth of profits, sum;

P_n - amount of profit on new technology, sum;

Pc - amount of profit on conventional technology, sum.



Picture 4. Indicators of economic evaluation of promising options of agrotechnology

It should be noted that when applying new agrotechnology on weakly and medium saline soils for three years, there is no need to flush the soil before sowing cotton and autumn wheat, as the soil surface will be covered with plants throughout the year, which prevents secondary salinity due to a decrease in the salinity of mineralized waters to soil surface. As a result, the water consumption for washing the soil is also reduced. The increase in the content of organic matter in the soil due to the introduction of organic fertilizers and root and stubble remains of plants, the sideration of intermediate crops, in a short time (2-3 years), creates fertile soil and results high yields from cultivated crops.

The main advantages of the technology: a reduction of the rate of mineral fertilizers by 30 - 40 percent; increase of crop of cultivated crops by 15 - 20 percent; obtaining additional profit through the realization of repeated crops.

As a result of the application of agrotechnology, compared with the usual technology of cultivating only cotton and winter wheat by enriching the soil with organic matter, improving its nutritional regime and a number of other properties, profitability is increased by 50 percent, profit is 6521910 sum versus 595,500 sum according to conventional agrotechnology (pic-4). In the optimal version of profit, economic efficiency - profit growth from 1 hectare of sown area was 5926330 sums.

Conclusion: As a result of the application of the proposed agrotechnology, including a sequential alternation of basic crops with repeated and intermediate crops, with an obligatory annual introduction of high rates of organic fertilizers of the order of 20 and 40 tons / ha, as well as a microbiological preparation together with lowered rates of mineral fertilizers by 30-40 percent, for short term (2.5-3 years) allows to increase the content of organic matter in the soil and, in comparison with the control variant, cotton yields increase by 4.3-5.6 centner / ha, wheat 8.8 -13.5 centner / ha, mash –1.6-2.3 centner / ha due to improved nutrient regime in the soil in a variant with a high organic fertilizer rate, where the net profit was 592.6 thousand sum, profitability increased by 50 percent.

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