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DEVELOPMENT OF RICE PRODUCTION UNDER WATER SCARCITY: BASIC TRENDS AND ECONOMIC EFFICIENCY

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----------ABSTRACT----------

In this article , agrotechnical and economic efficiency, scientific-methodical, theoretical and practical recommendations for solving the problems of reclamation and irrigation system in the conditions of water scarcity, irrigation systems, and obtaining a high yield from rice and cereals based on new technologies have been developed.

KEYWORDS. ***Rice , irrigation, agrotechnics , trends , economic efficiency, new technologies.----------***

1. INTRODUCTION

In recent years, special attention has been paid to growing agricultural products, increasing exports, introducing modern technologies into the sphere, as well as rational use of water resources. However, at present, the growing shortage of water, population growth, as well as other reasons related to the human factor, require the introduction of water-saving technologies in the cultivation of water-loving crops. In order to improve the system of continuous and efficient cultivation, storage and processing of rice, stable provision of the domestic consumer market with rice products, increase the export potential and expand research work in this direction, as well as the widespread use of water-saving technologies in the cultivation of rice in the republic: 1. Approve the proposal of the Ministry of Agriculture, the Ministry of Innovative Development of the Republic of Uzbekistan and the Council of Farmers, Dekhkan Farms and Owners of Household Lands of Uzbekistan on the formation of elite seed farms (hereinafter referred to as Seed Farms) based on rice clusters or rice farms in areas where rice cultivation is allowed. Wherein: SE "Center for the Development of Seed Growing" together with the Research Institute of Rice Growing will establish a system for propagating reproductive seeds in seed farms;

Seed farms will receive highly reproducible seeds from foreign companies that have passed quarantine control or the Rice Research Institute and organize their reproduction; land areas will be allocated for the cultivation of elite and reproductive rice seeds in the manner prescribed by law; in accordance with the established procedure, an approbation inspection of the areas sown with seed rice will be carried out and a certificate will be received; Seed farms will carry out cleaning, sorting and packaging of seed rice.

Establish a procedure in accordance with which, starting from June 1, 2021, it is allowed to issue a certificate of conformity for seed rice also by legal entities that have been accredited in the prescribed manner. The Ministry of Innovative Development, as an exception, starting from February 1, 2021, within the framework of scientific and technical programs, announce a competition for target projects related to the development of breeding, agricultural cultivation and seed production system of rice with a implementation period of up to five years. At the same time, take into account that the fundamental and applied projects implemented in the direction of breeding are a logical continuation of previously implemented projects, and ensure their continuity, to develop a rice crop rotation program depending on the soil and climatic conditions of the regions, to establish a system for keeping records of sown areas and crop rotation in seed farms. At the same time, a scientifically based crop rotation system will be introduced to prevent the cultivation of rice for more than two years in one field; to study

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the soil and climatic conditions of the Khorezm region, to implement pilot projects for the import from abroad and propagation in local conditions of seeds of high-yielding varieties of rice. At the same time, based on the results of pilot projects, measures will be taken to expand this practice to other regions of the republic. In order to widely use water-saving technologies in rice cultivation, agree to the proposals of the Council of Ministers of the Republic of Karakalpakstan, regional khokimiyats, the Ministry of Agriculture, the Ministry of Water Resources and the Council of Farmers, Dekhkan Farms and Homestead Land Owners of Uzbekistan, providing for: sowing rice in seedlings by at least 20 percent in 2021, introducing a land leveling system using laser equipment - at least 50 percent, sowing rice using modern seed drills - at least 30 percent of rice areas; in 2022, seedling rice sowing at least 40 percent, the introduction of a land leveling system using laser equipment - at least 70 percent, rice sowing using modern seed drills - at least 50 percent of rice areas.

Deputy Prime Minister Sh.M. Ganiev, together with the Chairman of the Council of Ministers of the Republic of Karakalpakstan and the khokims of the regions, take measures for the most complete implementation of these proposals, starting from 2023 - their further expansion.

2. MATERIALS AND METHOD

The purpose of the work is to improve the regulatory structures of the lower level of rice systems, as well as methods for their scientific justification, which provide automation of irrigation in the on-farm link (irrigation of both rice and related crops) and increase the efficiency of the use of water and land resources, as well as contribute to the rational regulation of water air, thermal and salt regimes of soils on rice crops.
The objectives of the research included:

- to analyze the technical condition of rice irrigation systems, to identify ways to increase the yield of rice with the maximum preservation of the design of rice systems, leading to a reduction in cost and saving irrigation water, contributing to the improvement of the ameliorative state of rice systems, ensuring the rational maintenance of water-air, salt and thermal regimes of soils;
- To conduct hydraulic and static studies of control check structures made of fabric and composite materials. Develop a methodology to substantiate their calculated parameters;
- To develop methods of scientific substantiation of fabric pipelines providing irrigation of accompanying crops of rice crop rotation;
- To develop scientific bases for calculating the stability of mole drainage on heavy, weakly impermeable soils, which contributes to the conditions for the speedy removal of water for drying checks in the pre-sowing and pre-harvest periods, the regulation of water-air, salt and thermal regimes of the soil;
- Develop practical recommendations for production to use the control structures of rice systems.

3. RESULTS AND DISCUSSION

Rice Cultivation of grain much complicated small is a network. Spiked from growing grain from crops different like, rice crops spread area much narrower being, this rice work release of the market not only interregional exchange, but the world of the market development high dependence in advance set gives _ Rice Cultivation special irrigation from systems use, big in quantity investments attraction make, material and work expenses has been needing with depend _

Rice is the main food product for half of the world's population, and all rice-producing countries, including Uzbekistan, face the task of finding ways to increase the volume and efficiency of its production, improve its quality, and preserve the ecology of the environment.

In 119 countries of the world 742541804 tons of rice per year work releases _ Of this, China is the world's largest producer of rice with an annual production of 211090813 tons, followed by India with an annual production of 158756871 tons. United States of America On an area of 1253320 hectares, 8112.1 kg per hectare with a yield of 10167050 tons of rice, it starts the second decade.
In the list of rice-producing countries, Uzbekistan ranks 63rd and produces 212,000 tons of rice on an area of 72,300 hectares with a yield of 29.3 centners per hectare.

Table 1.Leading rice producing countries

No	Countries	Work release (ton)	Area (ha)	Productive k (kg/ha)	K 's work per head work output (kg)
1	China	211 090 813	30,449,860	6 932.4	151,443
2	India	158 756 871	42,964,980	3 695	118,787
3	Indonesia	77 297 509	14 275 211	5 414.8	291,672

4	Bangladesh	52,590,000	11,385,953	4 618.8	318,484
5	Vietnam	43 437 229	7,783,113	5 581	458,876
6	Myanmar	25,672,832	6,723,986	3 818.1	476,634
7	Thailand	25,267,523	8,677,627	2 911.8	365,226
8	Philippines	17,627,245	4,556,043	3 869	165,656
9	Brazil	10,622,189	1 943 938	5 464.3	50,695
10	Pakistan o n	10,412,155	2 765 559	3 764.9	51,578
11	United States of America	10,167,050	1 253 320	8 112.1	31,019
63	Uzbekistan	212,000	72 300	2 932.2	6,492

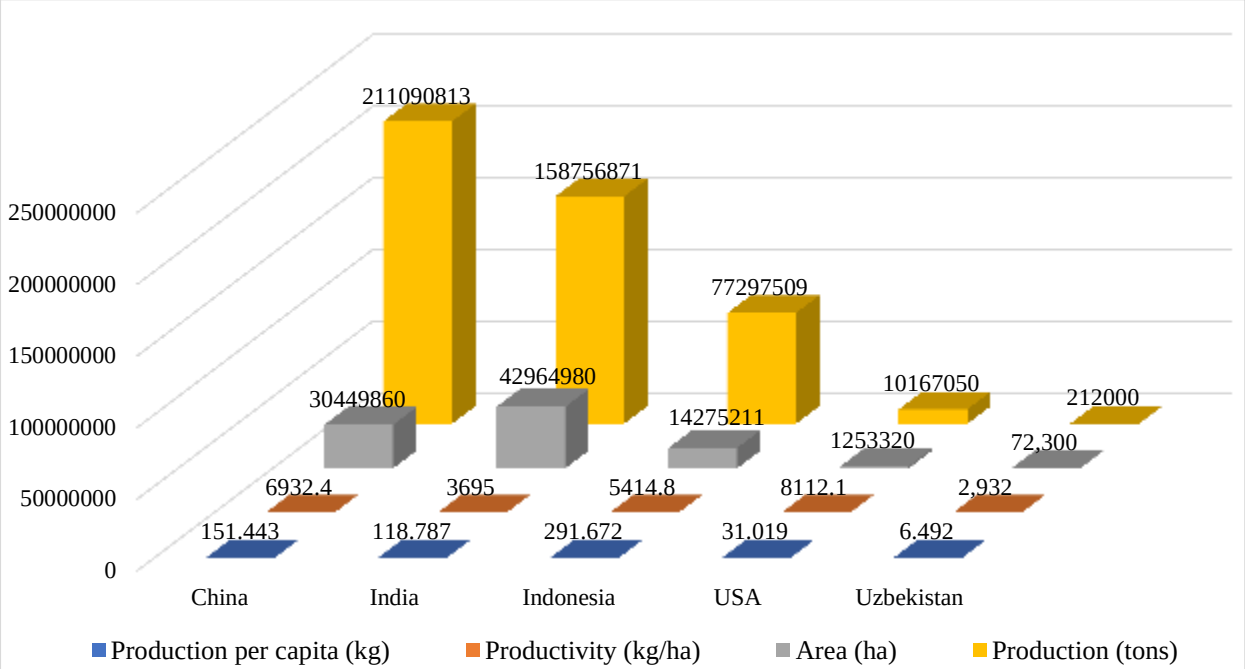

Diagram 1. Rice production figures in some countries

From this point of view, the development of scientific-methodological rules to ensure the improvement of the efficiency of rice cultivation, especially at the level of individual territorial subjects of its concentration belonging to the Republic of Karakalpakstan and the regions, is of both theoretical and practical importance.

Rice, as a warm and wet-loving crop, is one of the other food grains, and it is distinguished by its local distribution and the peculiarities of its cultivation in the country. The effectiveness of the development of rice cultivation is greatly influenced by the soil-climate conditions, the level of utilization of the bioclimatic potential of the cultivated area, and especially the unique biological capabilities of the culture of rice cultivation. With that together, local rice Cultivation the trends are very contradictory. On the one hand, small rice processing industry technical and technological of modernization _ enough not scientific _ based on varieties of orientation _ current to be done, the state by of support decline, food products rice with of provision high internal potential with our country significant level to import depend _ in 2021 Uzbekistan has 14 foreign countries from the states worth 7.5 mln. to US dollars equal to imported 28,000 tons of rice, rice _ _ import in 2020 with compared to 14.4 thousand per ton increased _ In 2021, Uzbekistan imported 27.6 thousand tons of rice from Kazakhstan, 248.2 tons from Pakistan, 60 tons from China, 25 tons from the UAE, 23 tons from India, and 19 tons from Russia. On the other hand, organizational and economic methods of regulating rice cultivation, which are applied in practice without sufficient scientific justification, often turn out to be ineffective and reduce the competitive position of rice.

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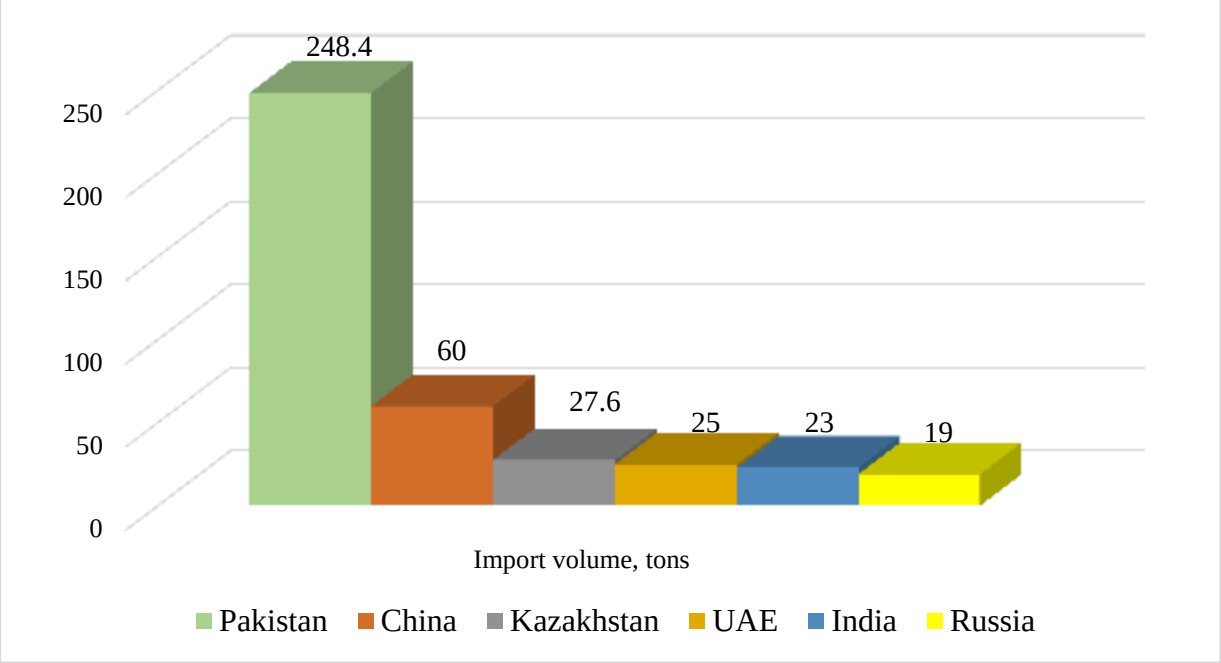

Diagram 2. On the import of rice to Uzbekistan in 2021 indicators

Therefore, it is necessary to find ways out of the crisis for domestic rice cultivation. One of these methods is intensification. The main conditions are; limited water, land suitable for rice cultivation, improvement of tillage tools and equipment, urban population growth, increased demand for rice-containing products. Intensification does not exclude the extensive development of land, the need for it arises in two cases: in cases where the growing demand cannot be covered only by additional intensification due to the limitation of land and water, the possibility of making additional investments depends on the demand for the product and production efficiency.
Intensification of rice cultivation is the main form of extended reproduction, which is carried out by improving the system of transferring the industry on the basis of scientific and technical progress in order to increase the size of the production area, increase labor productivity and reduce the costs per unit of production.

When determining intensification, it is necessary to proceed from its characteristic triple relationship: expenses I [1]production. However, products can also be obtained with the negative impact of intensification on the environment, so one of the necessary conditions for this process is environmental well-being.

When considering the intensification of rice cultivation, two aspects should be distinguished: the level of production intensity and economic efficiency.

Intensity level in the same e r field work release tools and concentration of labor level reflection makes _ Density level to determine for common and to himself characteristic, too value, too natural indicators contained _ _ indicators system is used.
Village economy products, in particular rice cultivation (I) intensity level main indicators the following includes: _ _
1. Village of the farm common expenses (village economy goals for main work release funds and Amortization ts yes not done work release expenses amount) per hectare of land, soums:

$$I_1 = \frac{F_0 + PZ - A}{PL}$$

this here _ _ F_0 is a village economy for purposeful a social work release of funds value, soum;
PZ — work release expenses, soums;
A — main of means depreciation, soum;
PL — area of land intended for agriculture, ha.
2. Cost of production funds (main and circulating) per 1 ha of agricultural land, soums.

[1] I — protection of the environment and provision of human health.

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$$I2 = \frac{F_0 + F_0 B}{PL}$$

here, F_0 B — Production working capital, soum.

3. The value of the main agricultural production funds (capital equipment) corresponding to 1 hectare of land, soums.

$$I3 = \frac{F_0}{PL}$$

4. Sum of current production costs of agriculture for 1 ha of agricultural land, soums.

$$I4 = \frac{PZ}{PL}$$

The above figures describe the intensity of all agriculture and are also used for rice cultivation. In order to objectively assess the level of production intensity in the conditions of inflation and sharp price increases, it is necessary to compare the actual and standard indicators of intensity.

The following indicators are used to determine the level of rice cultivation intensity.

- 1 hectare of crops to the field common expenses.
- 1 work release of tools price _
- 1 hectare of crops to the field right coming work release expenses size _
- energy equipment - 100 hectares of crops to the field right incoming energy sources.
- 1 hectare of crops to the field used volume of fertilizers (mineral and organic)
- the mechanism is equipped of work density - 1 hectare crop to the field right coming the mechanism has been developed work size (conventional and etc. _ yes).

Grain crops _ plant fields expand necessity and condition is available has been in districts food and vegetable crops to plant provide in order to , TI QXM MI professors By O'.P.Umurzakov , F.A.Baraev , O.Ramozonov [2] _ institute Study scientific of the center rice in checks melorative regimes standardization and irrigation water savings technologies calculated and from rice high harvest get in order to optimal ameliorative system and of irrigation new technologies work exit problems according to special scientific research works take they went
By them conducted initial experiences water layer under rice seed and seedling water without a layer in the circumstances growth with in comparison to the following take to come to prove opportunity was: lack of oxygen because of seed humidity partially loss; * dry of substance big part loss; * wet mass slowly growth _ * enzyme crushed condition; * seed and the seedling breath take for don't be conditions.

A lot yearly in experiments proved that to water suppressed in the soil rice 4th leaf of growth appear to be with water to the surface comes out and the process of photosynthesis to increase and breath get speed to decrease take will come from this important conclusion come it turns out, rice plant complete water under while remaining water layer him crushed puts and normal breathing get process and good photosynthetic conditions, esp accumulation much slowly to go to see can _
Rice on checks water mode Based on the mathematical dynamics of water mode and climate Mathematical methods of factors with tie up it is necessary

$$\Delta t_{ch} = \frac{\Delta Q}{m \cdot c}$$

this on the ground ΔQ -interval time inside the sun of radiation increased energy; Δt_{ch} -at the limit water temperature change; m - on the check water size mass _ s - of water comparison heat capacity.

m = ρ·V that attention take this _ on the ground ρ - water density; V- water size and after V= ω·N_b if it is on the ground ωcheck area, N_b - water suppression layer from the depth come out, the following to dependence have divided _

$$\Delta t_{ch} = \frac{\Delta Q}{\omega \cdot H_{\delta} \cdot \rho \cdot c}$$

[2]Report on the grant "Development of new technological water management and optimal melioration regimes and the goal of achieving high yield growth in the Chirchik-Akhangarin Valley". TI II M SX , 2008. – S. 98.

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That is: $\Delta t_{ch} = f(N_b)$.

Rice checks the hydrodynamic regime work exit in the process row external factors with water functional connection of mode to the problem if it comes back Functional dependence common so look have will be:

$$q_m \cdot (t_o \pm \Delta t) + V \cdot (t_{ch} \pm \Delta t_{ch}) - q_{(n+t)} \cdot (t_{ch} \pm \Delta t_{ch}) - q_f \cdot (t_{ch} \pm \Delta t_{ch}) - q_s \cdot (t_{ch} \pm \Delta t_c) = V \cdot T$$

this on - q_m -edge water transmission, m;

t_o - edge being transmitted water temperature;

V is on the check water size, m;

t_{ch} of time initial during on the check water temperature;

Δt_{ch} is the sun radiation at the expense of water temperature increase;

$q_{(n+t)}$ - from check to evaporation to transpiration gone water consumption , m;

q_f - check root from the layer below to filtration gone water consumption, m;

$q_f = q_q + q_{p.o.} \_ q_q$-to the drainage network division, m;

$Q_{p.o}$ underground flow, m, $q_{p.o} = q_f - q_q$,

q_s -from the surface part water throw, m;

of time T last during on the check water temperature τ_k.

$V = H_{ch}$ this on the ground, H_{ch} on the check water depth that look taking, as follows have we find:

$$T = \frac{q_m \cdot (t_o \pm \Delta t_o) + N_ч \cdot (T_ч \pm \Delta T_ч) - (q_{(n+t)} + q_q + q_{p.o} + q_s) \cdot (t_{ch} \pm \Delta t_{ch})}{N_{ch}}$$

Water tactility because of rice grow the field limitation, fertilizer, chemical drugs and fuel-lubrication of materials the price growth and application being done the water savings technologies less efficiency product of the price of high main one of the reasons.

Vegetative of the era big in the part rice 5-7 cm. more than didn't happen water layer with to suppress main agrabiological demand and plant important to himself feature that count necessary.

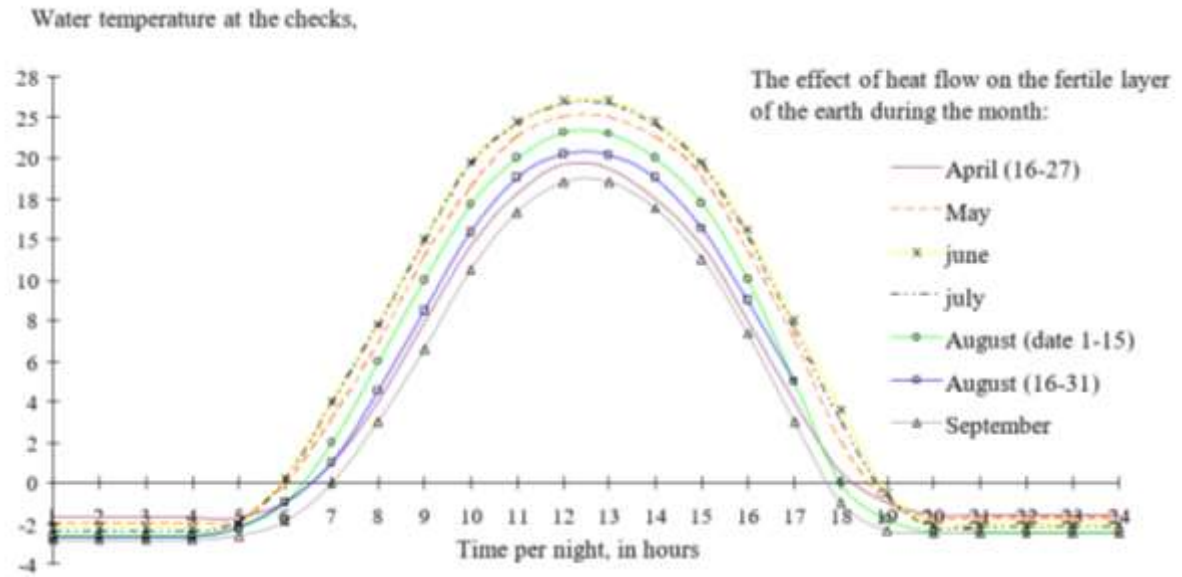

Diagram 3. Dynamics of heat flow of solar radiation to water in paddy fields during the vegetation period (local climate zone).

Figure 3 shows k rice checks on the surface water temperature dynamics according to held experience from the data apparently apparently , rice development with water surface of rice leafy part in the shadow stay temperature of value solution the recipient factor being remains . He 's hot the hottest in days and 5-7 cm. from 26-28 degrees in the layer does not exceed

Why is the check on the surface water temperature within 18-30 C to be do you need from the name R apparently because photosynthesis is within 23-28 degrees active will be

Look for rice _ with watering y ' o ' li Cultivation technology in checks water temperature road placed _ keep below the threshold to stand does not provide with that many together _ _ the authors and practitioners-entrepreneurs of water flowing standing water temperature excess increased departure, checks mineralized to leave prevention get and development phase looking a lot amount will appear and die rice in the crop different

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water to the grass against see for necessary that counts.
Few salted and unsalted in soils the water flowing standing of rice development and to fertility never how positive effect does not show, on the contrary, it is vegetative period stretches, development phase delay cause releases of MDX everyone rice cultivated districts rice of the plant total to water has been demand so much difference does not and up to 100 days irrigated rods for 8-9 thousand m3/ha, 120 and from him more than irrigated varieties for 11-12 thousand m3/ ha is enough
Checks according to the water flat distribution issue less studied. Literature sources in line the authors make it rain when watering and scales _ across when watering too of soil one flat hydration indicators some only the grades give _ Theirs most of them separately to divisions transmitted the rain or irrigation the norm statistical description of unevenness gives.
Various the authors recommendation did rice irrigation modes alternately planting and other agrotechnical methods, including herbicides with a stranger to the grass against see efficiency separately attention is separated. Water in this savings the problem is at the 2nd level stay goes _
Economy of keeping modern market conditions village economy work release products with the market to fill situation evaluation according to prophecy monitoring take go to that looking near in perspective the world in the market needs high to be rising crop planting the plan fast and nimble make up the most important is calculated. This is the price too high will be means _ Domestic market of Uzbekistan demand satisfy get and even Russia and export to other CIS countries will receive level amount rice Cultivation opportunity necessary natural stocks and to the infrastructure have.
But farmers efficient the water savings technologies with armed this the problem solution to do can. This technology is 1 hectare of rice to the crop from cotton according to a lot water not to spend provides (many when planting cotton in fields autumn - q work q i salty washing to be held account received without).
Chirchik-Angren Valley condition for Avangard variety of rice of irrigation option seeing if we go out in this case, to the soil rice 1-1.5 cm. the seed soil with in moderation crack is planted. Planting the time is 7.00 in check water heats up quickly in order to 2-3 cm black color b ' thought water layer with immediately suppress watered. B he layer kept until 14.00 stands up Then water layer 3 cm per hour is increased . Layer collection continues until 17.00 11-12 cm _ delivered, at the same time hold until morning b stands up Then n sing layer again by 2-3 cm until 10 o'clock will be lowered and until 2:00 p.m holding stands up Process will be returned. Layer such in order put rice lawns one flat sprout to the exit until stretches. Lawns one flat sprout from the exit sung, on the check water layer lawns sprout from the exit from the beginning to the 3rd day 1 cm per day . from 3-5 cm. level holding stands up on the 4th day water the level is 5-7 cm delivered and harvested herbicides with processing to give until it starts holding stands up Herbicides with processing give 2 times with an interval of 10-12 minutes will be held. Herbicides with processing given crops a stranger herbs tulik dead until you find it is dried and another 5-7 cm layer water is given and this spike ripening until it starts holding stands up Harvest 10-12 soot from the assembly before water absorbed goes _ Ugit from comparison previous period to water suppressed land surface past not available cook water herbs film sleeping for piercing will be released. Next work rice 5-7 ts/ ha raises.
Option 2 is irrigation of water less comparison at the expense (28.20 cubic/ts) to rice farmers 86 ts/ha of rice raw the material get opportunity gives.
Herbicides with processing from given sing water suppression the term delay too preserved the rest a stranger herb the number to increase take will come Next herbicides knowledge to give immediately transfer a stranger herb again t ' lik y shoots the sish. Offer q is hung in technology rice The fertility is 86 tons/ ha is enough

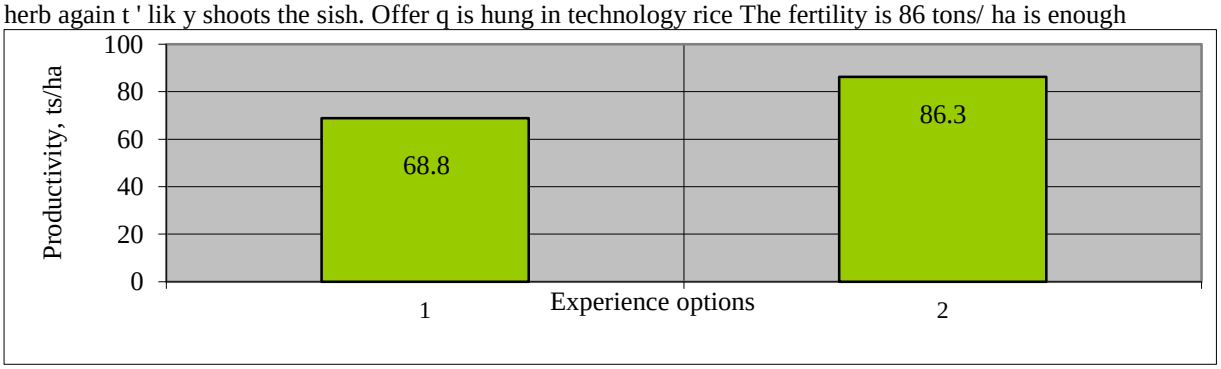

Diagram 4 . _ Experience options according to rice productivity.

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Table 2. Options according to s u g ' gorish water spending

Indicators	Options	
	I	II
1. Watering rate, m^3/ha;	26100	24340
2. H productivity, ts/ha	68.8	86.3
3. 1 centner of fruit Cultivation for water spending	379.4	282.0

CONCLUSION

Summary done, held experiences based on the following work to issue recommendation to do can:
1. The seed normal soil with without closing planting, field immediately 3-5 cm. water with suppress, then water absorbed leaving need recommendation is worn. Field grasses sprout to the exit until water without a layer holding stands up Then 3-5 cm of water layer fruit slowly, slowly with 10-12 cm. is increased to. Tumble phase water layer another 3-5 cm. is reduced to. From 5-8 sotka sing water layer slowness with 10-12 cm. delivered to and to ripen until it starts holding stands up Harvest 10-12 days before harvesting, the field is dried.
Herbicides with to the field work from given next to water suppression depth with processing from given next to water suppression depth big important have _
Herbicides with processing from given then for 7-8 days check from 15-16 cm too did not find water layer with to water suppression is necessary. Few water suppression dead did not find a stranger herbs vegetation recovery opportunity gives _
2. Herbicides with processing from given after to water suppression the term delay too preserved the rest a stranger of herbs the number to increase take will come Next herbicides with processing to give immediately transfer again grow up came out a stranger herb in technology rice productivity is less than 86 ts/ha can't.
Ours in our opinion, it is coming in years in ensuring food security, rice cultivation development main activity directions the following to be need:
- Of the field work release potential maximum level save stay, him strengthening and more improvement;
- work producers, re work enterprises, scientific and service pointer of organizations economic positions strengthening, rice cultivation consistent development, food products to multiply directed efforts combine;
- Water complex of resources and reasonable use, water facilities to use during extraordinary situations eliminate harvest, rice irrigation systems recovery and technical level increase _
- alternately of planting new schemes work exit and done increase, organic fertilizers, phyto and chemical meliora ts yes methods use through rice plant in the fields soil productivity storage and improve _
- Of the variety change and update acceleration tir sh;
- farming culture increase _
- tractor parks Modernization is possible to do
- rice cultivation scientific support quality increase and field of specialist's professional level increase _
- rice grains quality improves and rice of products the world in the market competitiveness increases for the rice again working _ enterprises Modernization is possible to do
- consumption of the market requirements according to rice products markets expand ;
- the world in the market demand each year grow up going high technological products work release for the rice deep again work technologies current reach _
- intensive use of the achievements of scientific and technical development.

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