

GLOBAL SYMPOSIUM ON SALT-AFFECTED SOILS

20 - 22
October, 2021
Virtual meeting

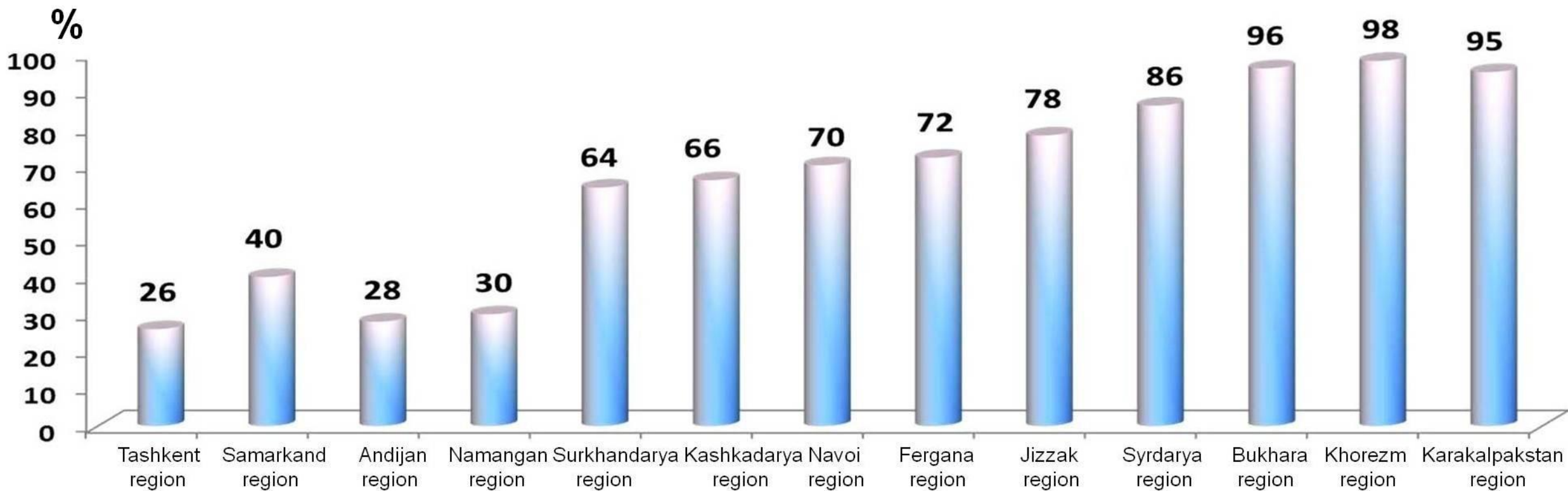
Innovative biotechnology for sustainable
management of saline soil fertility, nutrition
and productivity of cotton and wheat

prof. Gulnara Djumaniyazova





Area of saline soils in Uzbekistan, %





On saline soils, crops during the growing season exposed to multiple stress factors:

- salt stress;
- temperature stress;
- water deficiency;
- water stress (waterlogged soil);
- winter drought;
- pesticide stress;
- stress at disturbance of the technology of application of fertilizers

all these phenomena led to
contravention of microbiological processes in the soil
and resulted
in imbalance of mineral composition of the soil
which led to
contravention of plant nutrition
as result we can see

- decreasing of field germination of seeds
- inhibition of the development of the root system, stems and leaves of plants,
- weight reduction plant,
- increase the disease incidence of plants and quantity of pests,
- reduction of the yield and quality of agricultural products.





Plant development on saline soils in the Syrdarya region of Uzbekistan



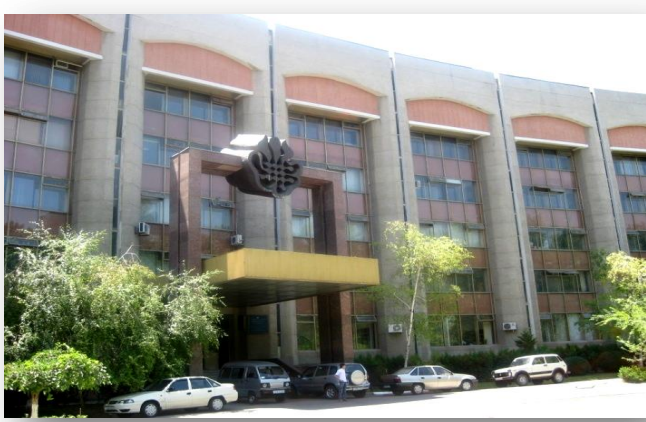
Development of cotton plant



Development of winter wheat

To help plants cope with stress and not disrupt the natural rhythm, it is necessary to provide them with high-quality, affordable and dosed nutrition through the root system and leaves

Therefore, our task was to develop anti-stress biotechnological methods for management the fertility of saline soils and nutrition of cotton and wheat plants.



In the laboratory of soil microbiology and biotechnology of the Institute of Microbiology of the Academy of Sciences of the Republic of Uzbekistan we have developed an innovative environmentally friendly, resource-saving and cost-effective biotechnology for growing cotton and wheat on saline degraded soils





New biotechnology is based on the complex use of the following biopreparations:

Biopreparations of the Rizokom series



for pre-sowing treatment of cotton plant seeds



for pre-sowing treatment of wheat seeds



Biopreparation of the Serhosil



for treatment plant leaves





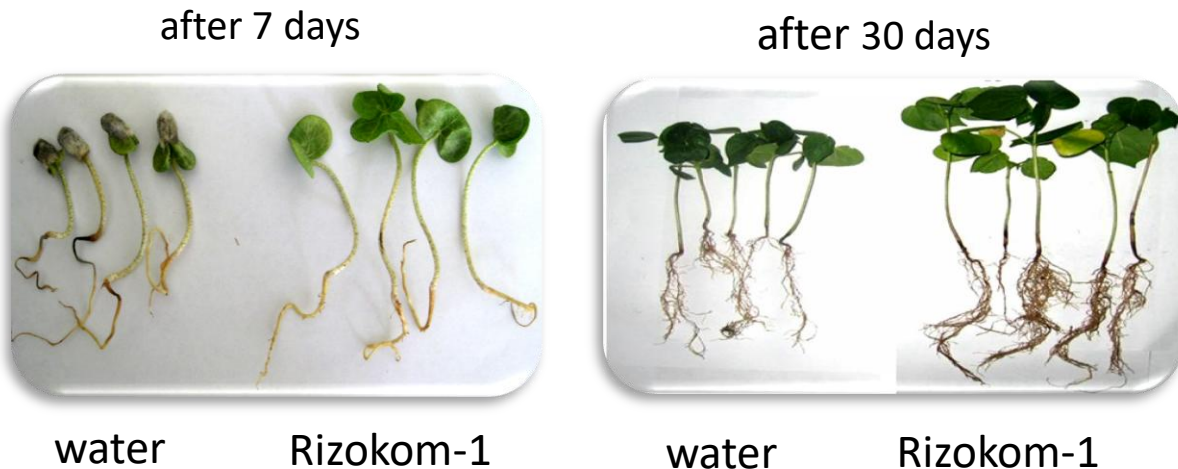
Biopreparation of complex action Rizokom-1



Composition: association of 4 active strains of salt-tolerant phosphor-mobilizing cotton PGPR with following polyfunctional properties:

- resistance to high concentration (10-15%) of chloride (NaCl, MgCl₂) and sulphate (Na₂SO₄, MgSO₄) toxic salts;
- phosphorus mobilizing ability;
- antagonistic activity against phytopathogen of cotton plant (*Verticillium dahliae*, *Fusarium solani*, *Fusarium oxysporum*, *Fusarium oxysporum vazinfectum*, *Alternaria alternata*);
- destructive activity to organochlorine pesticides (HCCH and PCB);
- release of phytohormones - auxins and gibberellins;
- root-forming and growth-stimulating activity

The amount of organochlorine pesticides in the soil after the application of the biopreparation Rizokom-1



water Rizokom-1

water Rizokom-1

Application rate: 50 ml/ha

Experience options	The determined amount of organochlorine pesticides in the soil (after 1 month, ng/g to the soil)
Control - soil (50 g) + HCCH (2 mkg)	2041,56
Experiment - soil (50 g) + HCCH (2 mkg) +biopreparation	14,21



Biopreparation of complex action Serhosil

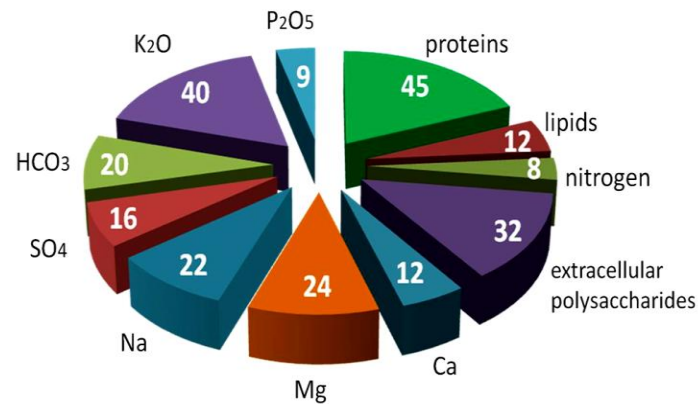


Composition: green microalgae
g.Scenedesmus.

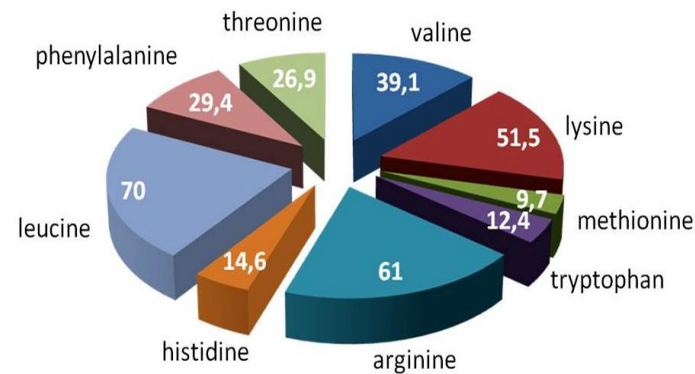
Method of application:
spraying the leaves

Application rate:
500 L/ha

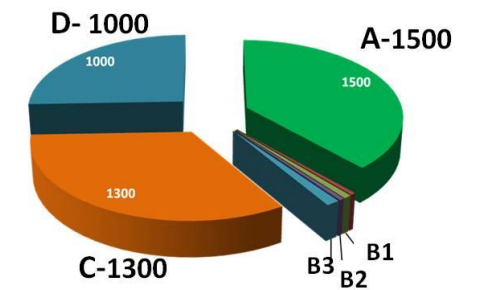
The chemical composition of the biopreparation Serhosil, %



Content of aminoacids in biopreparation, g/kg



Content of vitamins in biopreparation, mkg/kg

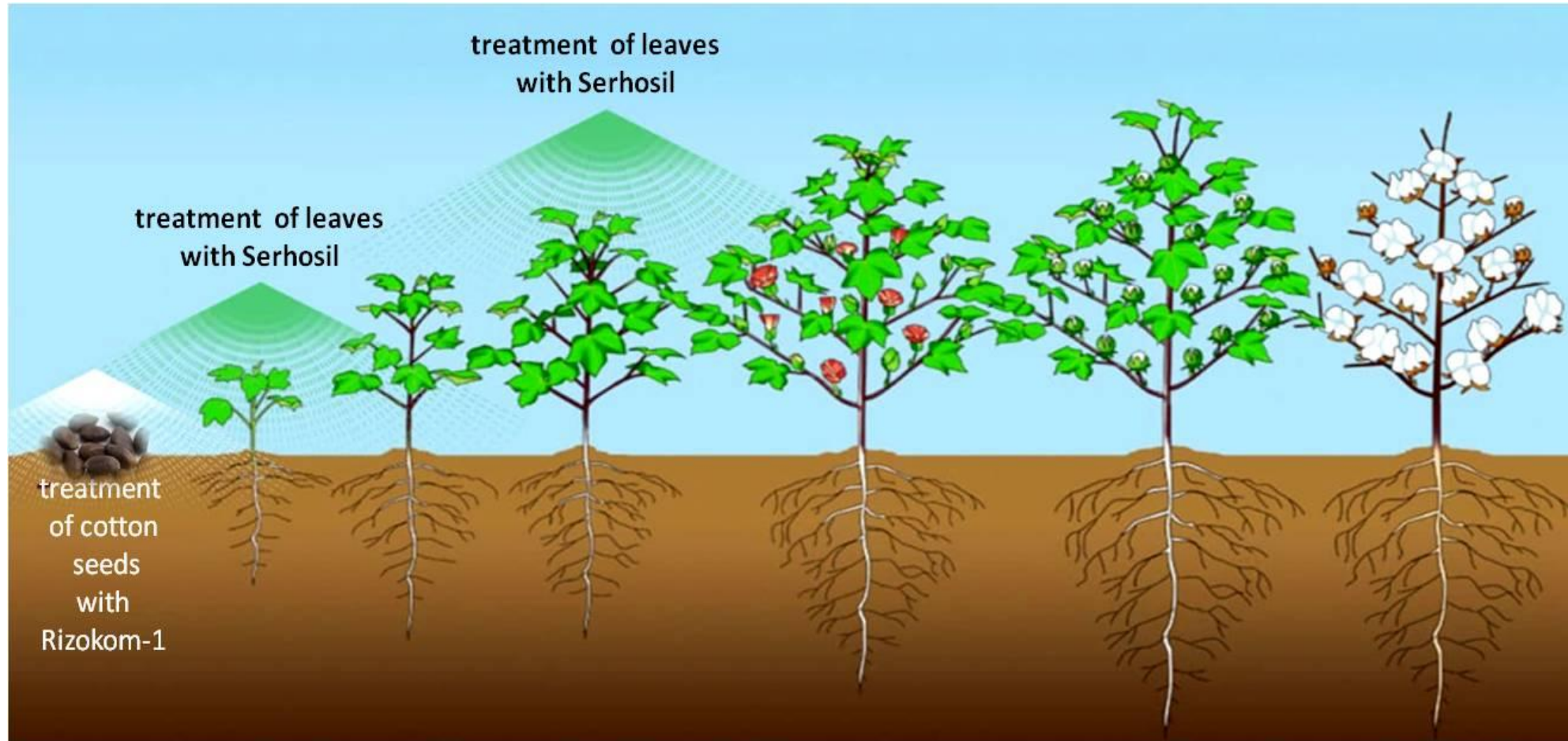


Content of biologically active substances:

Auxins, gibberellins, carbohydrates, proteins, organic acids - glycolic, citric, formic, oxalic
fatty acid - palmitic, myristic, oleic, linoleic, **phospholipids**,
the extracellular polysaccharides - 25-40% - glucose, galactose, arabinose, xylose



Technology of using biopreparations Rizokom-1 and Serhosil on cotton



**phase 5-6
of real leaves**

**phase
buds**



Influence of biotechnology on the development of cotton on highly saline soils of the Syrdarya branch of the Institute of Cotton Growing



NPK+ biotechnology



control, NPK

control, N.PK



NPK+ biotechnology

control, NPK.
14 cotton bolls

NPK+ biotechnology,
28 cotton bolls



The influence of Rizokom-1 and Serhosil on the development of cotton on slightly saline takir soil. Farm A. Namazov of Mirishkor district of Kashkadarya region



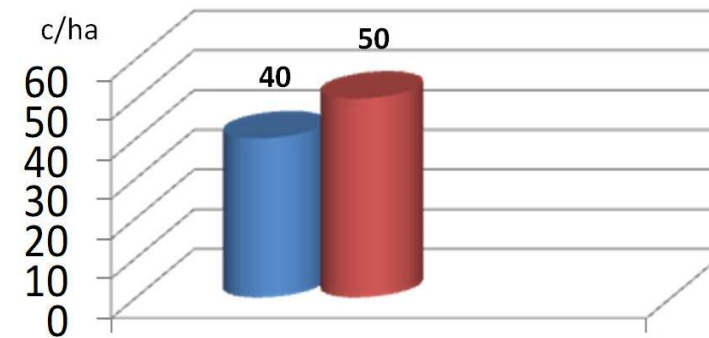
NPK+ Rizokom-1+Serhosil

control- NPK



**control- NPK,
average weight of 1 box
of cotton - 6,0 g**

**NPK+ Rizokom-1+Serhosil,
average weight of 1 box
of cotton - 8,0 g**



■ control-NPK

■ experiment-NPK+Rizokom-1+Serhosil



State tests of biotechnology on highly saline soils of the Syrdarya branch of the Institute of Cotton Growing



control, NPK-100%



NPK+ biotechnology



control, NPK-100%, on average 11-12 cotton bolls per plant



NPK+ biotechnology, on average 50-52 cotton bolls per plant

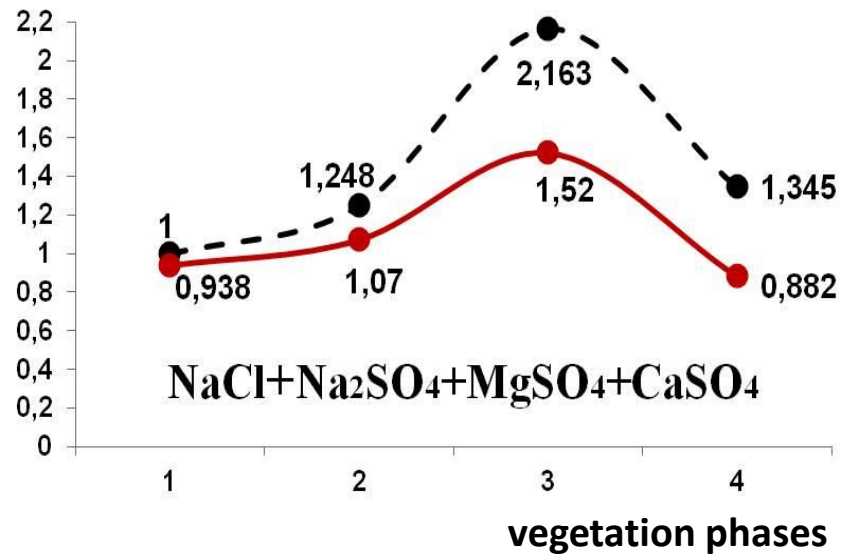
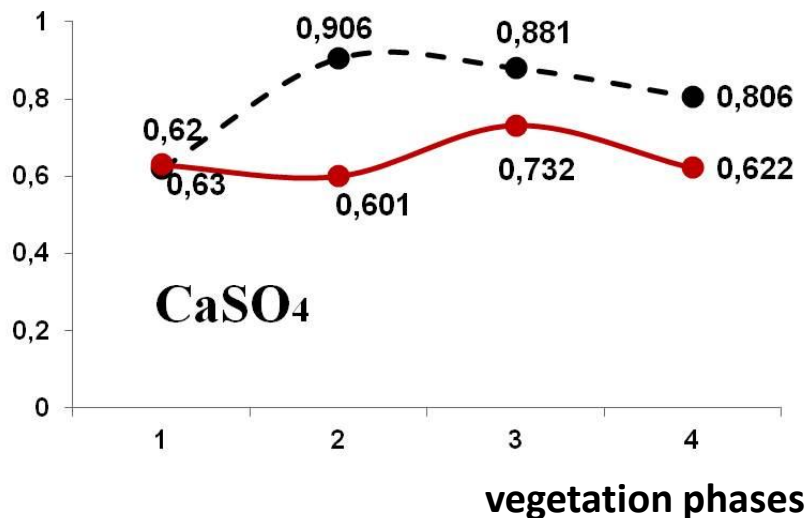
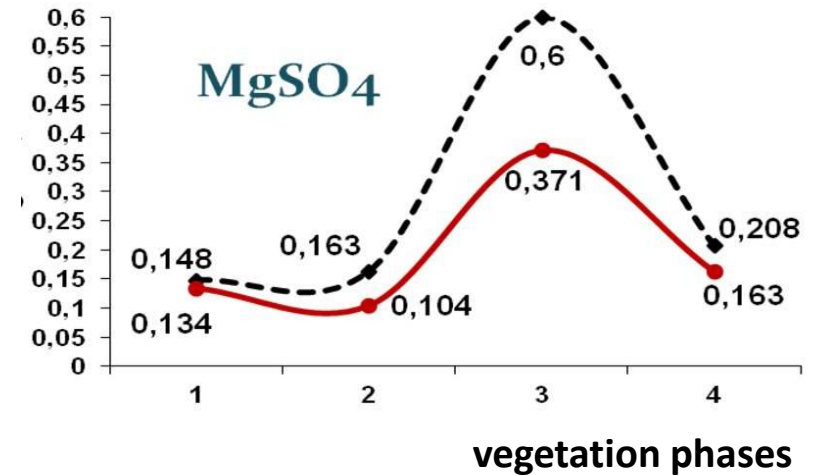
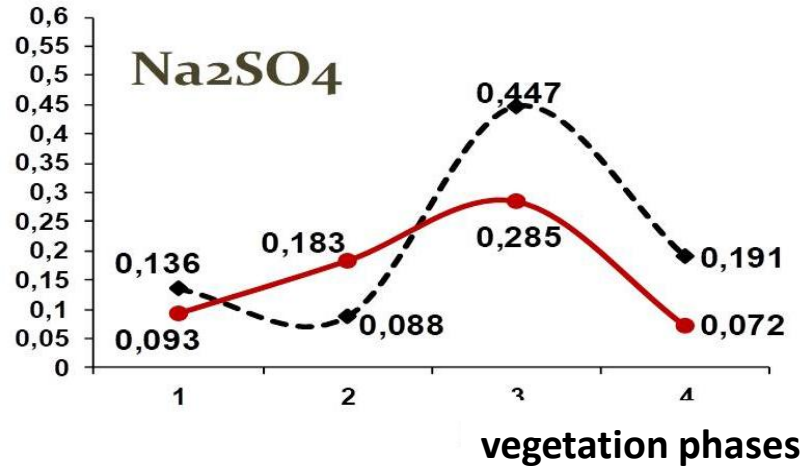
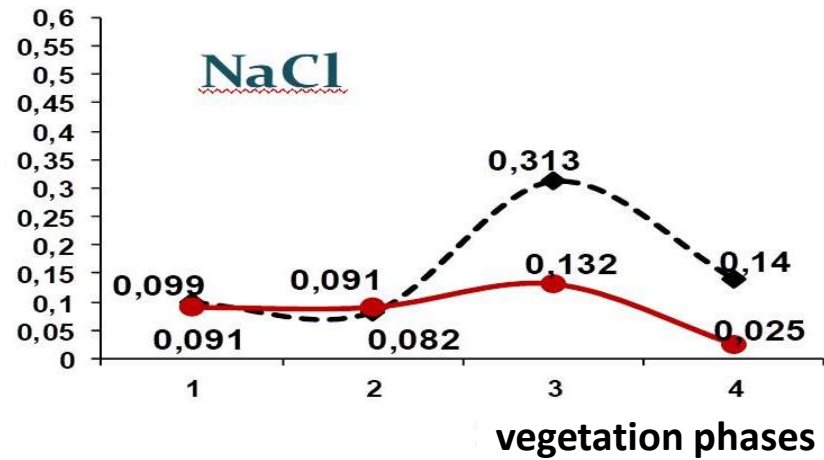
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harvest - 19 c/ha

harvest - 40 c/ha



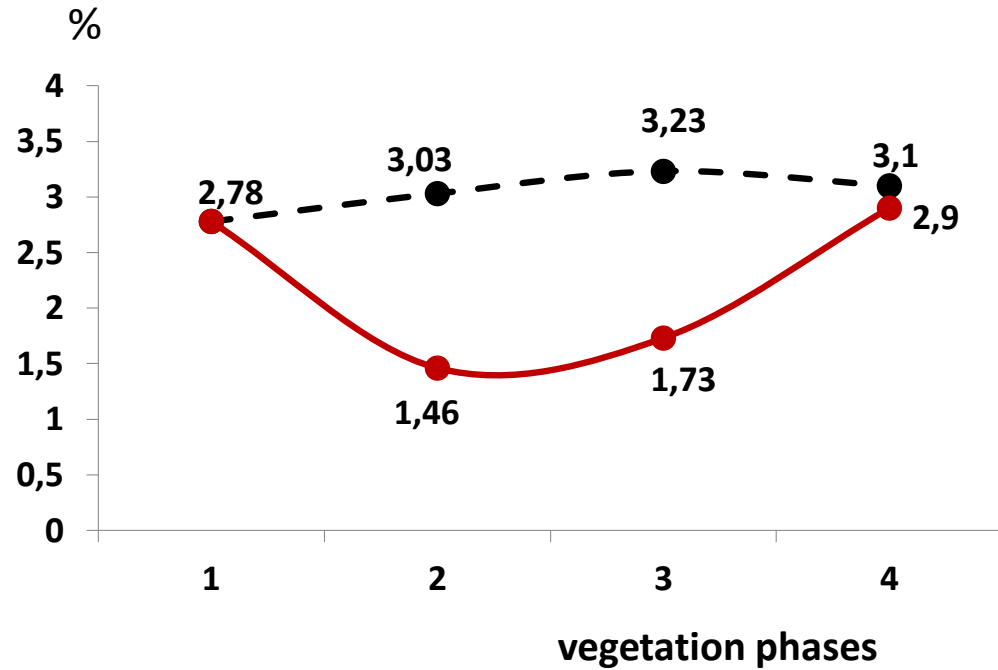
Influence of biotechnology on salt content in strongly saline soils during the growing season of cotton,% (Syrdarya branch of the Institute of Cotton Growing)



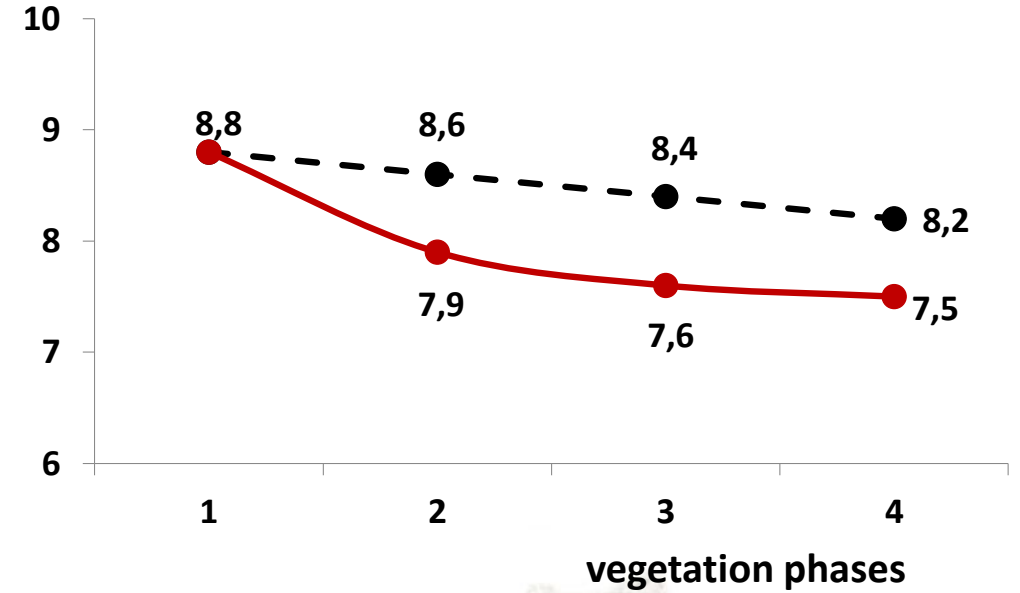
- 1- original soil
 - 2 - bud phase
 - 3 - flowering-fruited phase
 - 4 - ripening phase
- NPK
 — NPK+biotechnology



Influence of biotechnology on the dynamics of changes in the pH and humus content of saline soils during the growing season



- 1- original soil
- 2 - bud phase
- 3 - flowering-fruiting phase
- 4 - ripening phase



- NPK
- NPK+biotechnology



Biological preparations of the Rizokom series were included in the Resolution of the President of the Republic of Uzbekistan dated July 14, 2018 No. PP-3855

"On additional measures to increase the efficiency of commercialization of results scientific and scientific-technical activities"



In pursuance of this Resolution, a small company was created for the production and introduction of new biotechnologies in the agriculture of the Republic



Influence of biotechnology on cotton yield in field conditions, moderately saline soils

(Syrdarya region, Oqoltin district, Cotton grown with 1 watering, 2020)



control, NPK-100%



NPK+ biotechnology



**Fergana region, Rishtan district Rus-Uzbek Tex Cluster .
Influence of biotechnology on the development of cotton in the desert zone, in
strongly saline soils (+ 10 cotton bolls on 1 bush), 2021 y.**



Control field, NPK-100%



NPK+ biotechnology



Results of biotechnology in highly saline soils (Kungrad district of the Republic of Karakalpakstan, "Kaysar Mahmud" farm, 2021)



NPK+ biotechnology



control, NPK-100%



NPK+ biotechnology



Cotton harvest 2019-2021 when using biological products Rizokom-1 and Serhosil on an area of 20 000 hectares

Region	Farm	Cotton variety	Cotton yield, c / ha		Increase in yield, c/ha	Increase in yield, %
			control, NPK	NPK+RIZOKOM-1+SERHOSIL		
Bukhara region Shofrikansky district	LLC "Buxoro Zarxal Textile", "Shohrukh, Azizbek kelazhagi"	Bukhara -6	23,0±1,1	31,0±1,2	8,0±0,05	34
Bukhara region Vobkent district	"Push Toshobod"	Bukhara -8	40,0±2,1	50,0±2,5	10,0±0,7	25
Fergana region Uzbekistan district	"Mukhtasarkhonbegim"	Наманган-77	16,0±0,7	28,0±1,6	12,0±0,98	75
Fergana region Fergana region	JV LLC "Fergana Oceana"	C-8290	18±1,0	29,0±1,06	11,0±0,98	61
Fergana region Kushtepa district	JV LLC «Global Textile Solutions»	Наманган-77	16,0±0,65	22,0±1,1	6,0±0,94	37,5
Fergana region	«Patilakhon»	Наманган-77	35,0±1,7	40,0±1,7	5,0±0,35	14,3
Andijan region	«Buz Imkon Rivozh »	Андижон-35	33,0±1,2	39,0±1,47	6,0±0,6	18
Kashkadarya region Nishan district	«Kholiyarov Abdusalom»	Порлок-4	27,0±1,05	46,0±2,3	19,0±1,1	70

Region	Farm	Cotton variety	Cotton yield, c / ha		Increase in yield, c/ha	Increase in yield, %
			control, NPK	NPK+RIZOKOM-1+SERHOSIL		
Kashkadarya region Kasby district	«Kamashi Rosti-Rusti»		37,0±1,72	41,0±2,03	4,0±0,8	10,8
Andijan region Kurgantepa district	«Oq Suv»	Andijan-36	40,0±2,0	44,0±2,5	4,0±1,05	10
Navoi region Kyzyltepa region	«Rabotning barakali zamini»	Bukhara --6	33,0±1,29	40,0±2,0	7,0±1,0	21,2
Syrdarya region Bayavut district	«Ahmadiy»		35,0±1,3	40,0±2,0	5,0±0,2	14,3
Jizzakh region Dustlik district	«Bakhtiyorbek»		27,0±1,05	34,0±1,8	7,0±0,62	25,9
Tashkent region Chinaz "Organic" cotton	«Textile Technologies»		26,0±1,0	32,0±1,1	6,0±0,7	23
Tashkent region Pskent region	«Agro Stimul Tex Service»	Султон	26,0±1,0	40,0±2,3	14,0±1,1	53
Karakalpakstan Kungradsky district	«Mustakilik»	Ф-47-27	15,0±0,8	25,0±1,4	10,0±1,0	66
Karakalpakstan Kungradsky district	«Dzhienbaev»	Ф-47-27	23,0±0,78	30,0±1,5	7,0±0,05	30
the average			28±1,05	36,0±1,8	8,0±0,1	33



Cotton farms using biotechnology in the Karakalpakstan (2019-2021)

Region	Farm	Year	Cotton variety	Cotton yield, c / ha		Increase in yield, c/ha	Increase in yield, %
				control, NPK	NPK+RIZOKOM-1+SERHOSIL		
Kungrad district	«Мустақиллик»	2019	C-4727	12,0±1,8	20,0±2,1	8,0±1,0	66,6
Kungrad district	«Мустақиллик»	2020	C-4727	15,0±0,8	25,0±1,4	10,0±1,0	66,6
Kungrad district	«Dzhienbaev»	2019	C-4727	20,0±2,7	26,0±2,6	6,0±1,0	30,0
Kungrad district	«Dzhienbaev»	2020	C-4727	23,0±0,7	30,0±1,5	7,0±0,05	30,4
Turtkul	«Turtkul Agroklaster» LLC	2021	C-4727	26,0±0,8	34,5±1,5	8,5±1,0	32,7
the average				19,2±0,9	27,1±2,6	7,9±1,0	41,1



Biopreparation of complex action Rizokom-2



Composition: association of 3 active strains of salt-tolerant phosphor and potassium mobilizing wheat PGPR with following polyfunctional properties:

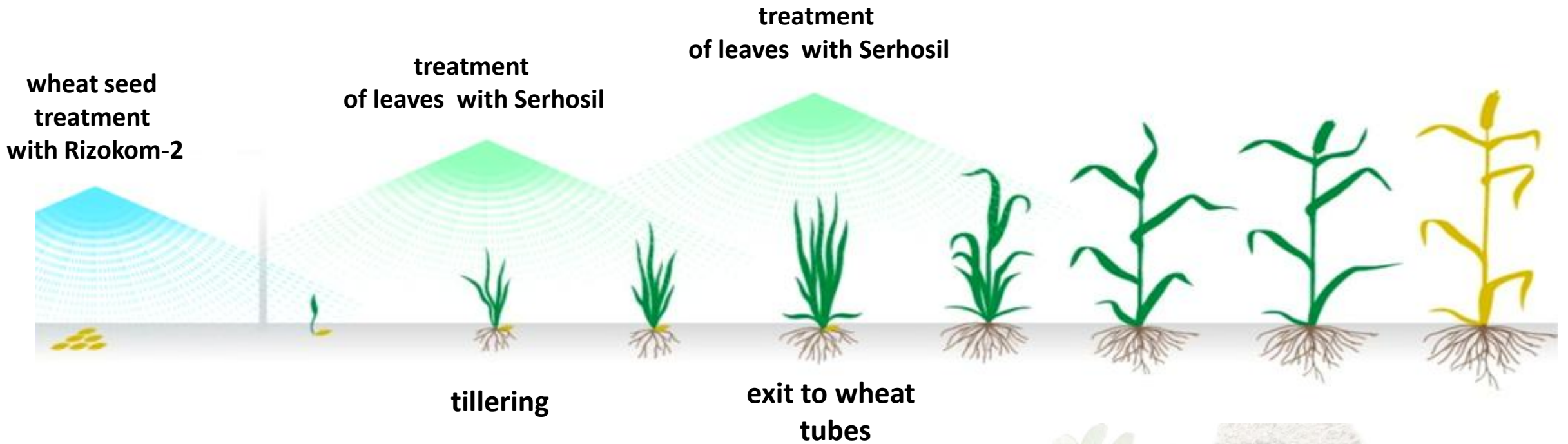
- increases the germination of seeds of winter wheat by 99% on saline soils
- converts phosphorus and potassium into forms available for plants
- normalizes the pH of alkaline soil
- improves the balance of the microbial community and nutrition of plant by macro- and microelements
- stimulates the root formation of wheat on saline soils
- restores the fertility of saline soils
- reduces the quantity of toxic salts
- raises immunity of plants, resistance to stress condition,
- reduces the incidence of wheat
- increases yield of grain to 10-12 c/ha
- abridges times of maturation of crops to 10-15 days

Application rate: 100 ml/ha





Technology of using biopreparations Rizokom-2 and Serhosil



Influence of new biotechnology on seed germination, growth and development of wheat on medium saline soil of Syrdarya region



Experience-
NPK +
biotechnology

Control-
NPK,
traditional
method





The efficiency of biopreparations Rizokom-2 and Serhosil on winter wheat on highly saline soils of Sirdarya region



Control -NPK



Experiment -NPK+ RIZOKOM-2+SERHOSIL





Influence of new biotechnology on the development of the root system of the aboveground mass of wheat, the development of spikelets and wheat grains on the highly saline soil of the Syrdarya region



**control
-NPK**

**Experiment -
NPK+
RIZOKOM-2+
SERHOSIL**



Control -NPK

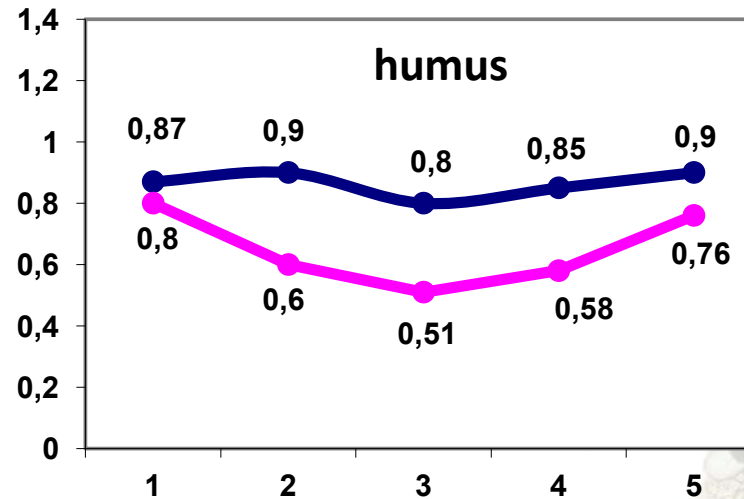
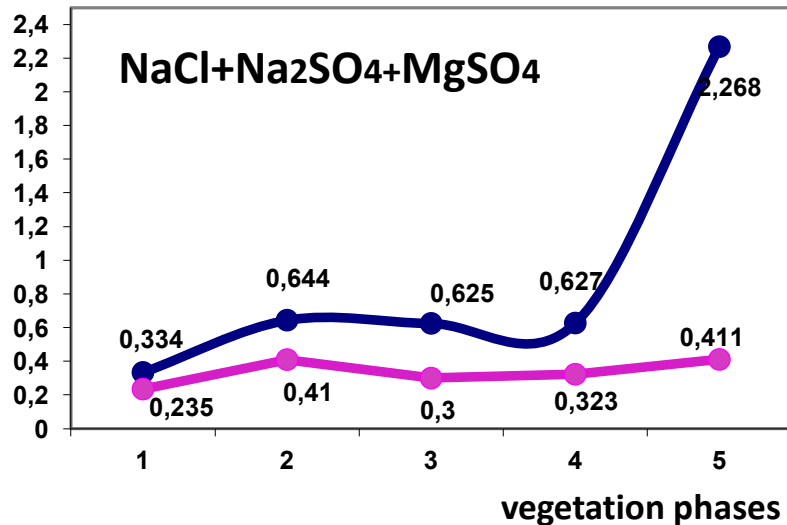
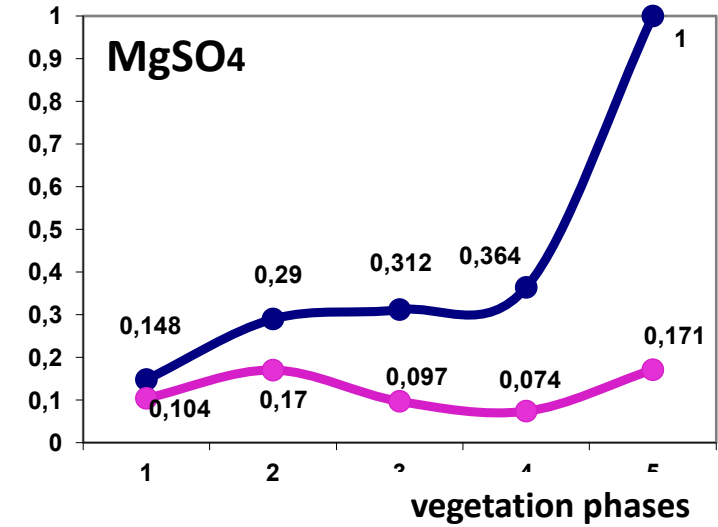
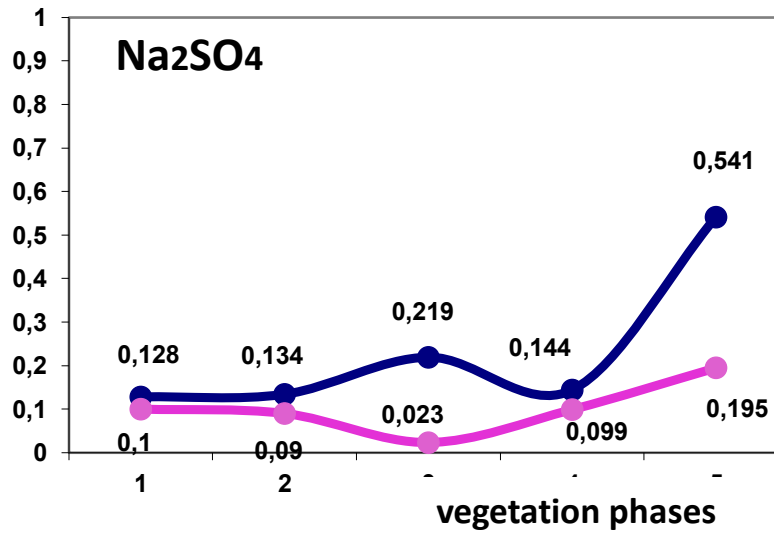
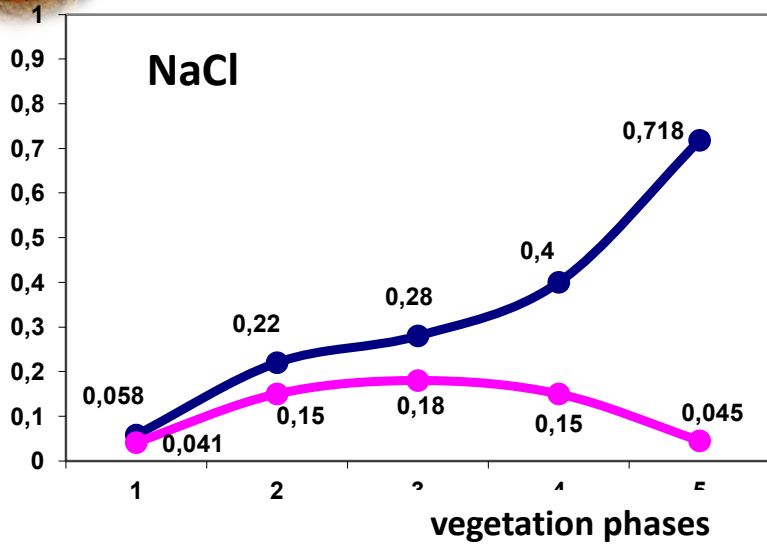
Experiment -NPK+ RIZOKOM-2+SERHOSIL



mass of grains



The effect of biotechnology on the salt content of strongly saline soils during the growing season of winter wheat, %



- 1- original soil
- 2 - tillering
- 3 - exit to wheat tubes
- 4 - earing
- 5 - maturation

— NPK - 100%
 — NPK-50%+ biotechnology



The influence of biotechnology on the development of wheat on medium saline soils of the Bukhara region

**RIZOKOM-2+
NPK**



**control,
NPK**



**control,
NPK**

**RIZOKOM-2 +
NPK**

**RIZOKOM-2 +
SERHOSIL+
NPK**



**control,
NPK**

**RIZOKOM-2+
NPK**

**RIZOKOM-2
+SERHOSIL+NPK**





Influence of biotechnology on biometric indicators of development and wheat yield on saline soils of Bukhara region

experience options	plant height, cm	spikelets length, cm	number of spikelets per 1 plant, pcs	Weight of 1000 grains, g	harvest center / ha	yield increase, centner / ha
control, NPK	67,3±1,3	6,5±0,6	3,7±0,3	51,0±1,1	52,5±0,8	-
experiment – RIZOKOM-2+ NPK	<u>74,3±2,3</u>	10,0±2,1	6,0±1,7	53,0±2,1	<u>70,3±2,2</u>	17,8±0,7
experiment- RIZOKOM-2 +SERHOSIL+NPK	<u>78,3±2,9</u>	<u>11,0±1,2</u>	<u>7,3±1,2</u>	55,0±2,9	<u>77,4±1,2</u>	24,9±1,1

p<0,05 –reliably with respect to control

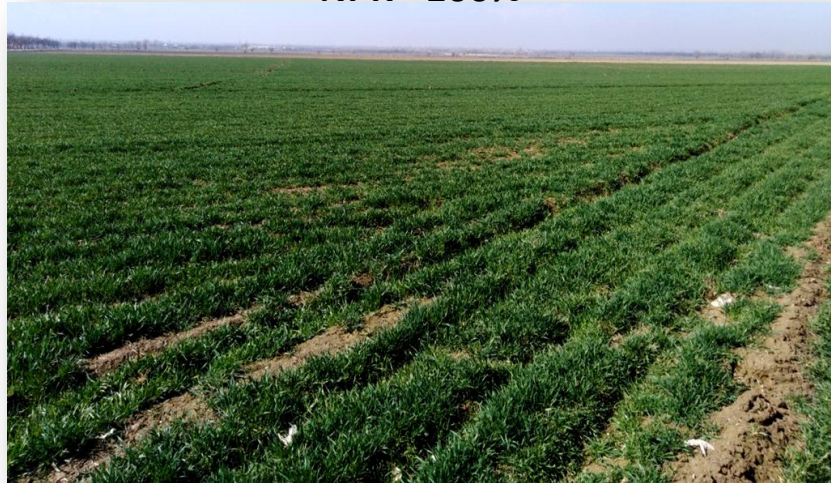




The impact of new biotechnology on the development of roots and plants of wheat in moderately saline soils of Andijan region (26.02.2020 y.)



NPK - 100%



NPK+биотехнология



**гўнг +
биотехно-
логия**

**назорат,
NPK**

**NPK+
биотехно-
логия**



The influence of biotechnology on the development of wheat on highly saline soils of the Fergana region, district – Uzbekistan, farm "Mukhtasarkhonbegim" (30.05.2021 y.)



in control - 28 c/ ha,
in experiment - 40 c/ha,
additional yield -12 c/ha



Wheat harvest when using biopreparation Rizokom-2 in 2020 -2021 y. on an area of 10 000 hectares

Region	Farm	Wheat yield, c / ha		Increase in yield, c/ha	Increase in yield, %
		control, NPK	NPK+RIZOKOM-2+SERHOSIL		
Kashkadarya region Kasby district	«Kamashi Rosti-Rusti»	35,0	61,0	26	74
Navoi region Kyzyltepa district	"Workers were barrakas zamini»	51,0	60,0	9,0	17,6
Fergana region Uzbekistan district (very salty soil)	"Mukhtasarkhon Begim"»	28,0	40,0	12,0	42,8
Fergana region Dangara district	"Dangara Mehr Tarovati"	68,0	80,0	12,0	17,6
Fergana region Yeouzewon District	"Bakhrombek"	67,0	80,1	13,1	19,5
	"Kaldirkoch"	68,0	80,0	12,0	17,6
	"Razibonu"	67,0	80,0	13,0	19,4
Fergana region Kuva district	"Oltin diyor Oq Oltin"	68,0	78,0	10,0	14,7

Region	Farm	Wheat yield, c / ha		Increase in yield, c/ha	Increase in yield, %
		control, NPK	NPK+RIZOKOM-2+SERHOSIL		
Fergana region Oltiari district	"Khairulo Bakhrom Boymatov"	68,0	80,0	12,0	17,6
Fergana region Toshlok district	"Lukmonov"	66,0	79,5	13,5	20,0
Fergana region district Uchkyprik	"AAP Azizov Akbarali"	67,0	80,0	13,0	19,4
Fergana region Furhat district	«Ўрикзор»	68,0	80,0	12,0	17,6
	"Integral"	69,0	79,0	10,0	14,5
Khorezm region Kushkupirsky district	"Oltin Tulpor Shiddati"	45,0	62,0	17,0	37,7
Khorezm region Gurlensky district	"Rustam Ahmad"	46,0	56,0	10,0	21,7
Andijan region Buston district	"Katta yul ziynati"	55,0	68,0	13,0	23,6
the average		53,7	65,5	11,8	22,0



The use of new biotechnology for growing cotton and wheat on saline soils has the following main effects:

ecological effect:

- ✓ the balance of soil microflora is normalized, the biodiversity of soil flora and fauna increases;
- ✓ the doses of mineral fertilizers are reduced by 25-50% depending on the agrochemical composition of the soil
- ✓ reducing or eliminating chemical pesticides for seed treatment by replacing them with environmentally friendly biopesticides
- ✓ decreases the chemical effect on the agrocenosis
- ✓ the degree of phosphatization, gypsum content, salinity, soil contamination with mycotoxins and organochlorine pesticides decreases
- ✓ the fertility of degraded soils is restored and gradually increases

economic effect:

- increases the yield of cotton and wheat by 20-30%
- the incidence of plants and their attack by pests is reduced by increasing the immunity of plants
- the ripening time of the crop is reduced by 15-20 days
- the doses of fertilizers are reduced depending on the chemical composition of the soil

resource saving effect:

- ❖ the efficiency of the applied fertilizers increases by increasing their digestibility by plants
- ❖ the costs of irrigation water are reduced by 20-30%
- ❖ the costs of sowing seeds are reduced by 15-20%

social effect:

- ☐ improves the quality of cotton fiber and wheat grain
- ☐ health of the population is improving





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Thank you for attention!

