PRO AGRO
LECTORIUM

Degraded pasture soils and innovative technologies to increase their productivity

Ministry of Education

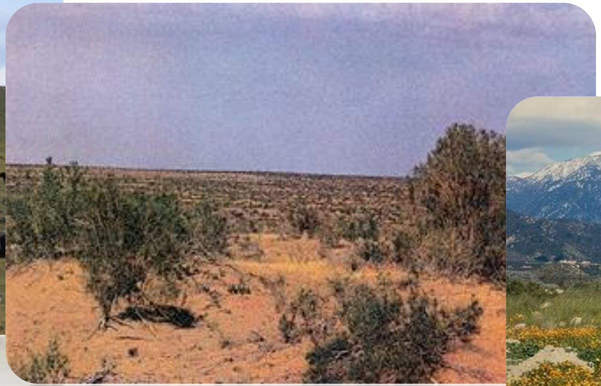
Mirzo Ulugbek National University of Uzbekistan

Professor L. Gaphurova

Introduction

Pasture soils condition and characteristics in the Republic of Uzbekistan.

- It is well known that pastures have always been an important resource for our people, who have extensive experience in agriculture and animal husbandry. But it is also no secret that in the recent past, our pastures have been damaged due to irrational land use.
- According to the analysis , 78% of the country's 21.1 million hectares of pastures have been degraded to date. In other fields, the situation is not very good either: on pastures and hayfields, the number and types of plants have decreased by more than 20%, and the yield has halved, including an average of 2 centners per hectare for fodder crops.



Pastures of Uzbekistan: condition and features

Pastures:

- ✓ Pastures are areas with natural vegetation that serve as food for livestock.
- ✓ Pastures are a national treasure and are protected by the state.
- ✓ Pastures are divided into desert, semi-desert, foothill, mountain, and plain; irrigated and non-irrigated pastures. Mountain pastures are seasonal and are used only at certain times of the year.
- ➢ Law “On Pastures” of The Republic Of Uzbekistan, article 3.

Area of hayfields and pastures in the Republic of Uzbekistan

№	Region	General land use		Including							
				Agricultural land		Counting					Homestead land
						Arable land		Perennial plantations	Fallow	Hayfields and pastures	
		Total Area	Irrigated	Total	Irrigated	Total	Irrigated				
1	Republic of Karakalpakstan	16,656.1	510.5	5,716.1	474.3	418.5	418.5	8	11.2	5,278.4	47.7
2	Andijan	4,303	273.5	256.6	234.2	202.4	202.4	30.2	2.8	21.2	48.1
3	Bukhara	4,193.7	274.7	2768	227.2	199.7	199.7	20.6	6.9	2,540.8	59
4	Jizzakh	2,117.9	300.4	1,265.2	277.5	480.8	260.7	18.5	8.2	757.7	31.9
5	Qashqadaryo	2,856.8	515.1	2,144.7	459	678.4	419.8	37.1	21.9	1,407.3	80.3
6	Navoiy	10,937.5	123.5	8,866.4	108	111.5	91.7	10.4	6.8	8,737.7	20.6
7	Namangan	718.1	283.2	389.2	238	191.5	191.5	44	2.5	151.2	50
8	Samarqand	1,677.3	380.2	1,300.8	311.3	428.8	246.5	69.5	5.2	797.3	87.2
9	Surxondaryo	2,009.9	325.6	1,143.7	271.8	279.8	239.9	33.3	0.3	830.3	62.9
10	Sirdaryo	427.6	287.2	287.5	267.3	249.9	249.9	7	10.4	20.2	19.3
11	Tashkent	1,525.4	399.2	823.3	341.7	331.8	297.8	50.5	0.8	440.2	65.9
12	Fergana	700.5	368.7	320.6	301	247.7	247.7	49.4		23.5	72.7
13	Xorazm	608.2	265.9	331.8	222.4	205.5	205.5	13.1	3.8	109.4	51.4
14	City of Tashkent	33.1	3.8	0.1	0.1	0.1	0.1				6.9
Total		44,892.4	4,311.5	25,614	3,734.2	4,026.4	3,271.7	391.6	80.8	21,115.2	703.9

Pasture degradation factors

- The main reasons for the decline in pasture productivity are:
  - Firstly, climate change;
  - secondly, in the conditions of increasing livestock number at the disposal of the population, the process of using pastures is not regulated;
  - thirdly, the livestock breeding system adapted to the new conditions was not developed until recently;
  - fourthly, the reduction of fodder plant species on pastures and their replacement with other uncontrolled plant species;
  - fifthly, insufficient attention is paid to pasture irrigation, melioration, and seed production.
- It should be noted that all these factors contribute to pastures' degradation and seriously impede this industry's rapid development.

Pasture degradation factors

What is pasture degradation

- Pasture degradation is defined as a significant change in the natural vegetation of pastures as a result of excessive grazing (overgrazing, irregular use of vegetation for various economic needs), a decrease in forage productivity of pastures, and a decrease in the number of species.
- Of the 45 causes of the pasture crisis, 87% are said to be directly related to human activities, and a small 15% to natural processes (sudden climate change).
- The main components and shares of the pasture crisis are distributed as follows: an abrupt change in vegetation cover 44.0%, deflation 11.2%, salinization 8.7%, water erosion 5.5%, technogenic factors 2.1%, degradation of the well area 28.0%.
- Phytoindicators of degraded pastures

- **Phytoindicators of degradation** were found on arid pastures. These include Delphinium semibarbatum, Prostrata drupacea Bge., Acanthophyllum pungens (Bge.) Boiss., Peganum harmala L., Anabasis aphylla L., Phomis thopsoides Bge., Ammodendron conollyi Bge., Hordeum leprende robinkum. Bge., Eremostachys labiosa Bge, and others.

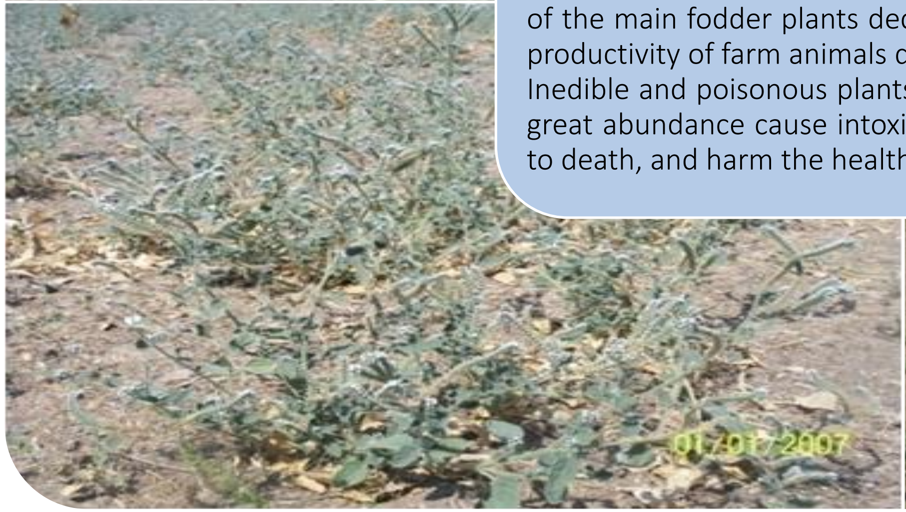
Pasture degradation indicators

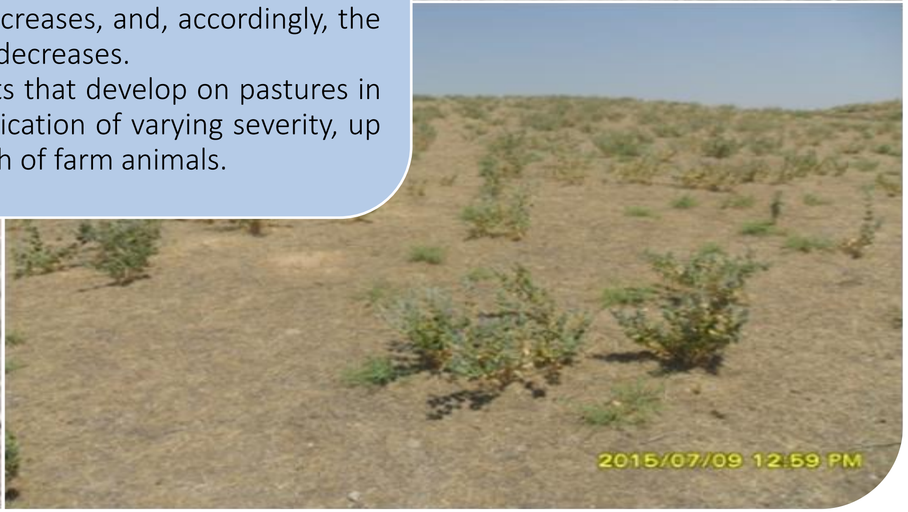
Indicator	Degradation degree				
	Non-degraded	Slightly degraded	Moderately degraded	Highly degraded	Very highly degraded
Number of plant species, pieces/ha	40	28-35	20-25	10-17	3-6
Sod area, %	70-80	60-50	40-30	10-5	-
Projective plants cover, %	45-40	35-30	25-20	10-5	2-1
Number of plants per 1 m2	300-350	200-250	120-150	50-30	9-10
Humus, %	>1.0	0.6-1.0	0.4-0.6	0.2-0.4	<0.2
Relative BA	100	60-80	40-60	20-40	0-20
Physical clay, %	30-45, 45-60	20-30, 30-40	20-30	10-20	<10
Dense residue, %	<0.3	0.3-1.0	1.0-2.0	2.0-3.0	>3
Type of humus, in layer 0-20 cm	fulvate-humate	humate-fulvate	humate-fulvate	fulvate	fulvate

Inedible and poisonous pasture plants

One of the signs of pasture degradation is an increase in the degree of weediness, i.e. an increase in the abundance and area of thickets of poisonous, inedible, and weedy species - kozykulak, harmel, heliotrope, akkuray, and others. At the same time, the abundance and productivity of the main fodder plants decreases, and, accordingly, the productivity of farm animals decreases.

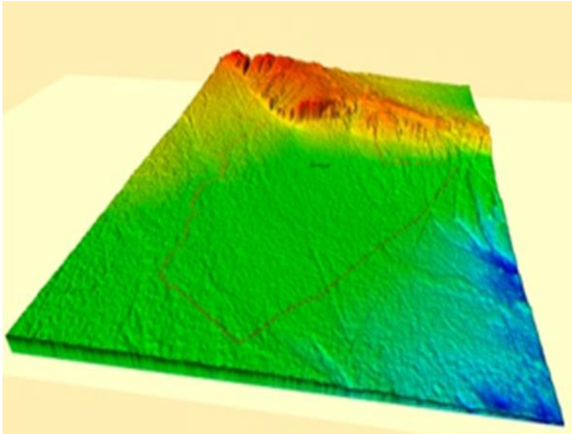
Inedible and poisonous plants that develop on pastures in great abundance cause intoxication of varying severity, up to death, and harm the health of farm animals.

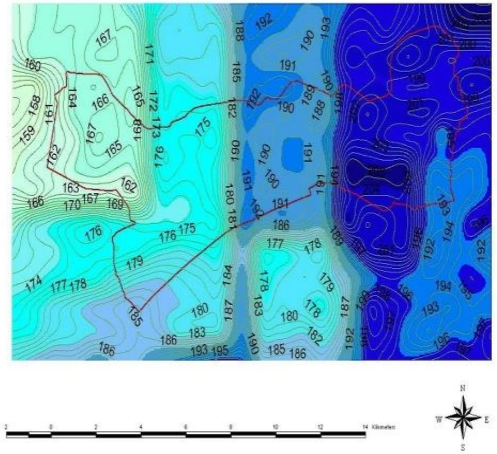


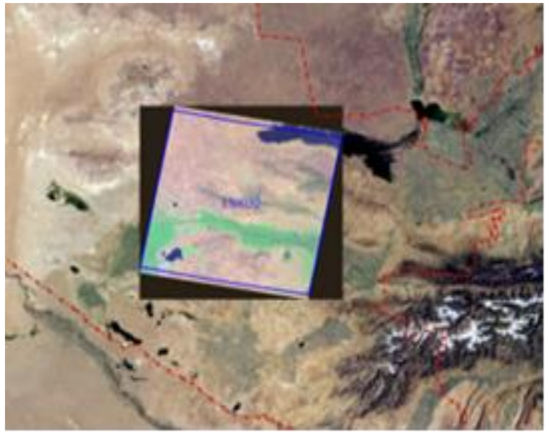


Monitoring the state of desert pastures based on ERS and GIS technologies

The use of remote sensing methods in monitoring desert pastures using joint remote sensing methods (Earth Remote Sensing) is relevant since remote sensing methods allow the creation of operational digital maps with real boundaries of desert pasture vegetation. These maps make it possible to assess the situation and take effective measures aimed at the conservation of natural fodder lands and their rational use. The Center for Remote Sensing and GIS Technologies has developed a method for processing space images.







Pasture degradation factors

- ❑ Compaction of pasture soils
- ➢ Soil compaction depends on the speed and duration of movement of grazing animals and their physical properties during degradation.
- ➢ The cattle hooves reach a pressure of 1.5-2.0 kg/cm2 when standing and 4 kg/cm2 when walking, which is higher than the pressure of the tractor wheels.
- ➢ Usually, when animals are grazing, the soil becomes denser and salinity increases in some places as the groundwater level rises and evaporates through capillaries.
- ➢ When the soil is wet, especially on slopes where sheep graze, pits form instead of footprints. On sandy and light soils, degradation of the sod layer occurs, which leads to increased soil erosion.



Innovative technologies for restoring and improving the fertility of pasture soils

❑ There are superficial and radical methods to increase the productivity of desert pastures and soil fertility:

➢ Surface improvement of pastures includes the enrichment of vegetation with highly nutritious, high-yielding species without increasing the natural vegetation cover; increasing its density, and measures of improvement of the growing environment of plants (sowing, harrowing, applying mineral fertilizers).

➢ In desert areas, surface improvement measures are most effective in areas with sandy desert vegetation where vegetation is sparse or the soil surface is dense.

➢ Radical improvement of pastures implies the partial or complete removal of natural vegetation cover (through regional cultivation) and the creation of new fertile pastures in their place.

Soil erosion and main types of soil erosion

In connection with the overload of pastures with livestock, large areas are subject to pasture erosion. On farms, livestock grazing should be strictly regulated based on the number of livestock, the type of animals, and the level of overgrazing of pastures. Mechanical erosion can occur due to the widespread use of super-heavy tractors and other equipment without considering the possible limit of annual soil self-healing in each natural zone. It causes soil structure destruction, and its water-physical properties and biological activity deteriorate

Soil erosion and main types of soil erosion

Water Erosion

Water erosion of soils is the washout and runoff of soil, and sometimes of soil-forming surfaces, by the temporary water flows. It is subdivided into surface (planar) and linear (ravine or river bed type).

Soil erosion and the main types of erosion of arid soils

- Wind erosion

- In wind erosion (deflation), dust storms (black storms) and everyday (local) wind erosion are distinguished. During dust storms, winds reach high speeds and cover vast areas. The wind raises clouds of dust, soil, and sand; and carries them away for a considerable distance. All this settles in a thick layer on the ground and fields.

- Soil protection forest belts. Forest strips reduce the harmful activity of the wind that can blow the soil away drying it and freezing of crops. They reduce surface water runoff and soil erosion and increase crop yields. Soil-protective water-absorbing forest belts designed to protect soil from water erosion should be located across the slope and in its watershed part.

Innovative technologies for restoring and improving the fertility of pasture soils

- Phytomelioration of pastures

- Phytomelioration (lat. "phytón" - plant, + "melioration" - improvement) is land melioration with the help of plants. Phytomelioration is used to strengthen moving sands, drain wetlands, and much more. Phytomelioration of pastures is a new promising direction in the management of desert pastures, which consists of a set of measures to increase the productivity of natural pastures. Over the past half-century, the following technologies have been developed in the field of phytomelioration of desert pastures:

- ✓ Creation of autumn-winter pastures on the hills
- ✓ Creation of enclosures
- ✓ Creation of pasture agrophytocenoses for use at different times of the year.

- **The purpose of the enclosures construction** in desert areas is that they not only halve the wind speed of varying intensity, characteristic of the desert climate; but also increase the accumulation of moisture in the soil due to precipitation and relative humidity.

- **This technology creates favorable conditions** in the region for the growth and development of natural grasses even at a distance of up to 100 meters. As a result, the overall productivity of pastures will increase by 2-2.5 times. Black saxaul, cherkez, and other shrubs also serve as food for sheep, goats, and camels during the autumn and winter months.

Innovative technologies for restoring and improving the fertility of pasture soils

Promising phytomeliorants

Qora saksovul – Haloxylon aphyllum (Minkw) Iljin

Paletskiy Cherkezi – Salsola Paletzkiana Litv

Cho'g'on – Halothamnus subaphylla Botsch

Shuvoq, Yovshan– Artemisia diffuza H.Krasch

Izen – Kochia prostrata (L) Schrad

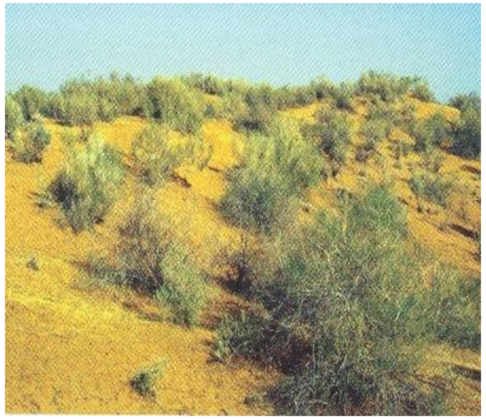
Teresken – Ceratoides ewersmanniana Botsch, et Ikonn

Innovative technologies for restoring and improving the fertility of pasture soils

- The role of the sagebrush-ephemeral pasture exchange scheme in restoring soil fertility

- Pasture rotation refers to pastures that are not used all year round. Sagebrush-ephemeral pastures are usually designed for a two-field 10-year crop rotation system. In this case, pastures are in the spring-autumn-summer-winter season for 1-5 years. And for 6–10 years they are used in the cycle: summer-autumn-spring-winter. With this use, pastures rest. During this time, the agrochemical, agrophysical, water-physical, and biological properties of degraded pasture soils restore, productivity increases, and plants reach full development.

HALAKSOOXYLON PERSICUM BUNGE



ANABASIS SALSA

CALLIGONUM SETOSUM LITV

SALSOLA RICHTERI

Innovative technologies for restoring and improving the fertility of pasture soils

Best practices

- Agrobiotechnologies applied on pasture soils (phytomelioration through the use of plants - wheatgrass, isen, cho’g’on, cherkez, camphorosma, saxaul, teresken plants; UFO-NER application technology) led to the formation of sod in soils, improvement of humus, optimization of agrochemical properties and biological activity, increasing the fertility, viability, and density of plants, which, in turn, leads to the restoration of soil fertility and a decrease in degradation processes.

- The results of resource-saving technologies presented in the study (use of hydrogel, use of the herbal preparation Agropyron desertorum L. "Microgrower" and processing by the UFO-NER method) in 2012-2015 in the farms "Abdurakhmon bobo" and "Mukhiddin bobo" with an area of 5 hectares in the Nurota district of the Navoiy region, increased the yield of seeds of male grasses by 0.5-1.5 q/ha.





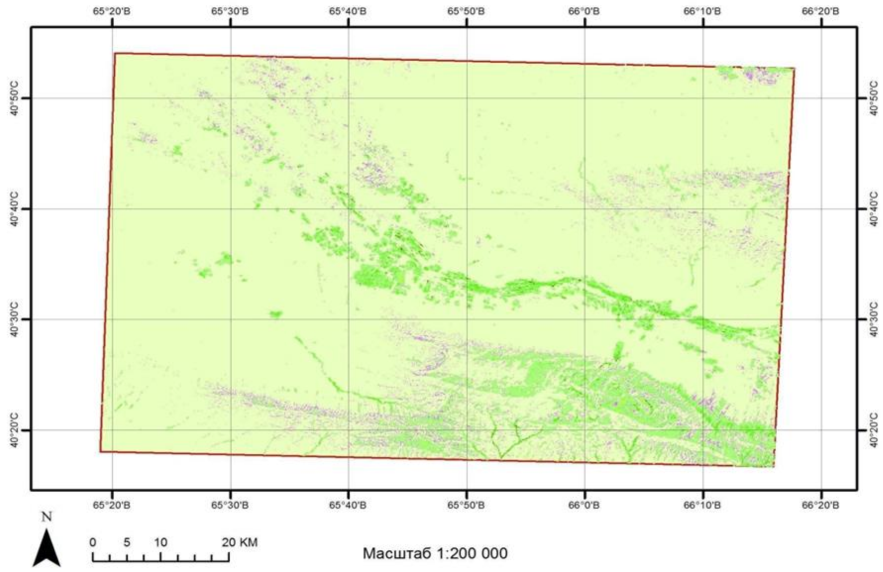

eTrex

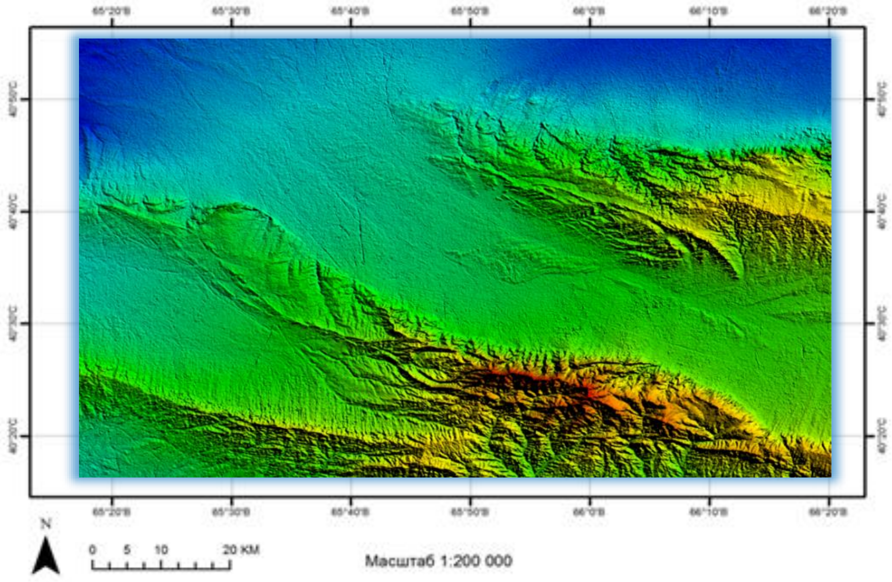


Innovative technologies for restoring and improving the fertility of pasture soils

Best practices

- There was monitoring of existing pastures in the Nurota region based on ground observations and electronic maps created with GIS technologies:
- The total area of non-degraded pastures is 0.06%, slightly degraded pastures area is 1.05%, moderately degraded pastures area is 2.3%, severely degraded pastures area is 4.6%, and very heavily degraded pastures accounted for 92.1% of the land.





Innovative technologies for restoring and improving the fertility of pasture soils

International experience - agrovoltaics

- The Fraunhofer Institute for Solar Energy Systems in Germany has announced the application of agrovoltaics technology, in which solar power plants are placed on land along with agricultural activities. The land use ratio reached 186%. Under the conditions of the agrovoltaic system, the soil temperature was lower in spring and summer, and the humidity in the hot and dry summer months of 2018 was higher than in the control zone. These results confirm the high potential of agrovoltaic technologies for drought-prone regions.

- Solar farm in Kubuqi Desert, China. One of the largest solar power plants with a capacity of 1,000 megawatts is located in this desert.

Innovative technologies for restoring and improving the fertility of pasture soils

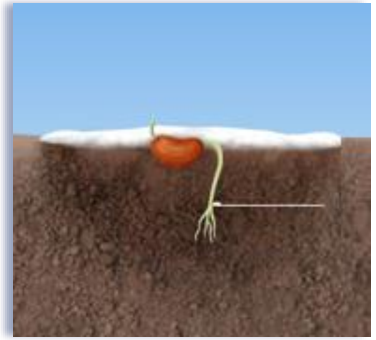
International experience - Cryogel in erosion protection

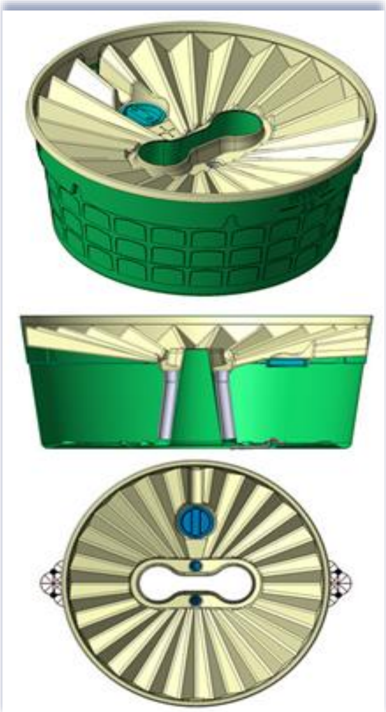
- Scientists from the Siberian Branch of the Russian Academy of Sciences and the Mongolian Ministry of Education, Culture, and Science have developed a method to protect sandy desert pastures from erosion using cryogels.
- Cryogel does not have any harmful effect on the local microflora of the soil. The polymer matrix of cryogel in the soil is, on the one hand, strong enough to withstand the effects of erosion processes, and on the other hand, it is very flexible so as not to impede plant growth. Seeds germinate through the cryogel layer, forming a stable green cover. Cryogels are harmless to humans and environmentally friendly.

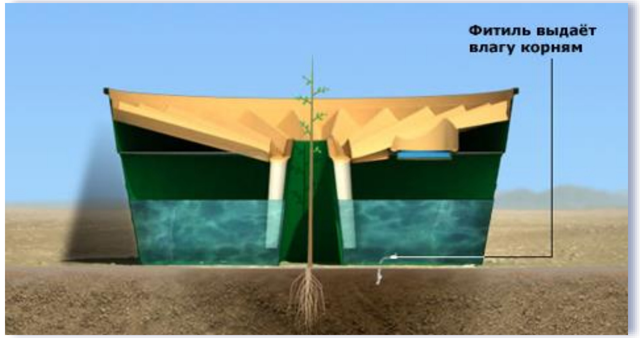
Innovative technologies for restoring and improving the fertility of pasture soils

International experience - Groasis smart incubator method

- According to the creators of Groasis (Waterbox), this is a "smart incubator" that removes moisture from the air by collecting water condensation (without using energy) and ordinary rain. The peculiarity of Groasis is that it is a shelter for seeds, providing them with a favorable microclimate during the most difficult period of germination and gradually on a flat surface.







Innovative technologies for restoring and improving the fertility of pasture soils

International experience – the cultivation of phytomeliorants in block incubators in the Aral Sea region

- Specialists of the Japanese company "OYO Corporation" Technology are involved in the introduction of new advanced technology for the production of block incubators for growing various phytomeliorants. In the future, saxaul seedlings grown in block incubators will be transferred to the dried bottom of the Aral Sea.

- Practical testing of the technology of the water-saving system of cocoons (product of the Land Life Company) on saline soils of the Moynaq district.



etrex
HIGH SENSITIVITY

Ways to improve the productivity of desert pastures

- A significant part of the land fund of the Republic of Uzbekistan is occupied by pastures, which serve as the main source of fodder for livestock. However, the destabilization of the environment as a result of anthropogenic factors and population growth led to the degradation of desert pastures.

- The insufficient stability of the desert complexes of the Aral Sea region, especially under the influence of anthropogenic factors, urges systematic and periodic monitoring of the state of desert pastures, obtaining operational information about the direction and extent of changes occurring in them. At the modern technical level, the problem of obtaining information is solved using GIS and remote sensing data, which makes it possible to quickly obtain a large amount of information about the state of desert pastures.

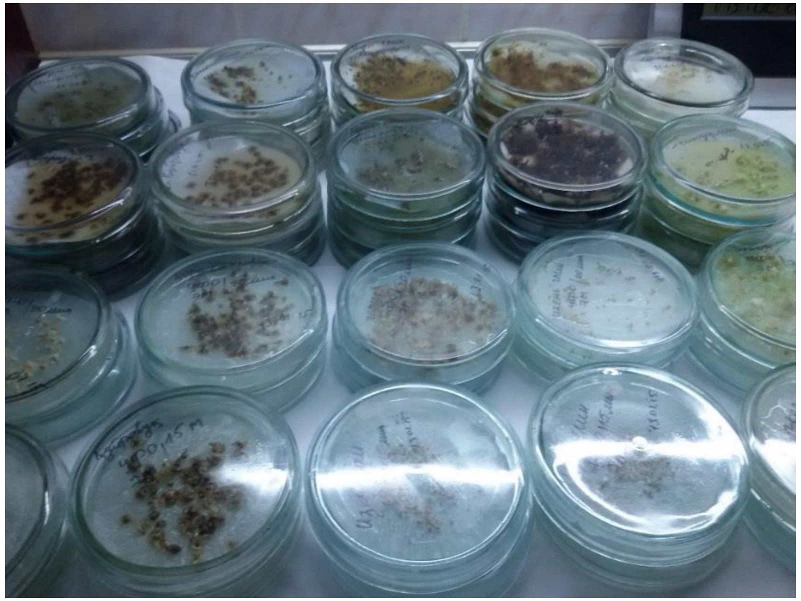

95
90
85
80
75



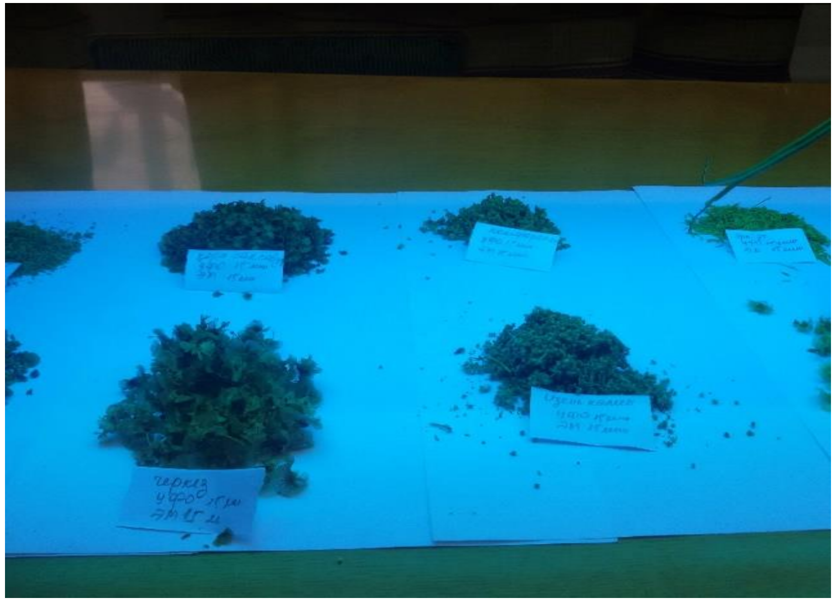



Use of grazing seed granulation technology

Germination of pasture seeds when using the biological agent Mikroustirgich



Application of ultraviolet and magnetic resonator to pasture seeds



Hydrogel application for improvement of seed germination and vitality

Enzymatic activity of soils in experimental variants (under wheatgrass plant)

Horizon, cm	Catalase, 1g of soil for 5 min.	polyphenol oxidase, mg/puprurgalin per 10 g of soil	Peroxidase, mg/puprurgalin per 10 g of soil	Humification coefficient
Control				
0-15	2.70	4.00	3.20	1.25
15-30	1.80	3.10	2.40	1.23
Treated seeds				
0-15	4.11	5.60	4.61	1.26
15-30	3.30	4.80	3.90	1.20
Mikroustirgich				
0-15	4.11	5.64	4.68	1.30
15-30	3.30	4.80	3.90	1.21
UV + ELF				
0-15	4.11	5.60	4.60	1.20
15-30	3.30	4.80	3.90	1.20
Hydrogel				
0-15	4.30	5.82	4.90	1.35
15-30	3.50	5.00	4.20	1.28

Germination rate of pasture fodder seeds in different variants of experiment

№	Plant species	Control	Coated seeds	Mikroustirgich	UV+ ELF	Hydrogel 20kg/ha +
1	Astragalus	21.3±1.0	24.7±0.5	24.0±0.5	24.1±0.5	25.6±1.24
2	Wheatgrass	20.2±0.8	21.4±0.4	21.0±0.4	21.2±0.4	22.1±1.0
3	Izen	16.6±0.8	17.8±0.7	17.1±0.7	17.4±0.7	18.6±0.8
4	Teresken	20.6±0.6	21.8±0.4	21.2±0.4	21.5±0.4	21.3±0.6
5	Salsola	15.3±0.6	16.4±0.8	16.0±0.8	16.1±0.8	16.0±0.8
6	Cho'g'on	8.6±0.6	9.5±0.5	9.1±0.5	9.3±0.5	10.3±0.6
7	Saxaul	6.0±0.8	7.9±0.6	7.4±0.6	7.8±0.6	7.6±1.0

Annual growth of pasture fodder plants in the field according to the experimental options, cm

Experiment options															
2013					2014					2015					
Control	Coated seeds	Mikroustirgich	UV+ELF 20 min.	Hydrogel, 20 kg/ha	Control	Coated seeds	Mikroustirgich	UV+ELF 20 min.	Hydrogel, 20 kg/ha	Control	Coated seeds	Mikroustirgich	UV+ELF 20 min.	Hydrogel, 20 kg/ha
Astragalus															
24.0±0.01	25.4±0.04	25.1±0.04	25.2±0.04	26.4±0.02	56.4±0.1	61.5±0.5	61.3±0.5	61.0±0.5	62.0±0.5	70.1±0.1	75.4±0.2	75.4±0.2	75.1±0.2	78.1±0.2
Wheatgrass															
9.5±0.01	10.8±0.06	10.4±0.06	10.5±0.06	11.0±0.02	54.3±0.14	61.8±0.1	61.6±0.1	61.4±0.1	62.8±0.1	68.4±0.4	70.3±0.1	70.3±0.1	70.1±0.1	74.1±0.1
Izen															
18.1±0.04	19.9±0.05	19.5±0.05	19.4±0.05	19.7±0.14	49.6±0.28	52.5±0.3	52.2±0.38	52.2±0.38	53.2±0.38	63.4±0.5	66.6±0.3	66.3±0.3	66.4±0.3	70.4±0.3
Teresken															
19.2±0.2	20.7±0.10	20.4±0.10	20.5±0.10	20.2±0.08	49.0±0.07	50.6±0.8	49.6±0.08	49.5±0.08	50.0±0.08	63.7±0.3	64.5±0.4	64.2±0.4	64.1±0.4	68.1±0.4
Salsola															
9.5±0.08	10.5±0.06	10.2±0.06	10.4±0.06	10.7±0.13	37.2±0.17	38.4±0.11	38.0±0.17	37.1±0.17	40.0±0.17	51.5±0.2	62.5±0.2	62.2±0.2	62.1±0.2	66.1±0.2
Cho'g'on															
21.1±0.05	22.2±0.2	22.1±0.2	22.1±0.2	22.9±0.2	54.9±0.09	56.7±0.15	56.2±0.18	56.3±0.18	57.2±0.18	68.5±0.4	70.8±0.2	70.4±0.2	70.2±0.2	75.2±0.2
Saxaul															
29.1±0.29	30.5±0.5	30.4±0.5	30.4±0.5	31.6±0.5	72.30±0.29	75.6±0.12	75.2±0.3	75.4±0.3	76.6±0.3	86.5±0.2	89.2±0.1	89.0±0.1	89.0±0.1	92.0±0.1

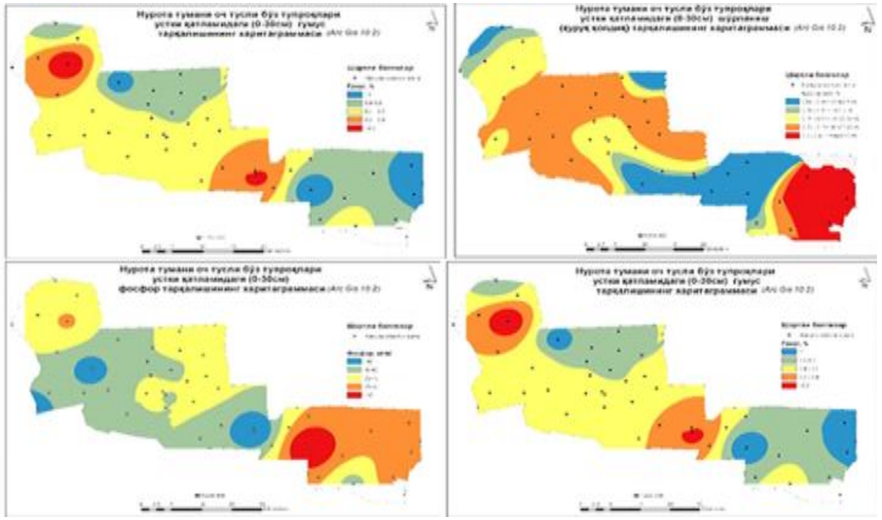
Hay yield of pasture fodder plants in different variants of the experiment, centner/ha

Experiment options														
2013					2014					2015				
Control	Coated seeds	Mikroustirgich	UV+ELF 20 min.	Hydrogel, 20 kg/ha	Control	Coated seeds	Mikroustirgich	UV+ELF 20 min.	Hydrogel, 20 kg/ha	Control	Coated seeds	Mikroustirgich	UV+ELF 20 min.	Hydrogel, 20 kg/ha
Astragalus														
3.4±0.06	3.6±0.12	3.7±0.12	3.6±0.12	3.8±0.14	11.7±0.39	12.2±0.30	12.4±0.30	12.2±0.30	13.5±0.46	12.7±0.39	13.3±0.32	13.1±0.31	13.2±0.31	14.5±0.46
Wheatgrass														
1.6±0.08	1.6±0.1	1.7±0.1	1.7±0.1	1.8±0.1	8.7±0.37	9.0±0.32	9.2±0.32	9.0±0.32	9.0±0.38	9.7±0.37	10.3±0.34	10.1±0.33	10.0±0.33	11.0±0.38
Izen														
3.1±0.08	3.4±0.16	3.5±0.16	3.5±0.16	3.6±0.17	11.5±0.63	12.1±0.30	12.4±0.30	12.1±0.30	12.8±0.36	12.5±0.36	13.4±0.30	13.0±0.28	13.1±0.28	14.8±0.36
Teresken														
2.5±0.26	2.6±0.1	2.7±0.1	2.7±0.1	2.8±0.1	11.1±0.27	11.4±0.28	11.6±0.28	11.4±0.28	11.8±0.38	12.1±0.27	12.4±0.26	12.3±0.26	12.3±0.26	13.8±0.38
Salsola														
2.1±0.05	2.2±0.1	2.4±0.1	2.3±0.1	2.3±0.1	9.0±0.2	9.1±0.2	9.2±0.2	9.1±0.2	9.5±0.26	10.0±0.2	10.5±0.22	10.1±0.2	10.2±0.21	11.5±0.26
Cho’g’on														
2.7±0.06	2.9±0.07	3.3±0.07	3.2±0.07	3.2±0.07	11.4±0.3	11.8±0.29	11.9±0.29	11.9±0.29	12.5±0.46	12.4±0.3	13.0±0.30	12.9±0.32	12.8±0.30	13.5±0.46
Saxaul														
2.2±0.04	2.3±0.1	2.8±0.1	2.5±0.1	2.5±0.1	7.7±0.23	8.1±0.25	8.2±0.25	8.1±0.25	8.8±0.22	8.7±0.23	9.3±0.26	9.0±0.24	9.1±0.24	9.8±0.22

Agrotechnology of desert pastures fertility restoration and productivity increase

- Most of the land fund of the Republic of Uzbekistan is occupied by pastures, which mainly serve as a source of fodder for livestock. However, environmental destabilization as a result of anthropogenic factors and population growth led to the degradation of desert pastures.

- Insufficient stability of desert complexes, especially under the influence of anthropogenic factors, urges systematic and periodic monitoring of the state of desert pastures, obtaining operational information about the direction and extent of changes occurring in them. At the modern technical level, the problem of obtaining information is solved using Earth remote sensing materials, which make it possible to quickly obtain a large amount of information about the state of desert pastures.



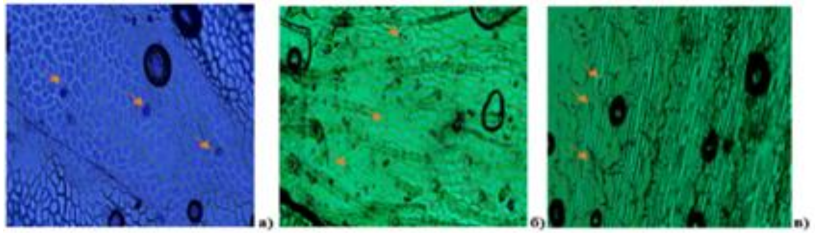
O'ZBEKISTON RESPUBLIKASI INTELLEKTUAL MULK AGENTLIGI
АГЕНТСТВО ПО ИНТЕЛЛЕКТУАЛЬНОЙ СОБСТВЕННОСТИ РЕСПУБЛИКИ УЗБЕКИСТАН

FOYDALI MODELGA PATENT
ПАТЕНТ НА ПОЛЕЗНУЮ МОДЕЛЬ
№ FAP 01299

Talabnoma kelib tushgan sana / Дата поступления заявки: 17.06.2015
Talabnoma raqami / Номер заявки: FAP 2015 0094
Ustuvorlik sanasi / Дата приоритета: 17.06.2015
Patent egasi (egalari) / Патентообладатель(и): Qishloq xo'jaligini mexanizatsiyalash va elektrlashtirish ilmiy-tadqiqot instituti, UZ
Научно-исследовательский институт механизации и электрификации сельского хозяйства, UZ

Adaptation technologies for the sustainable use of semi-desert pastures under climate change

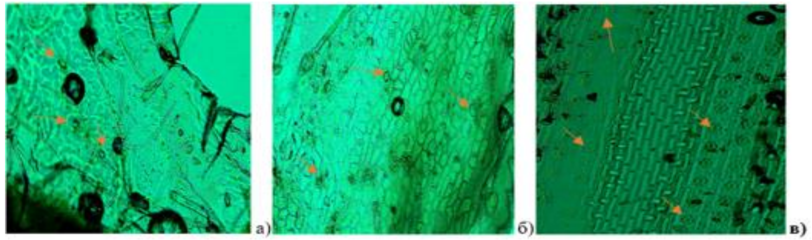
- A comprehensive technology has been developed to increase soil fertility in desert pastures, to preserve, restore and protect its ecological state based on resource-saving technologies. Due to the application of improved technologies to crops, promising collections of arid fodder crops were replenished and enriched. Agrotechnical measures have been developed for cleaning and collecting seeds; increasing their fertility and viability; creating and processing plantations of promising phytomeliorant plants. The proposed technology (phytomelioration - wheatgrass, izen, cho’g’on, astragalus, saxaul, teresken; Microustirgich biological agent; hydrogel; seed coating; UV-ELF treatment) improves the quality of forage, the productivity of desert-pasture phytocenoses and also helps to restore and increase soil fertility.



Adaxial (upper) paradermal section of the leaf surface on the example of desert pasture plants: a – kochia (*Kochia scoparia* L.); b – izen-2 (*Kochia prostrata* L.); c – teresken (*Ceratoides ewersmanniana*). (Arrows indicate stomata).

The adaptive properties of 15 varieties of desert fodder plants were studied and suitable varieties were recommended depending on soil and climatic conditions:

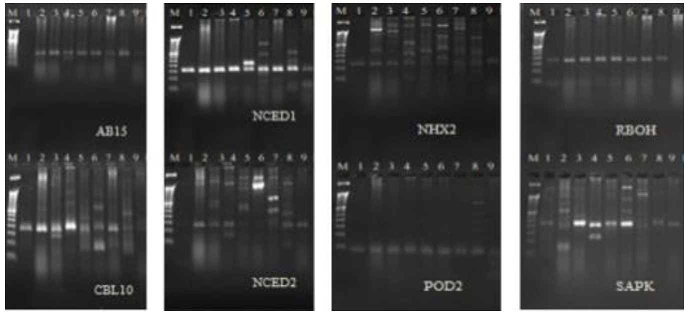
Saxaul - *Haloxylon aphyllum*
Cho’g’on - *Halothamnus subaphylla*
Salsola - *Salsola orientalis*
Teresken - *Ceratoides ewersmanniana*
Astragalus - *Astragalus agameticus*
Wheatgrass - *Agropyron desertorum*
Izen - *Kochia prostrata*
Camphorosma - *Camphorosma lessingii*



Abaxial (lower) paradermal section of the leaf surface on the example of desert pasture plants : a – astragalus (Astragalus); b - izen-1 (Kochia prostrata L.); c – teresken (Ceratoides ewersmanniana). (Arrows indicate stomata).

Adaptation technologies for the sustainable use of semi-desert pastures under climate change

- It was found that the POD2 marker (the gene responsible for drought resistance) had an amplification product in only one test sample (*Salsola richteri*). The PCR product was observed in all samples, and only the plant Atriplex (*Atriplex undulata*) did not have any allele in PCR screening with the gene-specific marker *RBOH* (controlling resistance to drought, cold, viral bacterial diseases, and cadmium stress).



Gel electropherogram of PCR-screening of gene-specific markers AB15, CBL10, NCED1, NCED2, NHX2, POD2, RBOH, SAPK2 linked to resistance to biotic and abiotic stress factors.

M – molecular weight marker, **1** – saxaul (*Haloxylon aphyllum*); **2** – cho'g'on (*Halothamnus subaphylla*); **3** – salsola (*Salsola orientalis*); **4** – teresken (*Ceratoides ewersmanniana*); **5** – izen (*Kochia prostrata*); **6** – camphorosma (*Camphorosma lessingii*); **7** – sagerbush (*Artemisia halfyta*); **8** – saltwort (*Salsola richteri*); **9** – artiplex (*Atriplex undulata*).

Panel of markers per genes controlling traits of resistance to biotic and abiotic stresses

№	Gene	Forward primer	Reverse primer	Feature
1	ABI5	tttgccacagagacaacgga	ccaagagctacacccgagtt	Tolerance to abiotic stresses
2	CBL10	gacgcggacaaggatggtaa	gataggaaagggccaagggg	Tolerance to abiotic stresses
3	NCED1	gagcgtcaacatcctttgcc	ggctccgtttcgagcataga	Drought tolerance
4	NCED2	ggagaacgaagacgacggtt	ccgtacggaactcgagatgg	Drought tolerance
5	NHX2	atggtggcgccgcattta	accaatcacaatgcaagcaca	Salt tolerance
6	POD2	cgctcccatagtgagtggtc	ccgatgcatcacatccctga	Drought tolerance
7	RBOH	aacgtcgacaatggaaccga	cccacgagaacttgcgtagt	Resistance to drought, cold, viral and bacterial diseases, and cadmium stress
8	SAPK2	actgtaggaacccccagccta	aaggataagcgccaaccagc	Salt tolerance

Innovative technologies for restoring and improving the fertility of pasture soils

International experience - Resource-saving technologies

Planting saxaul seedlings in plastic test tubes

- This technology (Russia - Russian State Agrarian University - Moscow Timiryazev Agricultural Academy, prof. Mazirov M.A.) effectively increases the safety and viability of saxaul seedlings. When testing this technology, it was shown that during the hottest time of the day, the internal temperature of the tube is lower than its surface. With a sharp fluctuation in daytime temperature (day and night), condensation forms in the tube, which creates additional humidity. This method effectively protects the plant from wind and strong sandstorms, as well as from animals that eat it. This method of planting can be carried out in autumn and spring. The study showed that life expectancy has increased by 85% and annual growth by 20%.

Innovative technologies for restoring and improving the fertility of pasture soils

International Experience - Innovative Drip Irrigation Method

- Scientists from Tottori University (Japan) have developed an innovative drip irrigation method for arid lands.
- One of the disadvantages of drip irrigation is that salts accumulate on the wet soil surface and cannot be removed by drip irrigation. Collected salt can be extracted by removing the cotton nonwoven sheet. This innovative technology improves water use efficiency and drip irrigation management.

Innovative technologies for restoring and improving the fertility of pasture soils

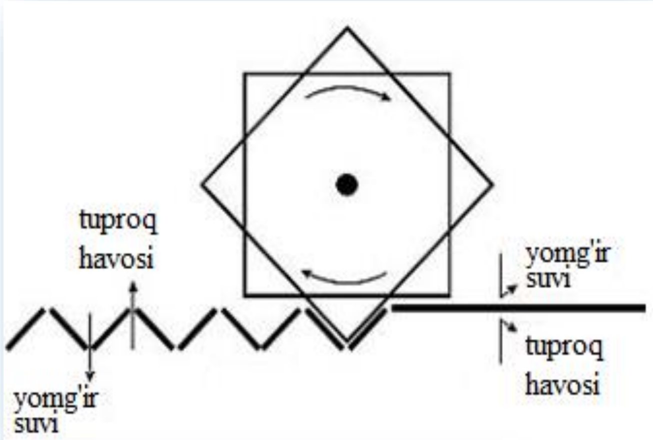
International experience - Mobile umbrellas for animals in pastures

- An American farmer found a way to hide pastures from the scorching sun: he proposed a large portable umbrella that can accommodate 40-75 animals. It will take about five minutes to open this umbrella. The umbrella can be transported to the pasture by truck or by horse. New models of umbrellas can be ordered with a remote opening and closing system, and with the possibility of emergency closing in strong winds. This method can prevent soil degradation.

Innovative technologies for restoring and improving the fertility of pasture soils

International experience - Imprinting technology

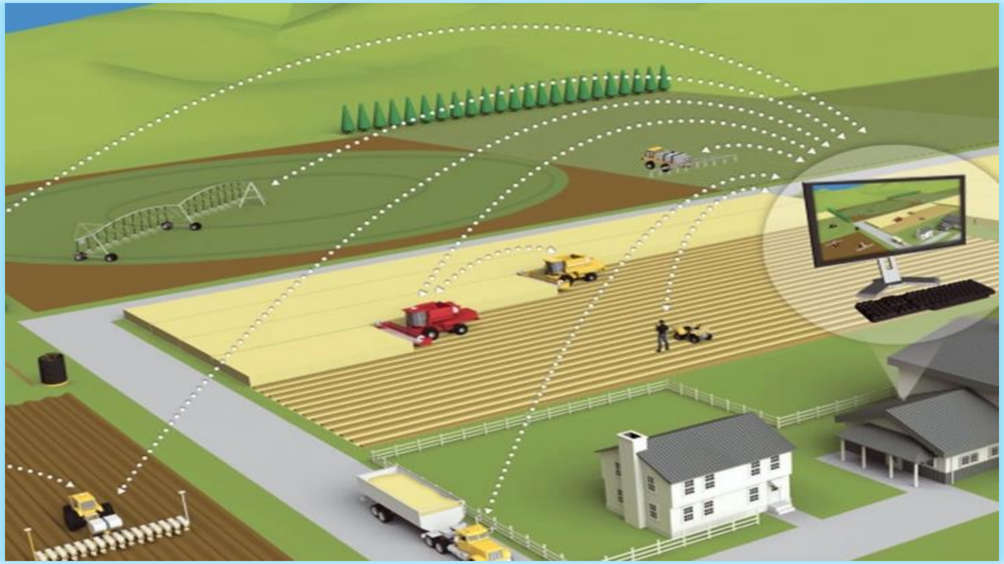
- Imprinting technology was invented in 1976 by Dr. R. Dixon (USA) and patented in 1977.
- Farmers use imprinting technology to control erosion and grow perennial weeds in their degraded areas to grow forage.
- Dixon Land Imprinter is a technology that saves rainwater and improves soil surface adaptability to adverse climatic conditions.



Innovative technologies for restoring and improving the fertility of pasture soils

International experience - Digital agricultural technologies

Digital technologies in agriculture are a set of measures aimed at optimizing the process of monitoring the state of the soil, as well as the effective use of remote national geolocation systems of satellite technologies to achieve the highest quality of the crop in accordance with all sanitary and environmental standards.



Innovative technologies for restoring and improving the fertility of pasture soils

International experience - Digital agricultural technologies

Innovative technologies for restoring and improving the fertility of pasture soils

International experience - Land degradation prevention technology "Great Green Wall"

The Chinese government wants to stop the expansion of the country's fourth largest desert - Tengger. In this regard, within 6 years, the "Great Green Wall" belt of plants adapted to dry and hot conditions will be created.

Work has already begun on the creation of a "strip" 500 km long and 1 km wide. If plants are inserted in loose sand, the sand will swallow their seedlings very quickly. To reduce the mobility of sand, small deepened ditches are fixed with straw.

China plans to complete the construction of the "Great Green Wall" on the border with the Gobi by 2050. Positive results are noticeable in areas where work began in the 70-80s of the past century. Growing trees have created a protective corridor, and the quality of life in nearby communities has improved significantly. As a result of this method, which was applied in areas where severe desertification was observed 20-30 years ago, it was proved that even agriculture can be practiced there today.

Problems in pasture management and ways to solve them

Problems:

- The extremely high density of animals in pastures;
- Acute shortage of pasture forage;
- Narrow seasonality of pastures;
- Complete absence of phytomelioration of pastures.

Ways of solving:

- Development of pasture management mechanisms including local communities
- Establishment of seed production of desert fodder plants;
- Creation of highly productive, multi-component pasture agrophytocenoses of various periods of use;
- Creation of seeded hayfields through the introduction of highly productive desert fodder plants;
- Development and adoption of the State Program for phytomelioration of desert pastures.

Contacts

Department of Soil Science, Faculty of Biology, Mirzo Ulugbek National University of Uzbekistan

«AgroEcoBioTechnologies» Center.

100174, Universitetskaya street, 4, Tashkent, Republic of Uzbekistan

E-mail: la.gafurova@nuu.uz

E-mail: glazizakhon@yandex.ru

PRO AGRO
LECTORIUM

Thank you!