

PROJECT: KNOWLEDGE MANAGEMENT IN CACILM PHASE II
I Component: KNOWLEDGE SYNTHESIS AND GENERATION

Review and synthesis of promising technologies and approaches on SLM Kazakhstan

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25-27 February, Almaty, 2014

Team formed on the basis of Department on scientific information supply with involving of PhD and undergraduate students

Leader of Component I - Tokseitova G.A.



Search for innovative technologies and approaches implemented in four major agro-ecosystems: rainfed cropland, irrigated agriculture, pastures and mountain ecosystems.

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Resources used:

- * Official letters to RI of JSC "KazAgroInnovation" and the National Universities (KazNAU and KNU named after Al-Farabi) are prepared
- * Reports of Research Institute of JSC "KazAgroInnovation"
- * Database of WOCAT, www.wocat.net
- * Consultation with the farmer (Khudayberdiev K.K.) - The head of the farm "NurAgro" Enbekshi-Kazakh district of Almaty region

Production of Biomineral fertilizers based on zeolite

- * **The technology of physical and chemical increase of sorption and adsorption volume in 10 times was developed that allows to create volumes and reserves by absorption nutrients, humic compounds and prolonged strains effective microorganisms**



- * **prevents leaching of nutrients**

- **Agroecosystem: irrigated and rainfed**
- **Source: KazRI of Soil Science and Agro-chemistry named after U.U. Uspanov, Kazakhstan**

NTOZ-1

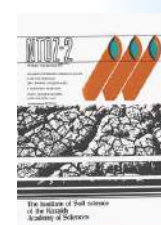
- * **Rice yield in the first year without pre-leaching and removal of salts from the soil**
- * **Limit of soil salinity is 15-20 times higher than in conventional technology of rice cultivation.**
- * **Shortens the growing season of rice for 10-12 days.**
- * **Allows the reuse of drainage return water with salinity up to 3 g/l.**
- * **Reduce the rate of phosphorus fertilization application twice.**



- **Agroecosystem: rainfed**
- **Source: KazRI of Soil Science and Agro-chemistry named after U.U. Uspanov, Kazakhstan**

NTOZ-2

- * **Yield of grain and forage crops on strongly saline soils in the first year without preliminary leaching.**
- * **Soaking seeds in solutions followed by drying.**
- * **Shortens the vegetation period of crops for 7 - 10 days.**
- * **Allows the reuse of drainage water with a salinity of up to 3 g / l.**
- * **Lowers the rate application of phosphorus fertilization twice.**
- * **Increases the food and biological quality of products**



- **Agroecosystem: irrigated**
- **Source: KazRI of Soil Science and Agro- chemistry named after U.U. Uspanov, Kazakhstan**

Nano - agroameliorative methods of increasing the productivity of crops on degraded soils

* Nano - agroameliorative technology based on low-volume drugs and adaptogens, increasing bio-energy and environmental sustainability of crops to extreme environmental conditions (soil salinity, alkali developing factors, pesticides, adverse agrometeorological conditions, etc.)



- Agroecosystem: irrigated
- Source: KazRI of Soil Science and Agro- chemistry named after U.U. Usanov, Kazakhstan

Cultivation of winter wheat under irrigation

- * Reduced number of tillage processing by 1.5-2.5 times.
Reduced seeding rate by 2 - 2.5 times.
- * Accelerated development of the plants in early spring.
- * The uniform distribution of irrigation water and reduced irrigation rates on 25-28%.
- * Opportunity for effective use of fertilizers due to local and fractional application.
- * Improved grain quality due to later foliar nutrition with nitrogen fertilizers.
- * Increase in grain yield up to 47-50 dt/ha



- Agroecosystem: irrigated
- Source: South-West Research Institute of livestock and crop production, Kazakhstan

Cultivation of grain-cereal crops under rainfed conditions

- * The direct seeding of winter wheat and barley, minimizing soil tillage, application of mineral fertilizers and application of herbicides.
- * Reduced costs and increased conditionally net income provide reducing in cost of production up to 748 and 1008 tenge/dt.



- Agroecosystem: reinfed
- Source: South-West Research Institute of livestock and crop production, Kazakhstan

Direct seeding of alfalfa under rainfed and irrigated agriculture

- * Pre-sowing disking and direct seeding of alfalfa (this is the essence of technology).
- * Increases the yield of hay, both under rainfed and irrigated conditions.
- * Reduces energy consumption for tillage in rainfed and irrigated conditions.
- * Herbicide (herbicide Pivot, 10% v.d.g.) provides increase of energy income, in average up to 20,698.1 and 6834.2 mJ, respectively, and coefficients of energy and bio-energy efficiency.



- Agroecosystem: irrigated and reinfed
- Source: South-West Research Institute of livestock and crop production, Kazakhstan

Development of agro-forestry strips by diagonally-group method

- * Partial soil processing, accurate placement of planting acreages and reduction of planting material.
- * Protecting farmland from soil degradation and increasing crop yields.
- * Uniform distribution of bulk snow on the inter-strip fields.



- Agroecosystem: rainfed
- Source: KazRI of forestry, Kazakhstan

Raised -bed- zero tillage technology of cropping

- * The combination of raised bed technology and zero (minimum) tillage.
- * Plowing, leveling, chiseling and harrowing are excluded.
- * Raised bed planting with simultaneous application of fertilizers.



- Agroecosystem: rainfed
- Source: KazRI of Water Economy, Kazakhstan

Space /satellite and ground-monitoring of ecological - reclamation status of grazing land

- *Systematic or periodic monitoring of desert rangelands.
- *Aero-Space pictures for an objective assessment of the situation and take effective measures to conserve natural grasslands and their rational use.



- Agroecosystem: rainfed
Source: KazRI of Water Economy, Kazakhstan

Holistic Conservation agriculture (Kazakhstan zero tillage technology)

- *Harvesting combines with shredders, which are crush and scatter plant residues from crop thrashing on the entire operating width of the reaper
- *Soil after harvest is not processed.
- *The soil should have a permanent cover with mulch.
- *Before sowing the field are treated with herbicides - glyphosates against weeds.
- *Sowing is done by hoe boot in a narrow strip of 19 mm.



- Agroecosystem: rainfed
Source: Kostanay Agricultural Research Institute, Kazakhstan

Space/Satellite assessment of productivity of grain crops, timing and volume of basic agricultural work

- *Satellite assessment of the timing and volume of basic agricultural work is based on the analysis of changes in the spectral characteristics of fields on space pictures during the vegetation season.
- *Areal assessment and evaluation of productivity of crops is based on the use of remote sensing (RS), synchronous ground route surveys of fields under grain crops in different soil-climatic zones.



- Agroecosystem: rainfed
Source: RI named after acad. U.M. Sultangazin, Kazakhstan

Autumn and early spring irrigation as a mechanism to improve pastures in context of changing climate in southern Kazakhstan

- *12 km of channel and 5 locks for water supply were restored in the pre-sowing period through autumn and winter moisture- recharging irrigation.
- *Moisture- recharging irrigation improves the growth of grass on the pastures.
- *Water reserve for crops is being commuted in soil.
- *The number of vegetation irrigation decreasing and terms of their conduct relegated.



- Agroecosystem: rainfed
Source: WOCAT, Kazakhstan

Development of seed plot for perennial grasses

- *Pasture management through a restore of system of transhumance and radical improvement of pastures.
- *Radical improvement of pastures by planting perennial legume crops (sainfoin, alfalfa, etc.) cereals (Rump, hedgehogs, etc.), forage grasses and their grass-mixtures.
- *In the first and second years of life of grass, pastures are not used for grazing.
- *Technology recommended to use on rangeland of temperate and slightly saline zones.



- Agroecosystem: rainfed
Source: WOCAT, Kazakhstan

Technology of fastening Aral sea's drained bottom's soil

- *Planting of the saplings on the lots of the dried seabed of the Aral Sea was done in holes and uninterrupted furrows, which were formed by hands or cultivated by KON - 2.8 PM . Depth of holes and furrows is 20-25 cm. Distance between holes was 1.5-2 m. Furrows were perpendicular to the prevailing winds (west-east) and placing mould in several options: 1 - moulds on both sides; 2 - the same from the southern side of a
- *Furrow; 3 - the same from the northern side. Furrows alternated with holes rows. Length of rows variants in repetition was 100 m. Saplings were filled up by hands or in rows in 1-2 meters, distance between rows was 2-2.5 meters.



- Agroecosystem: fastening Aral sea's drained bottom's soil
Source: WOCAT, Kazakhstan

Minimum soil tillage in grain crop production

- * Tillage by discs at a depth of 12-15 cm and harrowing.
- * Moisture reserve at a depth of sowing is 30% - more than in conventional tillage for soil preparation.
- * Increasing of field germination of seeds.
- * Reducing fuel consumption -15-20 l/ha (above 25-30 l/ha).
- * Reduced release of CO₂.



- Agroecosystem: rainfed
- Source: WOCAT, Kyrgyzstan

Growing sainfoin in mountainous agriculture - Suusamyr Valley

- * Improving soil structure as a result of the accumulation of high biomass.
- * Accumulation of biological nitrogen sufficient for two growing seasons.
- * Possibility to grow at an altitude of 700 to 3400 m above sea level
- * The high content of nectar that allows you to receive up to 150 kg of honey per 1 ha.



- Agroecosystem: mountainous agriculture
- Source: WOCAT, Kyrgyzstan

Raised planting of crops

- * Raised bed planting can be accomplished in 2 or 3 rows with row spacing of 15 cm
- * It reduces seeding rate.
- * It increases the yield of winter wheat from 5 to 8.3 dt/ha.
- * It creates optimal water-air and thermal regimes for crops.
- * It saves an irrigation water on 25-30% compared with an overlap.



- Agroecosystem: mountainous agriculture
- Source: WOCAT, Kyrgyzstan

Rotation of pastures in the desert regions of Uzbekistan

- * Providing feed balance.
- * Monitoring of pasture vegetation and productivity to meet the safe load and prevent overgrazing.
- * Allocation of two watering sources for sheep flocks.
- * Area around the watering source is divided into two sectors for rotational grazing.
- * Survey on pastures, definition of type and nutritional value.



- Agroecosystem: pastures
- Source: WOCAT, Uzbekistan

Drip irrigation using polyethylene film

- * Economical use of water, reducing evaporation of soil moisture, preventing soil erosion.
- * It is used to obtain yields of vegetable and melon crops.
- * The film unfolds on the beds and used as a screen for water.
- * Water supply to each plant is accomplished through the rag or gauze cords. Wash out of topsoil is excluded.



- Agroecosystem: irrigation
- Source: WOCAT, Tajikistan

Mulching of rainfed vineyards on terraces in loess hilly areas

- The vineyard was planted on the straight slope terraces.
- Bulldozers were used to prepare terraces.
- Selected local grape varieties in combination with other crops are planted between the rows.
- Planting the vineyard to the tilled soil.



- Agroecosystem: rainfed
- Source: WOCAT, Tajikistan

Planting of haloxyton to stabilize sandy soils

*In order to stabilize the soil and stop the process of desertification, on 15 hectares of bare land affected by wind erosion, shrubs of Haloxyton were planted.

*Haloxyton plantation improve soil structure and water infiltration into the soil.

*Tractors were used for land plowing, and the seeds were planted manually.

* Haloxyton are totally dependent on winter precipitation and dew to meet their water needs.



- Agroecosystem: reinfed
- Source: WOCAT, Tajikistan

Restoration of rangelands by seed perennial shrubs

*Improving the condition of pastures by sowing prostrate summer cypress (Kochia prostrata).

* Preventing wind and water erosion.

*Rehabilitation of saline soils, an increase of forage for livestock.

* Collection and sale of seeds.



- Agroecosystem: pastures
- Source: WOCAT, Tajikistan

Cultivation of fodder crops on steep slopes of arid highlands

*Intensive cultivation of forage grasses on sloping ground with a slope of 60% on low-productivity soils under irrigation.

*Low-grazing land has evolved into a highly productive within 3-5 years and became suitable for bevel-care system.

* Technology proved to be very effective in these environmental conditions for the rapid restoration of degraded lands.



- Agroecosystem: high mountain pasture
- Source: WOCAT, Tajikistan

Phytopesticides

*Help in combating pests and diseases without chemical pesticides.

* Environmentally safe.

*Phytopesticides derived from plants, including: the stalk of potato, onion or tomato, extracts of garlic, pepper, dandelion.

*Phytopesticides can store up to a year.



- Agroecosystem: high Pest Control
- Source: WOCAT, Tajikistan

currently is not considered as modern innovative technologies

Soil-protective minimal technology of the tillage and sowing

*Accumulation of moisture.

*Prevention of water and wind erosion.

*Accumulation of organic in humus layer.

*During the spring period on the stubble background there is a sowing of grain crops by the direct or combined seeder there with covering of seeds on depth of 3,8 centimeters.

*After shoots at presence of weeds it is carried out a local tilling of the littered sites of a field.

*Fertilized fallow with minimum and chemical tillage.



- Agroecosystem: rainfed
- Source: WOCAT, Kazakhstan

currently is not considered as modern innovative technologies

Increasing the fertility of degraded irrigated lands

*Use of phosphogypsum (meliorant) on degraded soils improves physical and chemical properties of soil, increases calcium stores in the content of absorbed bases.

* Accelerates the growth and development of plants, reduces water consumption per unit of product.

*Effective in the southern regions of Kazakhstan

- Agroecosystem: irrigated
- Source: KazRI of Water Economy, Kazakhstan

currently is not considered as modern innovative technologies

Technology of production and application of vermicompost

- * Concreted trench for manure processing.
- * Height of manure is 30 cm + 5 kg of Californian worms.
- * 1 watering once a week to maintain moisture in manure (60-70%).
- * Production of vermicompost for 20-25 days. Vermicompost application rates per 1 ha is 2.5-5 tons.



- Source: WOCAT, Kyrgystan

Do not have innovative basis

Technology for Spring cleaning and construction of water points for animals

- The exact location of water seepage was determined and cleaned from mud mass.
- 3 intercommunicate water trenches were built for animals watering.
- Water is supplied in the form of a cascade.
- At the end of the construction water trenches connected by a pipe with the water outlet. The pipe laid in the trench with a small depth of 0,30 meter.
- 15-17 animals can simultaneously drink water at this point.



- Source: WOCAT, Kyrgystan

Do not have innovative basis

Monitoring of the state of rangeland

- * Site selection to determine the yield and assessment of vegetation cover (frame of 1 square m.)
- * Information about the state of pastures (erosion, salinization, etc.).
- * Determination of the yield of surveyed forage pastures by mowing.
- * Mowing of hay with height of 7-8 cm, on short grass pastures - 4-6 cm, on tall grasslands - 6-7 cm.
- * Calculation of yield for each type of pasture).



- Agroecosystem: pasture
- Source: WOCAT, Kyrgystan

Do not have innovative basis

Forest shelterbelts against wind erosion on sandy-gravelly arrays

- Forest shelterbelts installed perpendicular to the direction of strong winds.
- The distance between trees in each belt was 4 m.
- The horizontal landing, which increases the growth on 25% was used.
- Furrow irrigation ditches (0.3 m in deep and 0.5 m in wide) were dug up to plant trees.



- Agroecosystem: Mountains
- Source: WOCAT, Tajikistan

Do not have innovative basis

Terrace with the barriers of trees

- * Bulldozer created a terrace on a steep slope strongly eroded (with a slope of 15%). In the lower part of the slope the dug ditches need to be diverting to drain excess rain and irrigation water to the nearby ravine. Terrace and a discharge channel was strengthened by rows of trees (poplar planted at intervals of 0.5 m) and two parallel strips of herbal plants with the width from 1 to 2 meters.
- * Layers of soil with grass taken from a nearby pasture were used to create a grassy strips.



- Agroecosystem: Mountains
- Source: WOCAT, Tajikistan

Do not have innovative basis

Buffer strip of arable land on steep slopes

- * Buffer strip of grass of 10 m in wide across the top of the slope.
- * Reduces soil erosion on arable areas (wheat, flax and pea).



- Agroecosystem: reinfed
- Source: WOCAT, Tajikistan

Do not have innovative basis

Pasture rotation, supported by additional watering points

- * Identified water resources are used for water harvesting in cement water intakes on which it passes through the pipes to the points of drinking water for animals.
- * Defined resting places for livestock.
- * Pasture rotation scheme introduced.
- * Grazing land in the area of the watershed was divided into ten parts, and at each site livestock grazing was allowed from five to eight days, thereby providing a longer time to grow grass on certain grazing areas.



- Agroecosystem: pastures
- Source: WOCAT, Tajikistan

Do not have innovative basis

Solar greenhouses

- * Production of vegetables in greenhouses, while reducing heat loss through the use of heat -insulation and maximum use of passive solar energy.

- * Using of greenhouse for year-round cultivation of vegetable crops by the use of the heat of greenhouse itself without the use of fuel materials.

- * During the growing season it is possible to get 3 - 4 yields.



- Agroecosystem: greenhouse
- Source: WOCAT, Tajikistan

Generalization of technologies



	Collected	WOCAT	Totally
Technologies	12	22	34
Approaches	1	0	1
Totally	13	22	35

Meeting on Component I: «Synthesis and generation of knowledge» Collection and analysis of promising innovative technologies

19.12.2013

1. Balgabaev N.N. - Director General, KazRI of water economy
2. Umirzakov S.I. - Director General, KazRI of Rice
3. Sadik D.A. - Professor, Head of Department, South-West RI of livestock and plant production
4. Saparov A.S. - Director General, KazRI named after U.U. Usmanov
5. Sulejmenov B.U. - Deputy Director General, KazRI named after U.U. Usmanov
6. Otarov A. - PhD, Head of the Department of Land Reclamation of saline soils
7. Kan V.M. - Dr., SOT
8. Mamutov J.U. - Ph.D., SOT
9. Mamonov A.G. - PhD, VNS
10. Shaharov R.J. - Head of department on developing of new technologies
11. Tokseitova G.A. - Ph.D., Head of Department on scientific and informational support
12. Kusanova M. Ph.D.
13. Kalieva H.G. - Manager of Department on scientific and informational support
14. Mamaev D.J. - Manager of Department on scientific and informational support



28.01.2014

National workshop on prioritizing SLM practices

* Kazakh National Agrarian University:

- * 1. Eleshev R.E., Doctor of Agricultural Sciences, academician of NAS RK
- 2. Kaldybaev S., Doctor of Agricultural Sciences, Professor
- 3. Jamalbekov E.U., Doctor of Agricultural Sciences, Professor
- 4. Schimshikov B.E., PhD, associate professor
- 5. Bildibaeva R.M., PhD, associate professor

* Kazakh Research Institute of Agriculture and crop production

- 6. Iorgankiy A.L. - Doctor of Agricultural Sciences, Senior Researcher
- 7. Ramazanov S.B., Ph.D.

Kazakh Research Institute of Potato and Vegetable Crops

- 8. Aytbaev T.E., Doctor of Agricultural Sciences, CEO

Kazakh Research Institute for Soil Science and Agro-Chemistry named after U.U. Usmanov

- 9. Saparov A.S., Doctor of Agricultural Sciences, Professor, Director General, National Coordinator



- * 10. Otarov A., PhD, Head of Dep. On reclamation of saline soils, Head of component III,
- 11. Shaharov R.J., PhD, Head of Dep. On development of new technologies
- 12. Kang V.M., DS of Agricultural Sciences, Senior Scientist
- 13. Mamonov A.G., PhD, Scientist
- 14. Jalankuzov T.D., Ph.D., Senior Scientist
- 15. Tokseitova G.A., PhD, Head Dep. on scientific and information support, Head of component I,
- 16. Sharypova T.M., PhD, Scientific Secretary
- 17. Mamaev D.J. - manager
- 18. Kaliyeva H.G. -Manager - Secretary

Involved organizations

No	Organization
1	Kazakh Research Institute of Agriculture and crop production
2	Kazakh Research Institute of Soil Science and Agro-Chemistry named after U.U. Usmanov
3	Kazakh Research Institute of Forestry
4	Kazakh Research Institute of Water Economy
5	Kostanay Research Institute of Agriculture
6	DTOO IKI named after Acad. U.M. Sultangazin
7	Southwest Research Institute of Livestock and Plant Production
8	Kazakh Research Institute of Potato and Vegetable Crops
9	Kazakh National Agrarian University
10	Kazakh National University named after Al-Farabi
11	JSC "KazAgroInnovation"
12	Ministry of Agriculture of the Republic of Kazakhstan

The results of the prioritization

*Result points are shown in the summary table at [Excel](#)

#	SLM technologies and approaches	Average
1	Biotechnological method for producing of Biomineral fertilizers based on zeolite (revision is required)	2.6
2	Reclamation of strongly solonetsous and alkaline soils under rice cultivation without soil pre-leaching and with the crop yield in the first year of Reclamation (NTOZ 1)	3.0
3	New technology to increase rice yield in saline soils of rice fields (NTOZ 2)	3.0
4	Application of nano-agro- ameliorative methods of increasing crop productivity on degraded soils in Kazakhstan	3.0
5	Conservation technology of cultivation of cereal crops in rainfed agriculture in southern Kazakhstan (Recommended for the regions of south and south-eastern Kazakhstan)	2.3

The results of the prioritization

Rainfed	Holistic Conservation agriculture (Kazakhstan technology of zero tillage)
	Raised -bed- zero tillage technology of cropping
Irrigated	Reclamation of strongly solonetsous and alkaline soils under rice cultivation without soil pre-leaching and with the crop yield in the first year of Reclamation (NTOZ 1)
	Application of nano-agro- ameliorative methods of increasing crop productivity on degraded soils in Kazakhstan
Pastures	Space / satellite and ground-monitoring of ecological - reclamation status of grazing land
	Direct seeding of alfalfa under rainfed and irrigated agriculture in Kazakhstan
Mountain	Development of seed plot for perennial grasses (Improvement of pastures by reseeding perennial legumes and grasses and developing of seed plots)
	Growing sainfoin in mountainous agriculture - Susamir Valley
	Growing fodder crops on steep slopes of arid highlands