Use of mineralized artesian water to organize irrigated crop farming in the Kyzylkum

Uzbekistan - Central Asia Countries' Initiatives for Land Management (CACILM)

left: General view of artesian well and irrigation water intake (Photo: A.Rabbimov)
right: Field of halophytes irrigated using plastic chute for furrow irrigation (Photo: A.Rabbimov)

Location: Uzbekistan / Navoi oblast
Region: Kanimekh district
Technology area: 0.03 km^2
Conservation measure: agronomic, management
Stage of intervention: prevention of land degradation
Origin: Developed through experiments / research, 10-50 years ago; externally / introduced through project, recent (<10 years ago)
Land use type:
Grazing land: Extensive grazing land
Land use:
Grazing land: Extensive grazing land (before), Grazing land: Intensive grazing/ fodder production (after)
Climate: WOCAT database reference: UZB003e
Related approach:
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Cultivating several food and forage crops in the Kyzylkum desert using mineralized irrigation water from a flowing artesian well

Pasture-based livestock production is an important component of Uzbekistan's agricultural sector, producing more than 60% of all the livestock output. Concentrated on an area of 17,5 mln. ha, it is based on the full or partial pasture keeping of animals. Assuming that the average pasture's productivity is 1,7 centners/ha (100%), forage availability during spring is 80%, 100 % in the summer & autumn & 60-65% during winter. Total forage shortage in the Kyzylkum desert is about 540 thousand tons (15% of total demand).
Considering this, production of reserve stock of forage is a relevant task. The Kyzylkum desert has artesian wells, which each produce 13-15 l/s. Water in the wells has neutral acidity (pH- 7,4) & medium salinity (Ec= 5.6-8.3 ds/m). The technology of salinity tolerant crops (halophytes) for livestock forage was introduced on the basis of irrigation using water from these wells. The suitability of these feeds to various groups of livestock animals was determined and a system of pre-feeding preparation was developed, taking into account the mineralization of irrigation water and quality of the halophytes.
The purpose of this technology is land improvement through retention of topsoil, rehabilitation of vegetation cover, prevention of overgrazing through reducing livestock pressure by organizing irrigated forage production.
The agricultural processes for establishing irrigated land are traditional and include plot leveling, plowing, chiseling, harrowing, sowing, cutting irrigation furrows and caring for the plantation. The following forage crops were successfully tested: winter cereal crops (Movlono barley, Kyrgyzskaya-1 rye, Prag Serebristy triticale, Kroshka millet), forage crops (Belozubaya maize, Aip-13150 pearl millet, Oq Zhuhori and Venichnoe sorghum, Sudan grass, Tashkentskaya and Eureca alfalfa, D-1 and D-2, common licorice) & forage halophytes (K. scoparia (L.) Schrad, Bassia hyssopifolia (Pallas) O. Kuntze, S. altissima & Climacoptera lanata).
Using mineralized waters for irrigation is only possible in soils with a light texture The introduction of crop rotation with halophytes, which remove up to 40% of salts from the soil, is also mandatory for the ecologically sustainable application of saline water. Traditionally livestock production is the main source of income for the population of the Kyzylkum and important to create family savings. To improve their livelihoods, livestock numbers are increased without consideration of the area or condition of pastures. Unsystematic grazing and pasture use beyond its capacity threatens biodiversity. Forage production facilitates the creation of a reserve stock of forage and alleviates pressure on the pastures. There are 63 artesian wells in the Kanimekh district, which can be used for irrigated crop farming on an area of 350-400 ha. In the Kyzylkum desert, this technology may be introduced on an area of 25 000 ha.

Classification

Land use problems: Low quality soils and an arid climate A low natural fertility level of desert soils and extremely arid conditions (low precipitation, low air humidity and high summer temperatures)

Land use

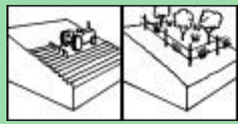
Extensive grazing land
Grazing land: Extensive grazing land (before)
Grazing land: Intensive grazing/ fodder production (after)
extensive grazing land
rainfed

Climate

Degradation

Biological degradation: reduction of vegetation cover

Conservation measure



agronomic: Vegetation/soil cover management: Change of land use type

Stage of intervention

■ Prevention
□ Mitigation / Reduction
□ Rehabilitation

Origin

□ Land users initiative
■ Experiments / Research: 10-50 years ago
■ Externally introduced: recent (<10 years ago)

Level of technical knowledge

▒ Agricultural advisor
▒ Land user

Main causes of land degradation:
Direct causes - Human induced: overgrazing
Direct causes - Natural: droughts

Main technical functions:
- improvement of ground cover
- increase in organic matter
- increase in nutrient availability (supply, recycling,…)
- promotion of vegetation species and varieties (quality, eg palatable fodder)
- Crop rotation includes halophytes and alfalfa

Secondary technical functions:

Environment

Natural Environment

Average annual rainfall (mm)

□ > 4000 mm
□ 3000-4000 mm
□ 2000-3000 mm
□ 1500-2000 mm
□ 1000-1500 mm
□ 750-1000 mm
□ 500-750 mm
□ 250-500 mm
■ < 250 mm

Altitude (m a.s.l.)

□ > 4000
□ 3000-4000
□ 2500-3000
□ 2000-2500
□ 1500-2000
□ 1000-1500
□ 500-1000
■ 100-500
□ <100

Landform

■ plateau / plains
□ ridges
□ mountain slopes
□ hill slopes
□ footslopes
□ valley floors

Slope (%)

■ flat
□ gentle
□ moderate
□ rolling
□ hilly
□ steep
□ very steep

Soil depth (cm)

□ 0-20
□ 20-50
□ 50-80
■ 80-120
□ >120

Growing season(s): 220 days (April-November)
Soil texture: coarse / light (sandy)
Soil fertility: low
Topsoil organic matter: low (<1%)
Soil drainage/infiltration: good

Soil water storage capacity: low
Ground water table: 5 - 50 m
Availability of surface water: medium
Water quality: for agricultural use only
Biodiversity: low

Tolerant of climatic extremes: temperature increase, seasonal rainfall increase, seasonal rainfall decrease, heavy rainfall events (intensities and amount), wind storms / dust storms, droughts / dry spells, decreasing length of growing period
Sensitive to climatic extremes: floods
If sensitive, what modifications were made / are possible: The technology is stable regardless of climate change, since it is based on flowing wells, which are a guaranteed source of water. The crops grown are also biologically adapted to unfavorable desert conditions (dry winds, droughts, high temperatures, etc.).

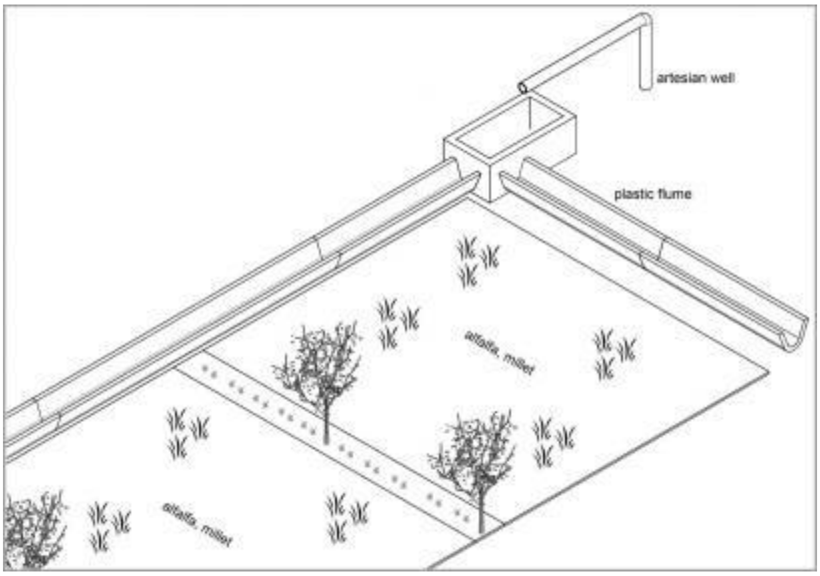
Human Environment

Grazing land per household (ha)

	<0.5
	0.5-1
	1-2
	2-5
	5-15
	15-50
	50-100
■	100-500
	500-1,000
	1,000-10,000
	>10,000

Land user: cooperative, medium scale land users, common / average land users, mainly men
Population density: < 10 persons/km2
Annual population growth: 1% - 2%
Land ownership: state
Land use rights: leased (Shirkats (large agricultural cooperatives) are granted public land for permanent ownership, which is then assigned to the shirkat members under rent conditions)
Water use rights: (Shirkats (large agricultural cooperatives) are granted public land for permanent ownership, which is then assigned to the shirkat members under rent conditions)
Relative level of wealth:

Importance of off-farm income: less than 10% of all income:
Access to service and infrastructure: low: employment (eg off-farm), market, drinking water and sanitation, financial services; moderate: health, education, technical assistance, energy, roads & transport
Market orientation: mixed (subsistence and commercial)
Livestock density: 10-25 LU /km2



Technical drawing

Water from a flowing well is supplied by gravity via a ditch or plastic chute assembly with outlets feeding the irrigation furrows. (R.Ibragimov)

Implementation activities, inputs and costs

Establishment activities

- Mobile irrigation plastic chute assembly

Establishment inputs and costs per ha

Inputs	Costs (US$)	% met by land user
Equipment		
- Mobile irrigation plastic chut	910.00	0%
TOTAL	**910.00**	**0.00%**

Maintenance/recurrent activities

- Leveling, plowing, compactor, cutting irrigation furrows
- Sowing
- Caring for plantations (irrigations)
- Mowing

Maintenance/recurrent inputs and costs per ha per year

Inputs	Costs (US$)	% met by land user
Labour	1818.16	100%
Equipment		

- Protection of the site

- machine use	189.60	100%
Agricultural		
- seeds	69.90	0%
- fertilizer	26.60	100%
TOTAL	**2104.26**	**96.68%**

Remarks:
Using plastic chutes for long-line furrow irrigation is not a mandatory element of the technology. In general, the technology is very cheap. The largest cost incurred is the hiring of labour to care for the seedlings during the vegetation period.
The cost was estimated for 1 hectare (as of 2009).

Assessment

Impacts of the Technology

Production and socio-economic benefits

++ increased fodder production
++ increased animal production
++ increased farm income

Production and socio-economic disadvantages

Socio-cultural benefits

++ improved food security / self sufficiency
++ improved health

Socio-cultural disadvantages

Ecological benefits

+++ increased soil moisture
+++ increased biomass above ground C
++ increased nutrient cycling recharge
++ increased soil organic matter / below ground C
++ reduced soil loss

Ecological disadvantages

+++ increased salinity

Off-site benefits

Off-site disadvantages

Contribution to human well-being / livelihoods

++ An increase in livestock production due to improved forage availability facilitates an increase in the shirkat farm's income, and therefore, the livelihoods for its members is improved

Benefits /costs according to land user

Benefits compared with costs	**short-term:**	**long-term:**
Establishment	very positive	very positive
Maintenance / recurrent	positive	very positive

Short-term: forage production, vegetables and melons, providing livestock with wholesome food during autumn and winter and food products to the population Long-term: preservation and increase of biodiversity, reduction in the pressure on pastures.

Acceptance / adoption:

100% of land user families (20 families; 100% of area) have implemented the technology with external material support.
There is no trend towards (growing) spontaneous adoption of the technology. due to a lack of farming standards in the local population's traditional livestock production

Concluding statements

Strengths and →how to sustain/improve	Weaknesses and →how to overcome
No special investment is required to introduce the	Lack of agricultural machinery personally owned by the

technology →To promote and persuade farmers to engage in pastoral irrigated fodder production	local land users involved in livestock production → Farmers association into groups for the joint acquisition of equipment
Quick income generation; Up to 1.5 million Sum of net profit per hectare can be generated →Perform all the activities provided measures technology to observe crop rotation	Lack of farming standards and experience among the local population traditionally practicing livestock production →Training in irrigated agriculture, promotion of technology
Locally available resources and materials are used → Use offered salt-tolerant varieties the technology of fodder crops	Possible tendency to soil salinization →Strict adherence to recommendations for crop rotation. Monitoring of soil salinity
Availability of a guaranteed source for irrigation water provides for the sustainability of production →Use recomendations in irrigation mineralized artesian waters	Lack of equipment and farming traditions →Change the mentality and habits
Creates employment opportunities, increases employment and production growth →To promote and persuade farmers to engage in pastoral irrigated fodder production	
Quick income generation and low level of investment into the technology →Training in irrigated agriculture and apply knowledge in practice	