

Promotion of high yield forage crops in short-farming rotation system under sprinkler irrigation on marginal lands (Kazakhstan)



Sorghum Forage industrial trial under sprinkler irrigation at Agro-Livestock Dairy Farm 'Hamburg', Taraz region



Sorghum grain production trial on degraded lands in southern-eastern Kazakhstan

Thematic Area: Crop/livestock diversification and sustainable management of marginal lands.

Purpose: Improve the livelihoods, resiliency to climate changes and income of poor farmers relying on marginal water and land resources in Kazakhstan.

Geographic Scope: Kazakhstan

Timeline: 2015-2018

Partners: International Centre for Biosaline Agriculture (ICBA);

Kazakh Research Institute of Water Management,
Ministry of Agriculture of the Republic of Kazakhstan.

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In southern-western part of Kazakhstan like in other Central Asian countries, intensive irrigation leads to soil erosion, loss of organic matter, salinization and waterlogging. The awareness of farmers on soil/water conservation and management of marginal lands is also very poor. Measures for the reclamation of salt prone marginal lands and water applied to crop and irrigation scheduling is still based on the previous traditional approaches. Furthermore, poor quality of soil and lack of water cause shortages of forage for livestock feeding in arid and semiarid regions are resulting in recurrent malnutrition for rangeland animals. To tackle the associated risks for sustainable agriculture and the long-term welfare of rural communities, researchers point to the need for diversification of agro-biodiversity and development of sustainable arid fodder and livestock feeding production.

The project focuses on crop/livestock diversification and sustainable management of marginal lands through the scaling up and dissemination of high-yielding forage production packages that are better adapted to the saline and marginal environmental conditions. It targets the selection of progressive farmers to enhance their capacity in efficient on-farm seed production and delivery systems of selected stress-tolerant forages and to apply efficient packages of forage production and utilization technologies for livestock feeding.

Specific objectives of the project were to: promote and adopt the technology of cultivation of high-yielding dual-purpose crops in short-farming rotation system under sprinkler irrigation on marginal lands; introduce, evaluate and scale – up environmentally and economically feasible forage-livestock production systems on marginal lands; assess the impact of technology development and adoption on crop-livestock productivity and increasing quality of livestock production; build the capacity of the NARS and farmers in crop diversification and seed production of dual-purpose crops in marginal conditions.

Activities and Outcomes

Under the conditions of low-productivity lands of private farm “Hamburg” in Dzhambul region, southern Kazakhstan an integrated agro-livestock and mixed farming model had been established on sodic saline soils at the area of 100 ha. Apart of others multi – purpose forage crops 5 high yielding salt and drought tolerant sorghum and pearl millet genotypes germplasm derived from ICBA have been out-scaling on large private farms in short crop rotation under sprinkler irrigation.

The project has been assessing ways and benefits of integrating pearl millet and sorghum into local crop-livestock feeding and farming production systems in diverse agro-ecological zones. It has supplied a set of improved lines and high-yielding accessions of pearl millet and sorghum in recent years. On station and multi-location evaluation identified promising dual-purpose varieties that produce grain for food and feed for poultry and livestock.

ICBA experiments leaded to releasing of new variety of sorghum 'Keshen'. This variety has been approved recently by the State Variety Testing Commission of Kazakhstan and released after successful evaluation in different agroecological zones.





Sorghum new variety – Keshen during seed maturation stage

'Keshen' yields up to 20% more compared with local sorghum varieties. The average yield of green biomass is around 45-72 t/ha. Grain yield varies between 3.28 and 4.36 t/ha. It also matures earlier than other tested varieties, within 96-128 days, and can be used as forage for all kinds of animals. It can be grown as main crop in early spring or second in pure stands or mixed with different salt tolerant legumes after winter wheat harvest or in rice rotation systems. The new promising dual purpose high-yielding, salt tolerant and rich in sugar stem variety of sorghum named 'Keshen' has been released as a result of selection of high productive populations of improved lines (ICRISAT) and local variety (Uzbekistan 18) during 2010-2015 at experimental station of the Kazakh Research Rice Institute in Kyzylorda. Plant survival, forage and grain yield values indicated that 'Keshen' grows and produces viable seeds on medium saline soils. It can also thrive on highly on sulfate-chloride type soils as found in experiments in the Syr Darya river basin areas in Kazakhstan. Furthermore, as experiments showed, it has fairly good digestibility and palatability for small ruminants and cattle animals.

On saline soils in southern Kazakhstan the field seed germination for the pearl millet improved lines from ICBA were lowest than for the sorghum and varied within limit 52,0-59,3%. Sorghum formed more than 68 t/ha and pearl millet 48 t/ha of green forage biomass under limited irrigation. These dual-purpose varieties could fill gaps in improving forage production and crop-livestock systems, especially dairy livestock husbandry production.



On farm trial on pearl millet for livestock forage production at Hamburg Farm, southern-eastern Kazakhstan

However, extra efforts are needed to secure sufficient amounts of seeds of the selected genotypes for wider application. In addition, national programs and farmers in the region need to strengthen their technical expertise and capacity in various aspects of technology of cultivation (including mechanization of main process) and seed production to meet the demands and for scaling up to larger number of farms.

Therefore it was conducted selection of progressive farmers around each test site in Jualy district, Dzhabul region, as well as training of technology of cultivation of best performed lines of sorghum and pearl millet, methodology on seed multiplication and seed production under sprinkler irrigation.

On the research sites of ICBA the production and multiplication of seeds of sorghum, pearl millet, clover, white seed amaranth and triticale were initiated for providing the private dairy farm "Hamburg" with the elite seeds for the autumn and spring sowing and the continuous production of biomass.

Future Directions

Future ICBA activities will aim to disseminate packages of forage production and utilization technologies under marginal conditions to farmers; improve crop diversification to increase overall farm productivity and sustainable year-round agricultural production with a special focus on forage-livestock feeding systems in rural areas; develop farmer participatory efficient seed production and delivery systems for farmers' wide scale adoption.

The next step is to ensure wide adoption of the high-yield forage crops (sorghum pearl millet, amaranthus, forage legumes), including their seed multiplication and distribution among interesting farmer clusters. In the future seeds can be produced by individual or cluster farms of nearby villages. Non conventional forage crops play a significant role in filling gaps in the crop-livestock feeding systems in the dryland areas of Kazakhstan. Since it is a relatively new non conventional forage crops in the region with no readily available markets, it is important to secure a market prior to large-scale cultivation.