Studies of the Effect of Marginal Growing Conditions (Karakalpakstan) on Grain and Forage Yield of Quinoa

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* Characteristic of soil and climatic conditions

Lands of the Republic of Karakalpakstan are referred to the final area of Amudarya's geochemical flow, therefore salt accumulation in soil and groundwater is exponential. The mechanical composition of the soil is medium loamy, with content of organic matter at 0,6-1,0% and nitrogen – 0,03-0,06%; Mineralization of groundwater from 1,08 to 24,3 g/l.

Objectives of the research

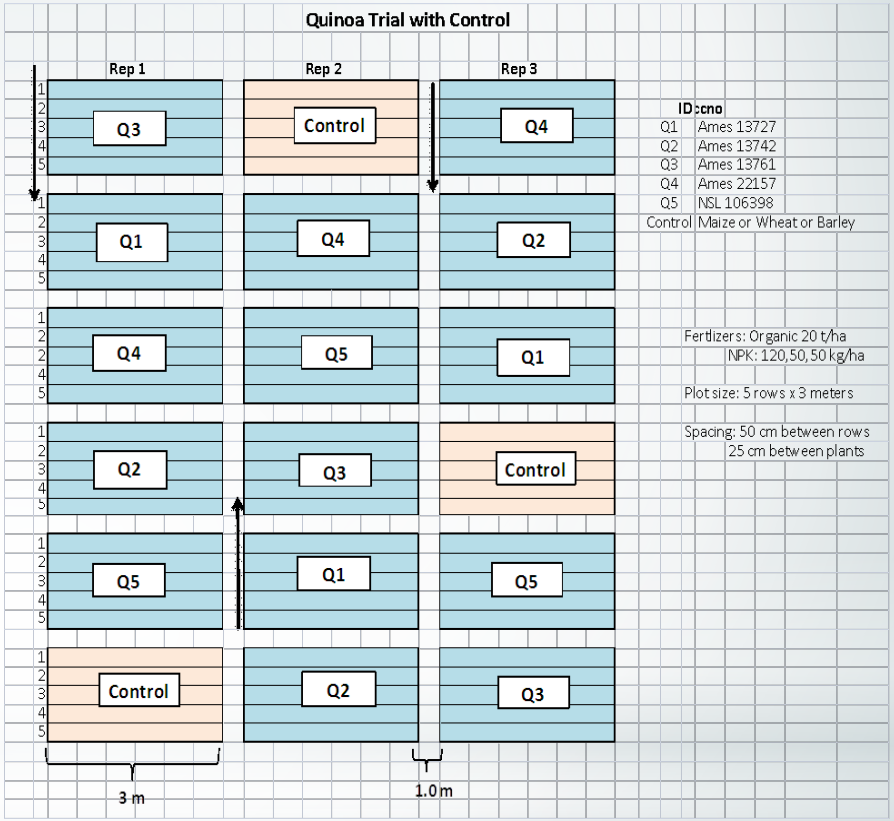
The main purpose of our studies was the evaluation of quinoa under dryland saline environments of Amudarya River Basin (water tributary of Aral Sea) as a cash high nutritional crops for:

- Human consumption;
- as livestock feeding source.

Due to above mentioned reasons, seed sowing of 5 quinoa cultivars were planted on saline farmer lands of Yliyas and Shortanbay Farms :

- Quinoa 1 Ames 13727
- Quinoa 2 Ames 13742
- Quinoa 3 Ames 13761
- Quinoa 4 Ames 22157
- Quinoa 5 NSL 106398

Scheme of field experience



Results of quinoa cultivation (2015-2016)

In 2015 year field experiment was carried out relatively late, on the 1st of May.

The meteorological conditions were characterized by high temperature, increasing above normal rate by 5- 12 ℃ at the end of June and at the beginning of July. Heat and dryness of air affected plant growth, development and green biomass accumulation.

Due to deficit of surface water for irrigation low survival rate of plants were observed . The plant density varied from 6 to 12 persent/1m^2.

Field experiment shown that the optimal seed sowing it this conditions, should be done at on a plain surface, sowing on on furrows not effectively.

2015 year

2016 year

* Care of plants

- **Technology of after seeding processing of crops, including aerating the soil around the plants, as for other plants with a wide interrow distant between them, for providing cultivars with sufficient amount of air and removing of salt around the plants;**
- **Nutrition of plants with nitrogen and phosphorous fertilizers during the initial phase of development, when the pace of growth is low;**
- **In 2015 yeas, feasibility of irrigation by drainage water with the level of salinity at 8-10 mg/l of water;**

Quinoa growth and grain accumulation in 2015 year
Ilyas farmer

Cultivars	Date of seeding	Date of maturing	Quantity of days	Average height of plants	Crops yield, t/ha
Quinoa 1	05.V	15.IIIV	96	38	0,70
Quinoa 2	05.V	15.IIIV	96	41	0,82
Quinoa 3	05.V	15.IIIV	96	41	1,31
Quinoa 4	05.V	15.IIIV	96	35	0,80
Quinoa 5	05.V	12.IIIV	93	44	0,82




* In 2016 year carried the following work was performed:

- **Fertilizing. Organic fertilizers were added under the main tillage, estimated at 20 t/ha of manure's active ingredient. Mineral fertilizers – normal rate before seeding was equal to $N_{180}P_{90}K_{90.}$ Application of ammonium nitrogen fertilizer was conducted at the rate of N30 during the phase of growing. The second application, with carbamide, took place in the phase of paniculation, with norm 40-50 kg/ha.**
- **In 2016 year we develop some parametrs of texnology cultivated of quinoa. Sowing seeds was planted more early on the 12th of April.**
- **Soil temperature was +11-13 °C; soil moisture was 75% from HB; wind velocity was up to 6-10 m/sec; air temperature +16+20 °C; total soil salinity ranges as 0,7-1,8 mg per 100 gr of soil.**

* The process of Quinoa cultivation

•**Control of pests, inhabiting in a natural reservation, by means of chemicals.**






Chemical composition and energy value of quinoa, cultivated in Karakalpakstan

Analysis of post-harvest plants processing revealed that quantity of mature seeds accounted approximately 3,05t/ha and 48,8%, hay and chaff - 69,5-51,2 %. Hence, such amount of biomass can be used rationally for animal feeding.

The results of the first year study, conducted by the Research Institute of Karakul Sheep Breeding and Desert Ecology (Samarkand, Uzbekistan), showed that all above ground biomass of Quinoa contains: 90,8-92,4 % of dry matter; 8,8-16,9 % of protein; 2,92-4,78 % of lignin; 16,9-32,4 % of nitrogen-free extractive substances. Large stems of quinoa plants (12-13 cm) can be cut to feed small ruminants in the form of green forage or mixed with hay or silage of other crops by adding nitrogen, sulphur and phosphorus containing substances. Chaff after threshing grain can be used for the preparation of feed pellets and forage blocks for small ruminants.

Cultivar	Region	Chemical composition, %						Gross energy, kcal
		Dry matter	Protein	Lignin	Fat	Ash	NFS	
Quinoa ICBA	Karakal-pakstan	90,8	14,24	4,78	10,6	27,1	16	3459,5

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Thereby, quinoa's above ground biomass is a nutritional forage for cattle in arid zone and can contribute to enhancement of livestock food supply and maintenance of farmers' living standards , those who live on a marginal lands.

For better palatability, it is necessary to use physico-chemical and biological methods of processing, aimed at the delignification indigestible part of lignin and transformation of the forage into convenient form for digestion.

While making up a ration, it is necessary to take into consideration a sharp deficit of protein in arid zone. Quinoa, meanwhile, has a substantial amino acid composition and contains 9 essential amino acids, including lysine, izoleucine, which cannot be found in main cereals. Quinoa and soy bean have similar composition of valuable elements, though quinoa is more resistant to environmental conditions.

* Major outcomes and perspectives of quinoa cultivation in Karakalpakstan

- **Grain of quinoa is indispensable for population from the nutritional point of view. It can be used for reducing malnutrition of people, living in the Aral Sea region and suffering from deficit of specific elements. For this purpose, it would be reasonable to cultivate the best species of the world's collection.**
- **Another direction focuses on creation of new crop varieties with involvement of local wild species *of Chenopodiaceae*, especially halophytes of Karakalpakstan;**
- **It is necessary to develop detailed methods of cultivation, regarding regional soil and climatic conditions;**
- **Under the conditions of high temperature and dryness of air, seeding in the rows causes fast desiccation of soil and deteriorates growing of the shoots. Therefore, planting on a leveled ground is more reasonable with subsequent creating of rows;**
- **By-products and forage crops of quinoa are very beneficial in supplying of livestock with nutrition fodder.**

Thank you for attention!