Characterization of demonstration site including soil, climate conditions and crop yield

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Contents

Characterization of demonstration site including soil, climate conditions.

Soil

The soils are sirozem, gray-brown, brown desert, takyr-like, and in the irrigated area -meadow-marshy, mostly saline with salt amount of 33 to 325 t ha-1 in 2 m layer and humus content of 0.609 to 1.156 % in the cultivated layer. The soil of experimental site is rather dense with the bulk density fluctuating between 1.4 and 1.6 g cm^3. The highest bulk density was noted in the depth of 20-40 cm. All soil parameters were analysed by the method developed in Uzbek Research Institute of Cotton (UzRIC, 1973). Over the past 12 years, more than 50% of fields in the whole Qorao'zak district have been ranked as low to very low in P2O5, K2O and humus content.

Table 1: Soil chemical parameters in the demo site in Qorao'zak, Uzbekistan (2015)

Depth	N-NH4, %	P2O5, %	K2O, %	N-NH4 mg/kg	P2O5 mg/kg	K2O mg/kg	Humus, %
0-20	0.055	0.24	1.084	17.4	25.0	112.7	0.992
20-40	0.045	0.77	0.662	12.6	22.0	104.4	1.156
40-70	0.021	0.12	0.422	7.7	16.0	80.3	0.525
70-100	0.020	0.09	0.397	3.8	6.0	80.3	0.609

The irrigated areas of the project pilot site irrigated areas are considered to be of saline soil and the value of soil salinity 0.199 and 0.41. The content of Cl ranges from 0.03 to 0,065%, which is close to maximum allowable concentration (0.04%) for these conditions (Table 2). Salt in the soil is concentrated in the upper 0-15 cm layer and its value goes down in the lower horizons.

Table 2: Soil chemical analysis in the demo site in Qorao'zak district, 2015.

Soil depth	Solid residual	Soluble anions					Anions and cations	Soluble cations		Total
		HCO_3	Cl^-	SO_4^{2-}	Ca^{2+}	Mg^{2+}		Na^++K^+ on difference		
								meq/ 100g	in %	
0-15	0.55	0.50	0.89	5.74	2.50	2.96	5.46	1.67	0.038	0.41
15-30	0.235	0.50	0.79	1.93	2.00	0.49	0.49	0.73	0.017	0.199
30-60	0.53	0.44	0.79	5.05	1.75	0.99	2.74	3.54	0.081	0.413
60-90	0.285	0.60	0.69	2.61	1.50	0.99	2.49	1.41	0.032	0.243

The irrigation and drainage infrastructure has been deteriorating since the country's independence in 1991. Before independence, the normal period for overall maintenance of the canals used to be around three years but since then maintenance has been very erratic and insufficient. Because of insufficient flow control infrastructure, irrigation water flows constantly into most canals up to the tertiary level for most of the irrigation season. This leads to high water losses through the irrigation scheme. Water is provided to farmers for free and they do not participate in the management of the irrigation scheme.

Climate

Qorao'zak's climate is classified as severe continental with hot summers and cool winters. Summer temperatures are often surpass 45°C; winter temperature in January on average is about -8°C, with absolute minimum as low as -40°C. According to the data of the Karakalpak Research Institute of Crop and Land Management (KRICLM) located in Qorao'zak, the annual long-term precipitation is 110 mm, distributed as 18mm in fall (September- November), 60 mm in winter (December-March), 24 mm in spring (April-May) and 8 mm in summer (June-August).

Uzbekistan has extreme continental type climate, with hot dry summers, unstable weather in winter, and a wide range of variation in seasonal and daily temperatures. The desert and steppes are characterized by short winters with thin and unstable snow cover, and hot dry dusty summers. The mountains (over 600 m asl) have high precipitation (up to 600 mm per year).

The year 2015, in contrast with perennial mean was not characterized by favorable weather conditions for the production of agricultural crops. First rainfalls occurred in the middle of the January of 2015. May rainfall was positively affected the germination of different agricultural crops and, as a result, percentage of germination was high. In general, the winter of 2015 was favorable to the agricultural crops growth and development and warmer than usual and almost without snow.

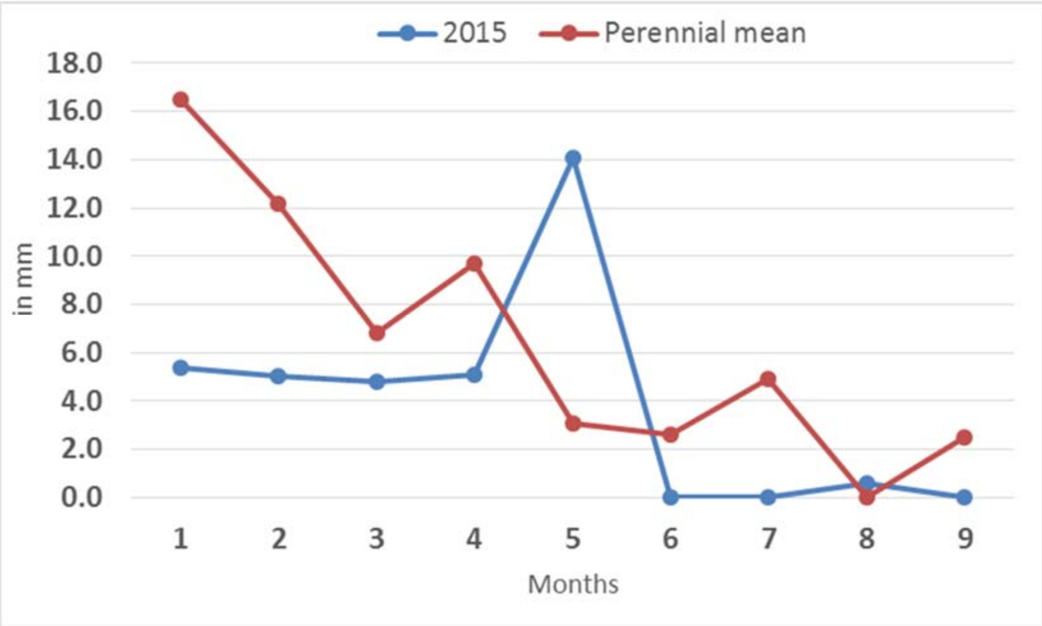


Figure 1: Mean annual precipitation, Qorao'zak (2015)

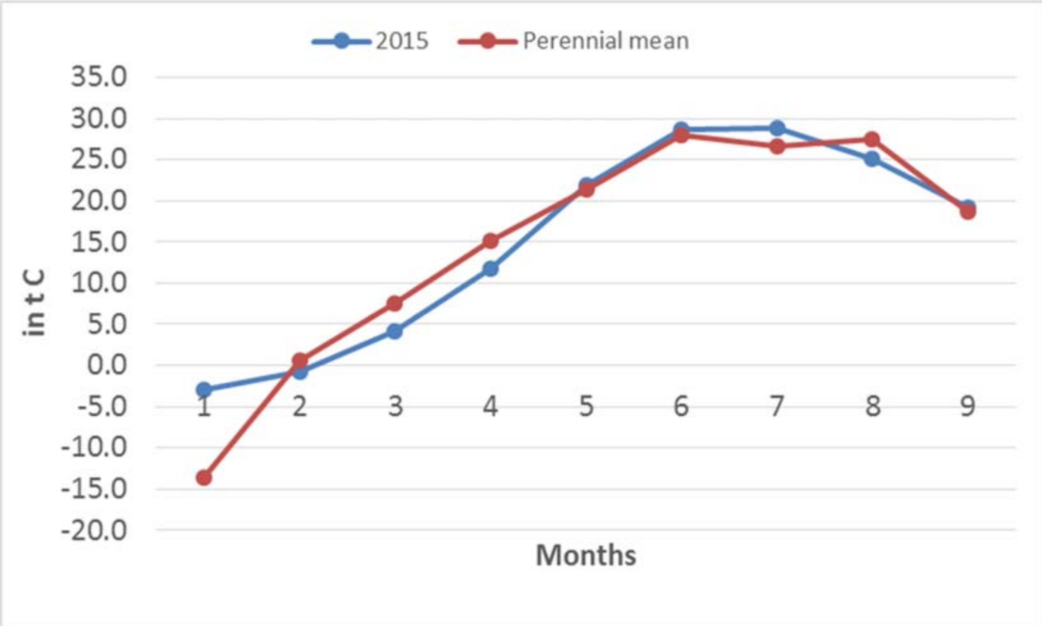


Figure 2: Average air temperatures in Qorao'zak district (2015)

In 2015, temperature regime during period from April-June was closer to average monthly temperature April-June in long term average. The lowest temperature was observed February-March (Figure 2).

Water resources are in short supply in most of Qorao'zak district. The three canals supplying water to Qorao'zak district are Mayjap, Shokharik and Aytgejap, which originate from large canal Kyzketken of the Amudarya. Ground water resources are polluted by untreated sewage and drainage water, which contains high levels of agrochemicals and minerals.

Integration of legumes into cereal cropping systems under no-till and conventional tillage

Introduction

Integration of mung bean into continuous wheat cropping to increase crop production and improve soil fertility through implementation of double cropping will be demonstrated. A field continuously planted to wheat or barley selected on Qorao'zak district.

This experiment conducted at the project demo site in Shakhap farm of Karaozak district in July 2015. Three different mungbean varieties planted after wheat harvest as double crop which is not common practice in the conditions of Karakalpakstan. Three mungbean varieties was grown under no-till practice.

Treatment

- Wheat
- Wheat +Mungbean (Durdona 16 kg ha)
- Wheat + Mungbean (Marjon 16 kg ha)
- Wheat + Mungbean (Local 16 kg ha)

Experimental design

The experimental design is a randomized complete block design with three replicates. Plot area is 100 m^2 (20*5).

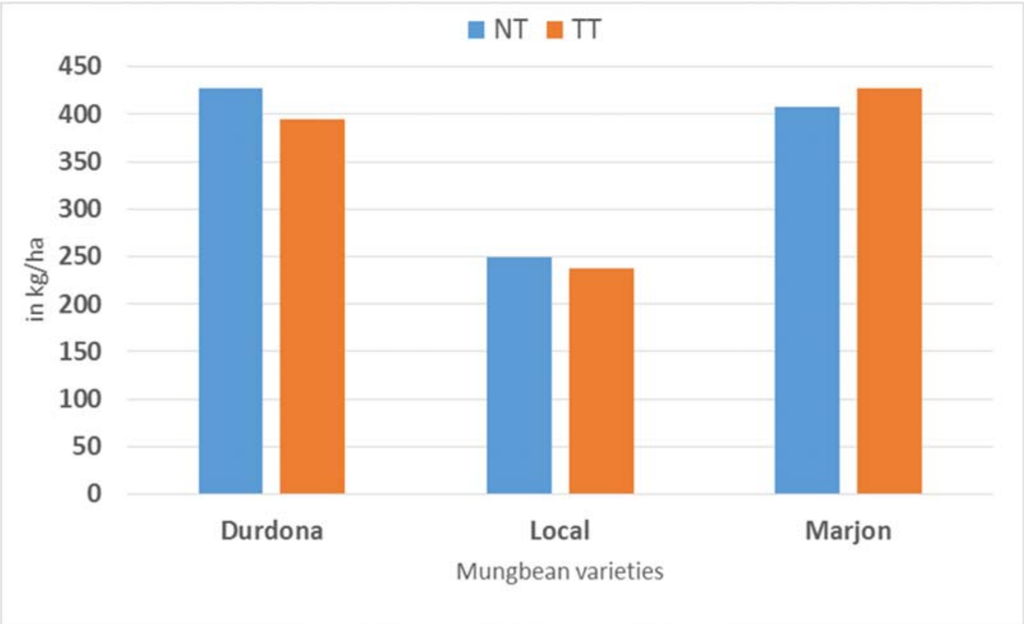
Results

ANOVA shows that the varieties had significant statistical difference in this experiment (p<.001) while tillage system had close to significant difference (Table 1).

Table 1: Analysis of variance

Source of variation	d.f.	s.s.	m.s.	v.r.	F pr.
Varieties	3	690184.	230061.	38.82	<.001
Varieties.Tillage	4	2435.	609.	0.10	0.980
Residual	16	94813.	5926.		
Total	23	787432.			

Mungbean grain yield was significantly affected by varieties and tillage system. The Durdona variety showed the highest grain yield (427) with no-till tillage but in traditional tillage Marjon variety had the highest yield (427 kg/ha). The local variety gave consistently the lowest grain yields across two tillage systems.



Cost benefit analysis

Highest net income (327 USD ha-1) was obtained from the no-till Durdona variety while local variety had negative net benefit in both tillage methods.

Conclusions

Planting date is a key parameter in the climatic conditions of Karakalpakistan because in some years early frost can decrease grain yields. Thus, growing early maturing varieties after the winter wheat harvest ensures to harvest at least grains besides the forage biomass. The cost benefit analysis using averages from one observation confirmed the advantage of no-till mungbean achieving a higher net income of 327 USD per hectare.

Table 14. Cost-benefit analysis (USD ha-1) for three different mungbean varieties under two tillage systems

Cost items	NT			TT		
	Durdona	Local	Marjon	Durdona	Local	Marjon
Yield kg/ha	427	250	407	395	237	427
Crop price per kg/$	2.1	2.1	2.1	2.1	2.1	2.1
Yield $	897	525	855	830	498	897
Total variable costs	570	570	570	668	668	668
Profit	327	-45	285	162	-170	229

Annex

No-till mungbean planted after winter wheat harvest