EFFECT OF PLANTING DATE ON PRODUCTIVITY NO-TILL MAIZE IN SOUTH KAZAKHSTAN PROVINCE OF KAZAKHSTAN

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Abstract. *Traditionally, agriculture in south Kazakhstan (SK) is dominated by mid-size and small farms. Agricultural production is based on irrigated farming. A significant part of the cropping area is suffering from water scarcity. Therefore, improving agricultural production in irrigated areas through water-saving technologies is critical for achieving sustainable economic development of the region. Maize grain production is amounted to 462.000 tonnes while total area is 95600 hectares in Kazakhstan (FAO, 2010). The national average maize yield is about 4.6 tons ha-1, while potential exists for increasing the yield to over 8 tons ha^{-1} through increased use of improved hybrids or varieties, fertilizers and good crop husbandry including optimum planting date. Planting date, seeding rates, hybrid selection, tillage, fertilization, and pest control all influence corn yield in the irrigated conditions. The main objective of this study is to determine optimum planting date in the irrigated conditions of South Kazakhstan province under no-till technology.*

Keywords: *fertilizers, potential, maize biomass, grain yield.*

Materials and methods

Availability of earlier hybrids with shorter plants, lower leaf number, upright leaves, smaller tassels and reduced anthesis silking interval has enhanced the ability of maize to withstand high plant populations without showing excessive barrenness (Sangoi, 2001). Experiments were conducted under irrigated conditions in 2012 and 2013 to determine the optimum combination of planting date to maximize the yield of maize. A randomized complete block design with four replications was established to study yield potential and economics of improved fodder production. Four planting dates (April 15, repeated every 15 days until May 30) were evaluated for maize biomass yield with its agronomic traits. Seed was placed with 6 cm of soil cover in all treatments. Considering the importance of nitrogen (N), phosphorus (P), and potassium (K), recommended fertilizer rate was held constant for all treatments each year and the fertilizer rate was $N_{180}P_{90}K_{60}$. The maize field was irrigated three times during the vegetation period at the rates 600 m^3. Field data for both experiments were collected on seed germination, plant density, plant height, days to maturity, grain and biomass yield. We determined number of plants per m^{-2} at the stage of plant maturity. The experimental data analysis was performed using GenStat program 11th edition.

Climate

Climatic conditions of SK are very diverse, comprising steppes, hot and dry semi-deserts, and mountains. The climate is continental, with hot temperatures and low air humidity in summer time and cold and quiet unstable winter with low snow fall. Average frost-free period lasts for about 225 days. Average daily temperature is 16.9^{o}C. June through August is the hottest months sometimes temperature can go up to 40°C while lowest temperature is observed in January and February months when lowest temperature can go down to -35°C (Figure). A long-term annual precipitation level is around 350 mm. However, rainfall varies strongly over the year for example in 2011 average rainfall high up more 1000 mm per (Figure). Precipitation starts at the end of September and early October. The highest precipitation is observed in winter and spring seasons (78%) followed by autumn (18%) and summer (4%). Low precipitation level permits only irrigated crop production.

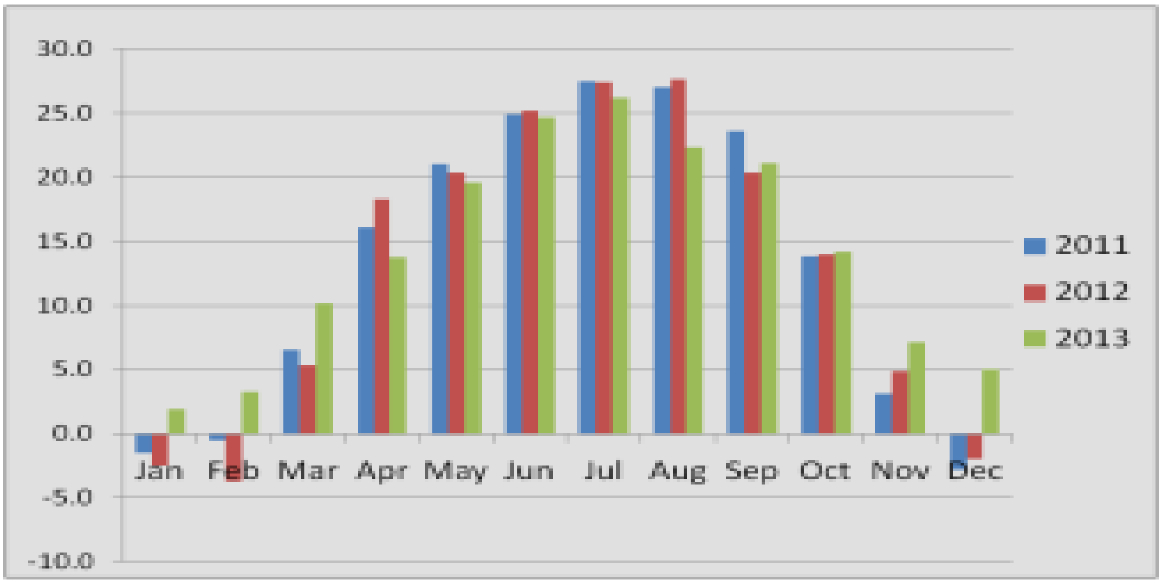

Figure 1: Average air temperature in Chimkent, Kazakhstan

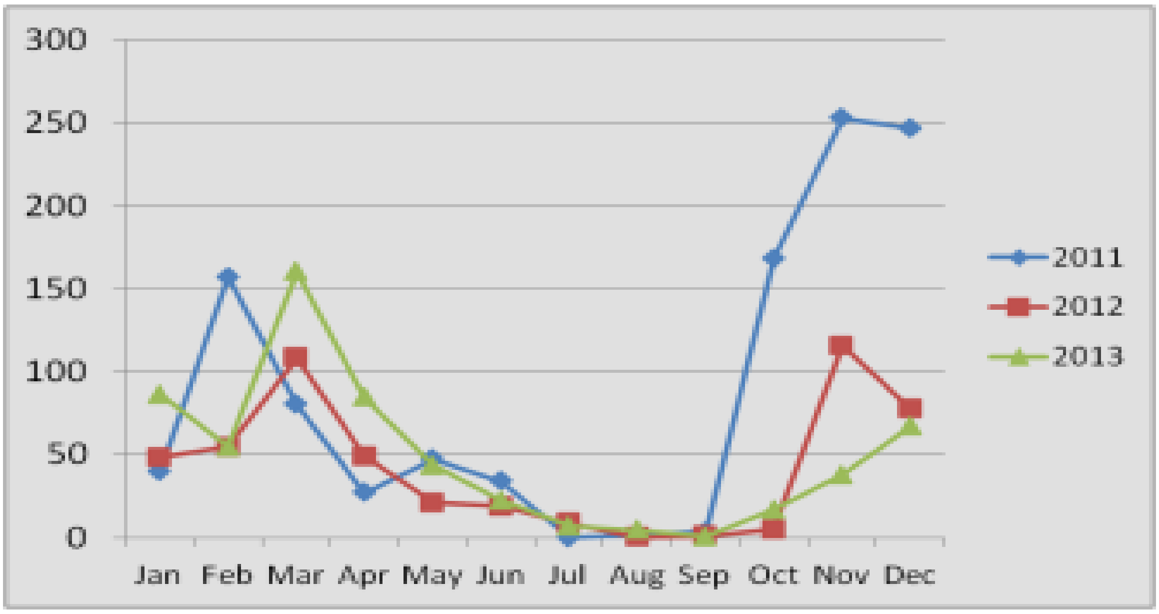

Figure 2: Mean annual precipitation in Chimkent, Kazakhstan

Results

Corn seed begins germination when the seed contains at least 25-30% moisture. Adequate soil moisture is most important feature to get rapid, uniform germination and emergence of maize and help set the stage for maximum grain yield at the end of the season. The data in Table 1 indicated that seed germination of maize was significantly (<.001) affected by years with highest seed germination of 82.6% obtained in farmer 2, when the crop was sown on May 30 in 2009.

Lowest seed germination of 64.9 % was noted, in farmer 1, with planting on 15 April in 2008. In our experiment four planting dates showed a relatively small trend of seed germination. The seed germination ranged from 64.9 to 82.6 % across treatments, farms and years. At planting date on 30 May, the seed germination increased up to 27% during the vegetation period. Farms not differed significantly (0.004) for seed germination.

Number of plants per m^2 is the most important agronomic trait to determine maize biomass and grain yield. Number of plants was significantly affected by treatment (i.e. planting dates). The highest number of plants per m2 was 9.35 in farm 1 in the treatment where maize was sown on April 30, 2008. The lowest number of plants was recorded (6.55) also in farm 2 where maize was planted on 30 May, 2009. Number of plants per m^2 ranged from 6.55 to 9.35 across the years and treatments.

On the basis of our experiment it was found that the maize crop grew the tallest (291 cm) and a high biomass yield when the plant is planted on May 15 (Table). The results revealed that plant height is an important variety trait and late sowing date reduced plant height. ANOVA statistics show that there were significant differences in maize plant height within years, treatments and farms (P<0.001). There was also close interaction between year and treatment on maize plant height while there was not interaction between year and farm, farm and treatment.

Table 1: Seed germination, plant density and height of maize at the experimental in South Kazakhstan

Farm	Treatment	Seed germination, %			Number of plants, m^2			Plant height, cm		
		2012	2013	Average	2012	2013	Average	2012	2013	Average
F1	15-Aprl	77.8	64.9	71.3	8.60	7.58	8.09	230.0	283.8	257
	30-Aprl	72.8	69.5	71.2	9.35	8.25	8.80	238.5	284.2	261
	15-May	74.3	66.6	70.5	8.75	7.72	8.24	257.1	325.5	291
	30-May	78.5	65.5	72.0	7.07	7.08	7.08	242.5	237.8	240
F2	15-Aprl	74.8	74.8	74.8	8.19	8.20	8.20	210.7	260.5	236
	30-Aprl	70.0	78.6	74.3	8.90	8.92	8.91	218.4	269.8	244
	15-May	71.5	71.7	71.6	8.33	8.34	8.34	235.4	311.3	273
	30-May	75.5	82.6	79.1	7.43	6.55	6.99	222.1	244.5	233
ANOVA	Year	<.001			0.083			<.001		
	Farm	0.004			0.715			<.001		
	Treatment	0.229			<.001			<.001		

Grain yield is obviously one of the most important factors to determine total production of maize. Results on grain yield (Table) revealed that planting date April 30 in farm 1 and farm 2 gave highest grain yield at a density of 8.80 and 8.91 m-2, respectively. The 2012 and 2013 growing conditions for maize in South Kazakhstan were, in general, very favorable with near (2012) and above average (2013) rainfall. Low climatic and disease pressure resulting in higher grain yields in 2012 compared to 2013. Thomson et al. (2009) reported that excessive rainfall may cause serious injury to a corn crop depending on its stage of development and decrease productivity. Grain yield was lowest for planting date 30 May at a density of 7.08 plants m^{-2}. Grain yield was highest with April 30 planting. Yield reduction was associated with planting dates. High yields can thus be obtained by planting date. The results revealed that grain yield was decreased by 2.0 and 0.7 t ha^{-1}, with early and late planting.

Table 1: Grain yield of maize (2012-2013)

Farms	Treatment	Grain Yield, t ha^{-1}		
		2012	2013	Mean
Farm 1	15-Aprl	4.4	3.9	4.2
	30-Aprl	7.4	4.9	6.2
	15-May	6.0	5.0	5.5
	30-May	5.7	4.8	5.2
Farm 2	15-Aprl	4.7	3.6	4.1
	30-Aprl	6.8	4.6	5.7
	15-May	5.1	4.7	4.9
	30-May	4.1	3.3	3.7
ANOVA	Farm	<.001		
	Year	<.001		
	T	<.001		

Decrease of 8 and 40% in grain yield under early and late sowing, respectively might be due to lower nutrient uptake and reduced photosynthetic translocation in the developing grain. It is therefore, evident that April 30 is optimum planting time for maize grain production in South Kazakhstan province. These results are in line with Fakorede (1985) who also reported a decrease of 30-38 kg ha^{-1} in maize grain yield for each day of delayed sowing. Ahmad *et al.* (2001) concluded that delayed sowing decreased shelling percentage, which ultimately resulted in lower grain yield. Highest grain yield with optimum planting time has been reported by Martiniello (1985) and Albus *et al.*(1990). McWilliams (1999) reported positive effect of planting date on maize yield. This is in line with our results. The planting date analysis showed that the best sowing date was April 30, and grain yields of other three dates were relatively lower.

Conclusion

On the basis of our experiment it was found that the maize crop grew the tallest (291 cm) and a high biomass yield when the plant is planted on May 15. There were significant differences in maize plant height within years, treatments and farms.

There was also close interaction between year and treatment on maize plant height. It should be mentioned here that the higher seeding rates gave almost similar yields while the low seeding rate frequently reduced grain yield of bed planted maize. In our experiment four planting dates showed a relatively small trend of seed germination.

The seed germination ranged from 64.9 to 82.6 % across treatments, farms and years. Number of plants was significantly affected by treatment i.e. planting dates while year and farm were not significant. Effect of planting date on maize grain yield was significant.

Analysis of variance showed that grain yield had significant difference within treatments (<.001) while number of plants within farms was unrelated to biomass yield.

The planting date analysis showed that the best sowing date was April 30, and grain yields of other three dates were relatively lower.

The results of this study proves that planting dates have significant effects on number of plants and grain yield in maize.

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