EFFECTS OF PLANTING PRACTICES TO MAXIMIZE GRAIN SORGHUM YIELD IN KANSAS DRYLAND CROPPING SYSTEMS

Alassane Maiga, Kraig L. Roozeboom and P.V. Vara Prasad

Agronomy Department, Kansas State University, Manhattan, KS 66506

Introduction

Grain sorghum is well adapted to semi-arid environments, but production practices must be optimized. Determining an optimal planting date, row spacing, hybrid selection and good stand for grain sorghum [*Sorghum bicolor* (L.) Moench] are critical to maximize yield and economics of production.

Planting practices have been of interest in crop production for decades and yield increases have been attributed to better light interception and more efficient water use. Research has shown that crop row spacing <30 inches will increase grain yield in high yield environments with little risk of reduced yield in low yield environments.

The earliest possible planting in order to take advantage of favorable growing conditions without being exposed to adverse environmental conditions can improve yields. Planting may be delayed long enough that choosing an early-maturity hybrid may be warranted. The variability in yield response to planting date and environment indicates that additional research is required to develop best management practices.

The objectives of this research were to determine the influence and interaction of planting date, hybrid maturity, row spacing, and seeding rate on grain sorghum yield in various environments in Kansas.

Materials and Methods

Field experiments were conducted at Manhattan, Hutchinson and Belleville in Kansas during summer 2009. Interactions between row spacing, maturity group, date of planting and plant density were studied. Fields were planted early(10 to 15 May) and late (10 to 15 June) at four seeding rates (20000, 50000, 80000 and 110000 seeds per acre) three rows spacing (10, 15 and 30 inches). Two hybrids were selected from two maturity classes (medium early DKS 44-20 and medium late DKS54-00) based on production conditions in Kansas.

Hand thinning was done when seedlings were 10 cm tall to achieve the desired plant density for treatments. The experiment was a split plot design with four replications. Weed control was accomplished with a pre-emergence application of dimethenamid-P and atrazine.

Grain sorghum head number per plant, test weight, percent grain moisture, and grain yield were recorded at harvest and grain weight was adjusted to 14% moisture.

Analysis of variance was performed using the PROC MIXED procedure of SAS. Mean separation was evaluated through LSD among all treatments. Main effects and all interactions were considered significant at $P \leq 0.05$.

Results

Our results indicate that there were significant effect of planting dates across different environments (Table 1). The yields of grain sorghum were higher when planted during May than June. Among the different locations, grain sorghum yielded significantly highest (10761 kg/ha) during early planting date in Belleville. It was observed that maturity classes had no significant effect on sorghum yield under different environments (Table 1). The effect of row spacing on grain sorghum yields was greater in Belleville and Hutchinson. In Belleville, the yields were highest under narrow rows (10818 kg/ha) when compared to wider row spacing. It was also observed that narrow spacing increased yield (8523 kg/ha) than wider rows in Hutchinson, Kansas. However, row spacing did not affect yield in Manhattan (Table 1). The plant population (seed rates) study revealed that, there were significant differences among the seed rates under different environments. It was found that seed rates at 50000, 80000, and 110000 seeds/acre were significant (Table 1).

Table 1. Planting date ,hybrid maturity, row spacing and seeding rate on grain sorghum yield in several environments in Kansas

TREATMENTS	BELLEVILLE	MANHATTAN	HUTCHINSON
	(kg/ha)		
Date of planting			
May	10761^{a}	7510^{a}	9229^{a}
June	9155^{b}	5544^{b}	7464^{b}
LSD (0.05)	337	356	245
Hybrid maturity			
Early	10020^{a}	6667^{a}	8366^{a}
Late	9896^{a}	6387^{a}	8327^{a}
LSD (0.05)	NS	NS	NS
Row spacing (inch)			
10	-------	6529^{a}	8523^{a}
15	10818^{a}	------	-------
30	9098^{b}	6526^{a}	8170^{b}
LSD(0.05)	337	NS	245
Seed rate			
20000	9517^{b}	5301^{b}	7820^{b}
50000	10243^{a}	6687^{a}	8618^{a}
80000	10179^{a}	7044^{a}	8647^{a}
110000	9893^{ba}	7077^{a}	8302^{a}
LSD (0.05)	476	503	347

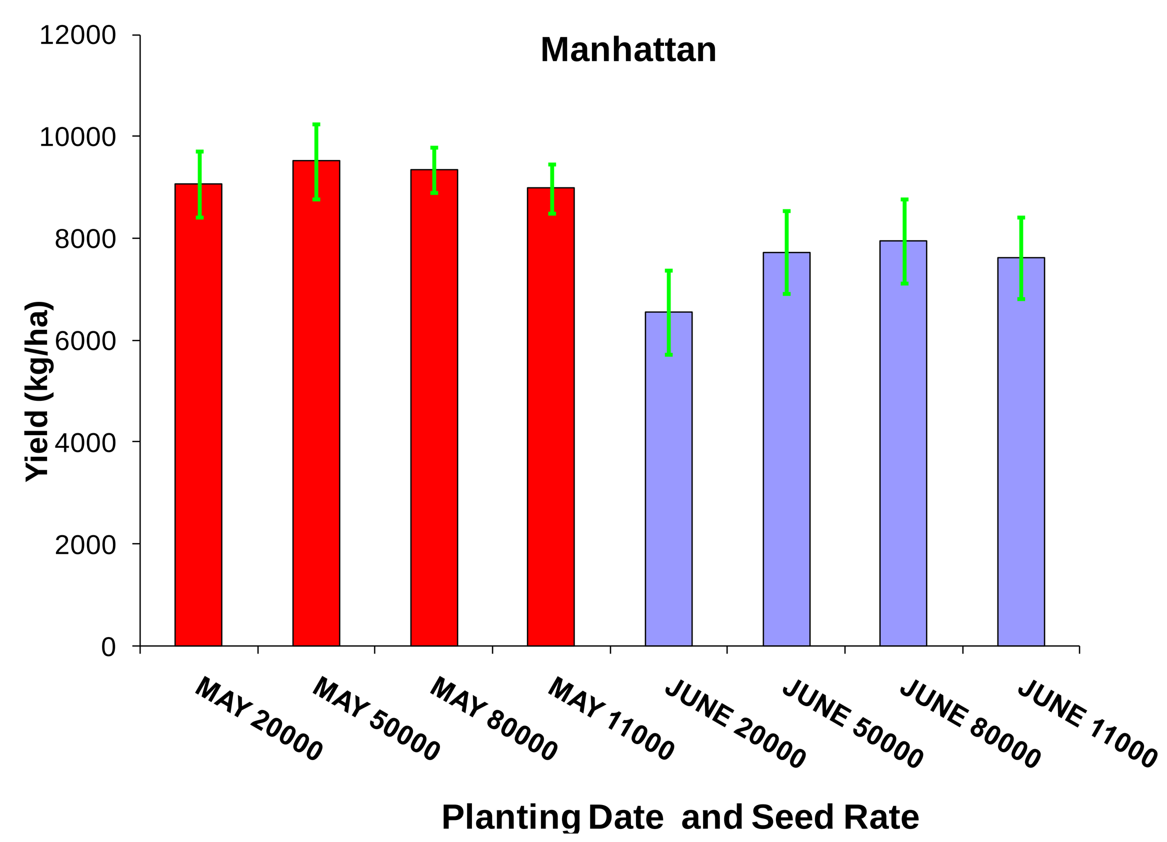

Fig. 1. Interaction effects of planting date and seed rate on grain yield of sorghum.

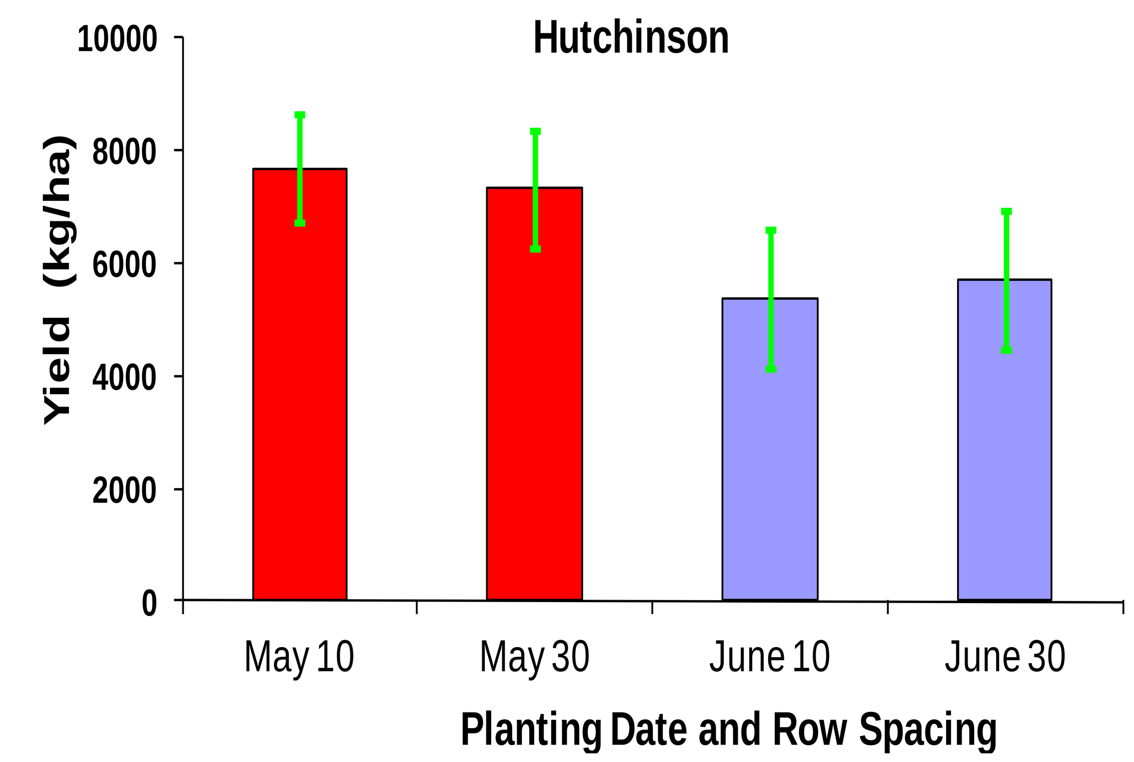

Fig. 2. Interaction effects of planting date and row spacing on grain yield

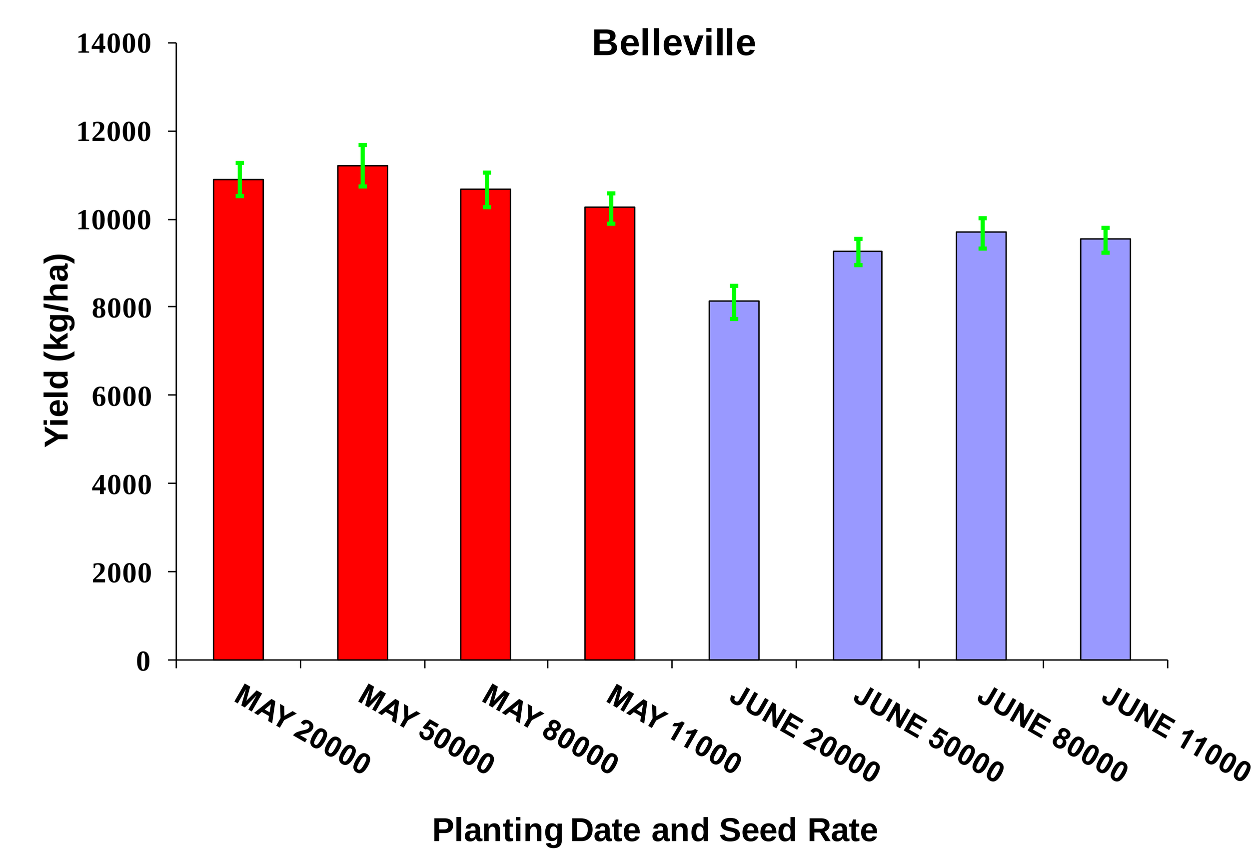

Fig. 3. Interaction effects of planting date and seed rate on grain yield.

The interaction between date of planting and seed rate was found to be significant in Manhattan and Belleville (Figures 1 and 3). Lower yields were produced when sorghum was planted late at lowest plant population (Figure 1). The interaction effects of date of planting and row spacing was significant in Hutchinson, where the grain yields were higher under narrow row spaced plants and planted during May (Figure 2) and lowest was observed with narrow spacing and planted late .

Conclusions

We conclude that early planting date (May) recorded higher yields in all the locations when compared to late planting (June). The maturity group showed no variations in grain sorghum yield across different environments. The narrow row spaced yielded higher than wider row spaced plants at all locations . In order to achieve higher yields , the plant population of 50,000 and 80,000 seed/acre could be economical for all grain sorghum production environment in Kansas.

Acknowledgments

We thank the International Sorghum and Millet (INTSORMIL) Collaborative Research Support Program of USAID and K-State Center for Sorghum Improvement for financial support.