

2010

# Potential for Sorghum Genotypes in a Double-cropping System

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## Recommended Citation

Goff, Ben Michael; Moore, Kenneth J.; Fales, Steven L.; and Heaton, Emily A., "Potential for Sorghum Genotypes in a Double-cropping System" (2010). *Iowa State Research Farm Progress Reports*. 419.

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# Potential for Sorghum Genotypes in a Double-cropping System

## **Abstract**

The majority of the ethanol currently produced in the United States is derived from the hydrolysis and fermentation of starch provided from corn (*Zea mays*) grain. Although this is a suitable temporary solution, there are some long-term issues associated with continued use of corn grain as an ethanol feedstock. It has been estimated that if the entire U.S. corn crop was used for ethanol production, it would only meet approximately 15 to 25% of the U.S. transportation fuel need. Thus ethanol produced from biomass is expected to help meet the energy needs that grain ethanol may not provide.

## **Keywords**

RFR A9005, Agronomy

## **Disciplines**

Agricultural Science | Agriculture | Agronomy and Crop Sciences

# Potential for Sorghum Genotypes in a Double-cropping System

## RFR-A9005

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### Introduction

The majority of the ethanol currently produced in the United States is derived from the hydrolysis and fermentation of starch provided from corn (*Zea mays*) grain. Although this is a suitable temporary solution, there are some long-term issues associated with continued use of corn grain as an ethanol feedstock. It has been estimated that if the entire U.S. corn crop was used for ethanol production, it would only meet approximately 15 to 25% of the U.S. transportation fuel need. Thus ethanol produced from biomass is expected to help meet the energy needs that grain ethanol may not provide.

Sorghum (*Sorghum bicolor*) has been advanced as a potential crop for the production of lignocellulosic ethanol. It is capable of producing large quantities of biomass with minimal inputs. As with most row crops, the cultivation of sorghum may lead to excessive soil erosion. Double-cropping has the benefit of incorporating a winter annual crop into the system in the fall, which reduces the erosive potential of the land during the winter and early spring. The objective of this study was to compare the yields of several sorghum genotypes grown as a single crop and double-cropped with triticale (x *Triticosecale* Wittmack).

### Materials and Methods

This study was conducted at the ISU Sorenson Research Farm, Boone County, IA, during the 2007–08 and 2008–09 growing seasons and at the ISU Northwest Research Farm, Sutherland, IA, for the 2008–09 growing season. Triticale was planted in the fall of the year at 100 lb of PLS/acre and was harvested in early June. Twelve sorghum genotypes representing three sorghum types (forage, sweet, and sorghum x sudangrass) were used for the study. All sorghum was planted at 12 lb of PLS/acre and was fertilized with 110 lb of N/acre (Urea). The season-long crop was planted in late May and harvested after frost. The double-cropped sorghums were planted immediately after triticale harvest and were harvested in mid-September to allow for adequate time for establishment of the winter annual crop. Data was analyzed as a split plot design in PROC GLM in SAS with cropping system as the whole plot and sorghum genotype as the subplot.

### Results and Discussion

When averaged across sorghum genotypes and locations, the total system yields were 8.77 and 6.56 T/acre for the season-long and double-cropping, respectively. Although the sorghums grown as a single crop produced higher yields, the difference was not statistically significant. There were considerable differences among the locations and years. In 2008 in central Iowa, the single-cropped sorghum had yields of 7.80 T/acre compared with 7.30 T/acre for the double-cropping system. These were similar to the yields produced at this site in 2009 (6.93 and 6.42 T/acre). However, at the Northwest farm the single-cropped sorghums had much larger yields than the double cropping system (11.6 vs. 5.8 T/acre).

The lower yields of the double-cropping system compared with the single-cropping system is most likely due to a moisture limitation. At the time of harvest, the double-cropped sorghums were considerably less mature than the sorghums at the central IA/Sorenson location (data not shown). It is believed that the combination of the triticale crop removing the soil moisture and having less than average precipitation during the summer months caused the sorghum to produce less biomass.

The average yields of the sorghums grown are presented in Figure 1 with their respective rank for the system. Within the double-cropping system, the triticale yields were not statistically different and had a mean yield of 1.93 T/acre. This means that the variation within the system is due solely to the variation between the sorghum genotypes. There seem to be some differences in the suitability of sorghum genotypes for use in the two cropping systems. The genotypes that did the best in the double-cropping system (i.e. FS-5, M81-E, and Silo Master D) were among the lower half of rankings in the single-cropping system. The same was true for the top ranking genotypes (i.e. Mega Green, Pacesetter, and Sugar Graze Ultra) in the sole cropping system.

This may be explained by looking at the growth behavior of each cultivar. The top ranking sorghums in the double-cropping system are earlier maturing varieties, and the highest producing one when grown as a single crop are photoperiod sensitive and tend to stay vegetative throughout the growing season. At the time of harvest for the double-cropping system, the earlier maturing types have already maximized dry matter production, but the photoperiod sensitive sorghums are still accumulating biomass.

Overall, it may be concluded that although there were no statistical differences in the total system yields, the suitability of the double-cropping system may be susceptible to environmental factors and may have limited use in areas of lower summer precipitation. Also, it was shown that selection of sorghum genotypes needs to be based on the cropping system to be used.

#### **Acknowledgements**

We would like to extend our appreciation to Ryan Rusk and Josh Sievers at the Northwest Farm and to Roger Hintz and Trish Patrick for their assistance.

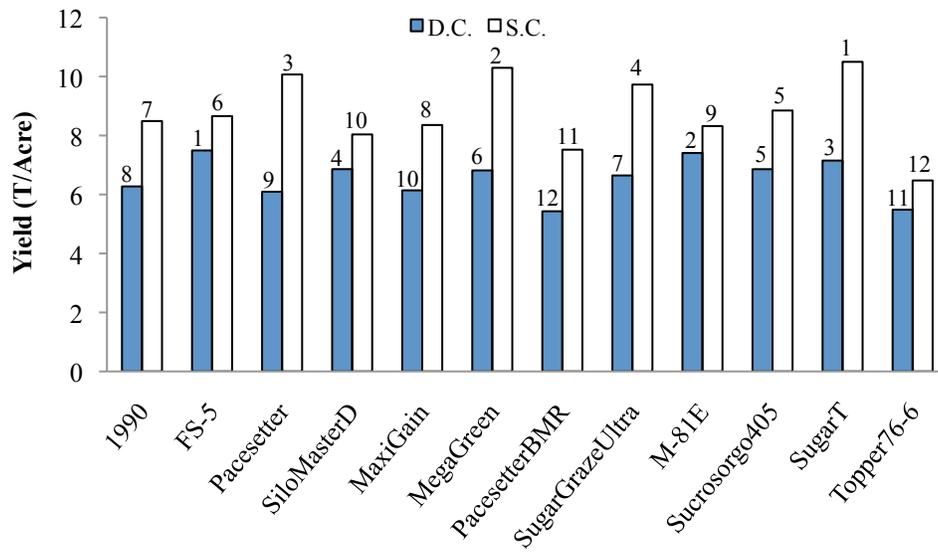


Figure 1. Yields of sorghum genotypes in a double-cropping system (D.C.) and single-cropping system (S.C.).