Arkansas Corn and Sorghum Promotion Board
Annual Report 2003
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Title: Helping Arkansas rice farmers exploit market opportunities by improved use of soybean, wheat, and corn in rice rotations.

Objectives:

1. Provide a set of management guidelines that farmers can use to assist them in maintaining their profitability should they change their rotations.
2. Explore the potential of using short-duration rice, soybean, wheat, and corn varieties in a range of crop rotations.
3. Measure the effects of fertility levels and crop sequences on pest and disease incidence in existing and new rotations.
4. Explore the use of conservation tillage in a range of rotations.
5. Determine the feasibility of using corn in rice based cropping systems.
6. Test existing cropping systems models that include the crop species used in this study.

Summary 2003 activity:

In March soil resistance and matching soil moisture samples were collected from all plots. Planting was completed on April 15, 2003. Seeding rates were increased to 34,000 plants a^{-1} that resulted in a higher plant stand than in previous years. Weed control consisted of Atrazine (1lb ai a^{-1}) plus Dual (1 lb ai a^{-1}) applied prior to planting. Weed control was good early in the season but poor later in the season suggesting a need to increase herbicide rates. Fertilizer rates were kept at the same rate as in previous years. Phosphorus (P) and Potash (K) were applied prior to planting. P and K fertilizers were incorporated in the conventional-till treatments and not incorporated in the no-till treatments. Nitrogen (N) rates were kept the same but the remaining amounts after a 25 lb a^{-1} N side dress application at planting were split into two applications. The first application was made 3 weeks after emergence and the second at flower. We realize this might not be the most efficient approach to N fertility but our yields were higher than in any other year. All plots were harvested on September 16, 2003. Harvesting was delayed because of the availability of spare parts for the combine.

Results:

Grain yields ranged from 72 to 179 bu a^{-1} with an average of 127 bu a^{-1} (Table 1). These were the highest yields obtained to date in this study. There was a 10 bu a^{-1} grain yield advantage for corn grown in the rice-corn-soybean rotation when compared to the rice-corn rotation. Conventional-till yielded 30 bu a^{-1} more than no-till. Enhanced fertility resulted in a 6 bu a^{-1} grain yield increase over the 'standard' fertility treatment that is a similar to the same comparison made in earlier years. As in previous years the variety P31B13 was the highest yielding but was followed closely by DKC61-25. This was the first year that we had a close variety comparison and that no-till yields were within reach of the conventional-till treatments.

Corn grain yields have steadily increased since this study began (Fig. 1). Much of this increase can be attributed to increases in grain yields in the no-till treatments and identifying a variety that can compete with P31B13. Increasing plant populations and reducing the amount of nitrogen applied early in the season and substituting that amount as an additional N application at flowering helped to contribute to higher yields this year. Yield increases in the no-till treatments are partially attributed to better soil physical conditions. However, data on soil resistance indicate more soil resistance in no-till treatments when compared to the conventional-till treatments (Fig. 2). This trend is the opposite of what was found in rotations that do not contain corn. Data collected from other rotations in the same study indicated that including soybeans in a no-till rotation can significantly reduce soil resistance. These data suggest that there would be advantages in planting corn after soybeans as compared to after rice. Despite the low grain yields in the no-till treatments there are advantages of this system. Data on erosion in 2003 showed that total solids in runoff water were 0.6% in the conventional-till corn plots compared to a 0.05% in the no-till plots. Total P lost in runoff was 1.8 mg L^{-1} in the conventional-till treatments compared to1.1 mg L^{-1} in the no-till plots. These data illustrate the value of using a no-till approach to reduce erosion and improve water quality.

We hope to increase our corn yields next year by increasing plant populations to 36,000 plants a^{-1}. We will continue to use an N top dress application at flowering and will increase the rate of herbicides used. The trial has been redesigned to provide a comparison of corn after soybeans with corn after rice. Having this comparison will assist in determining the role of soil resistance in influencing corn grain yield.

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Table 1: Summary of grain yields for all main effects in the long-term rotation study at the Rice Research and Extension Center, Stuttgart, AR.

System	Tillage	Fertility	Variety	Mean and range of Grain yield (bu a^{-1})
all	all	all	all	127 (72-179)
rice-corn (5)	all	all	all	121 (72-166)
rice-corn-soybeans (10)	all	all	all	132 (97-179)
all	no-till	all	all	112 (72-146)
all	conventional	all	all	142 (96-179)
all	all	standard	all	124 (72-179)
all	all	enhanced	all	130 (77-169)
all	all	all	DKC61-25	125 (72-163)
all	all	all	P31B13	129 (79-179)

Standard fertility = N = 200 lb a^{-1}, P_2O_5 = 60 lb a^{-1}, K_2O = 100 lb a^{-1}
Enhanced fertility = N = 300 lb a^{-1}, P_2O_5 = 80 lb a^{-1}, K_2O = 150 lb a^{-1}

Figure 1: Summary of corn grain yields for all treatment combinations, conventional-till and no-till combinations from 2000 to 2003.

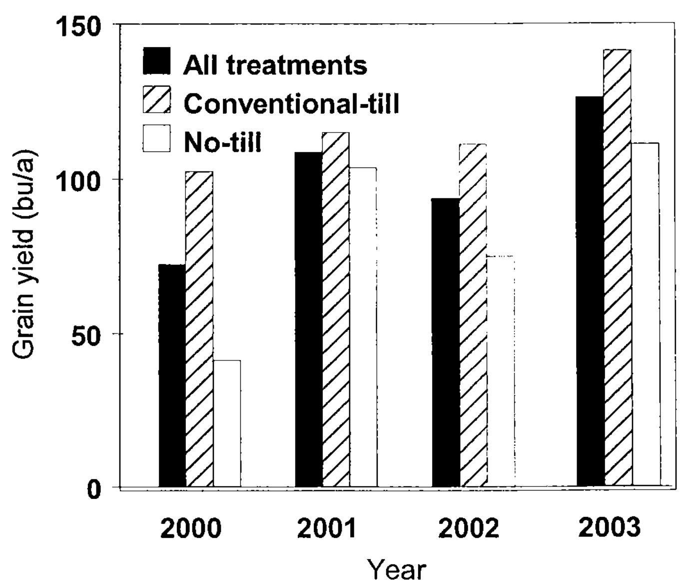

Figure 2: Comparison of conventional-till and no-till soil resistance (KPa) and soil moisture (%) values following corn and rice in a rice-corn rotation in 2003.