VIRGINIA

Mid-Atlantic Regional Interdisciplinary Cropping Systems Research Project

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This project is a regional effort with a main study location in Virginia and cooperative studies at different locations throughout the region (Virginia, North Carolina, Maryland, and Pennsylvania). The main study location (Camden Farm, Port Royal, Caroline County, Virginia) integrates all current best management practices for each crop in rotation and incorporates new practices based on cooperative research results (**Figure 1**).

The primary objective of the multi-state project in the Mid-Atlantic region is to evaluate three different (one conventional and two alternative) cropping systems under rainfed conditions.

The main study site has four different soil types, ranging from coarse textured Bojac to heavy textured Wickham soil (**Figure 2**). The detailed cropping systems treatments and the timeline of the project are presented in **Table 1**. The specific cropping system treatments are as follows:

1) Standard rotation of three crops in 2 years: no-till corn, conventional-till wheat, no-till double-crop soybeans.
2) New rotation of four crops in 3 years, all no-tillage: no-till corn, no-till full season soybeans, no-till wheat, no-till double-crop soybeans.
3) New rotation of four crops in 2 years, all no-tillage: no-till wheat, no-till double-crop soybeans, no-till barley, no-till double-crop corn.

All phases of each rotation are present each year in order to obtain data for each crop in rotation under varying climatic conditions encountered each year. Thus, there are seven strips in each of three replications. Individual strips are 2,000 ft. long by 60 ft. wide. All management practices at the main study site are performed with commercial farm equipment and site-specific management tools, including use of the global positioning system (GPS), a geographic information system (SGIS™) and a yield monitor (GreenStar™).

Figure 1. Field layout of cropping systems project at main study site. Each experimental strip is 60 ft. x 2,000 ft.

Grid soil sampling (60 ft. x 300 ft. grid, from 0 to 18 in. soil depth) for variable rate fertilizer application phosphorus (P) and potassium (K) is done prior to planting corn and soybeans. Variable rate fertilizer application maps are prepared from the soil test results using SGIS™ software. Similar application maps are prepared for side-dressing corn. Nitrogen (N) fertilizer for side-dressing corn is

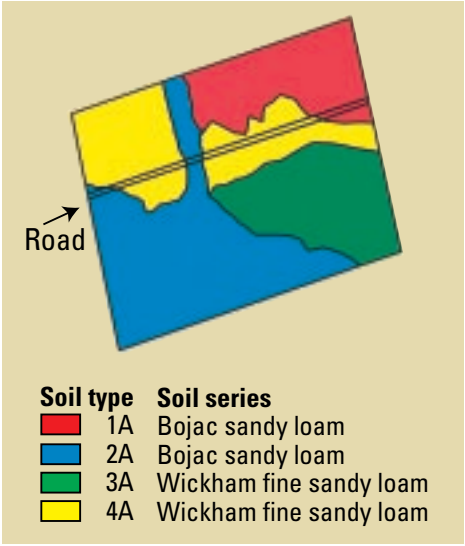

Figure 2. Soil type map of main study site.

varied by soil type (based on yield potential of each soil type), and fertilizer applications are made with a RoGator™ equipped with the Falcon Control System™.

Weather data at the main study site are recorded continuously using a Campbell Scientific weather station MetData1™. Volumetric soil water content to a 4-ft. depth is measured weekly on major soils in all 21 strips for all the crops in the cropping system. The weather and soil moisture data sets are combined to estimate water balance of each crop in the various cropping systems.

First-year results confirm the extreme importance of rainfall, rainfall patterns, and the water-holding capacity of the drought-prone soil types in the study. The 1998 growing season had sufficient rainfall early, but was relatively dry in July through mid-September. Full-season, no-till corn and soybean yields and water use efficiency for two contrasting soil types are shown in **Table 2**. Corn yields averaged 104 bu/A on a Bojac 2A soil and 193 bu/A on Wickham 3A. Yields increased as water-holding capacity increased. Corn extracted only 2.39 inches of soil water through the 4 ft.-depth on the Bojac during July and August of 1998. Approximately 50 percent of this water came from the 2 to 4 ft. depth. On the Wickham, corn extracted a total of 5.1 in. of soil water with about 60 percent from the 2 to 4 ft. depth. Similar yield and water use efficiency results were obtained with full-season soybeans with yields of 14 versus 42 bu/A on the Bojac and Wickham soils. The pounds of grain per acre-inch of water were 61 and 153, respectively.

TABLE 1. Complete cropping systems design with time scale.

Treatment 1	Treatment 2	Treatment 3	Treatment 4	Treatment 5	Treatment 6	Treatment 7
Fall '97	**Spring '98**	**Fall '97**	**Spring '98**	**Spring '98**	**Fall '97**	**Fall '97**
Wheat-CT	NT Corn	NT Wheat	NT Corn	NT FS Beans	NT Wheat	NT Barley
Summer '98	**Fall '98**	**Summer '98**	**Spring '99**	**Fall '99**	**Summer '98**	**Summer '98**
NT DC Beans	Wheat-CT	NT DC Beans	NT FS Beans	NT Wheat	NT DC Beans	NT DC Corn
Spring '98	**Summer '99**	**Spring '99**	**Fall '99**	**Summer '99**	**Fall '98**	**Fall '98**
NT Corn	NT DC Beans	NT Corn	NT Wheat	NT DC Beans	NT Barley	NT Wheat
		Spring 2000	**Summer 2000**	**Spring 2000**	**Summer '99**	**Summer '99**
		NT FS Beans	NT DC Beans	NT Corn	NT DC Corn	NT DC Beans
		Fall 2000	**Spring 2001**	**Spring 2001**		
		NT Wheat	NT Corn	NT FS Beans		
Fall '99	**Spring 2000**				**Fall '99**	**Fall '99**
Wheat-CT	NT Corn				NT Wheat	NT Barley
Summer 2000	**Fall 2000**				**Summer 2000**	**Summer 2000**
NT DC Beans	Wheat-CT				NT DC Beans	NT DC Corn
Spring 2001	**Summer 2001**				**Fall 2000**	**Fall 2000**
NT Corn	NT DC Beans				NT Barley	NT Wheat
					Summer 2001	**Summer 2001**
					NT DC Corn	NT DC Beans

TABLE 2. Effect of soil type on water use efficiency and corn grain yield (Main Study, 1998).

Soil type	Yield, bu/A		Total water use, inches		Water use efficiency, lb/A-inch	
	Corn	Soybean	Corn	Soybean	Corn	Soybean
Bojac 2A	104	14	15.88	13.74	367	61
Wickham 3A	193	42	18.33	16.46	590	153

Cooperative Studies

Dr. David Holshouser is the principal investigator on the cooperative study entitled "Cultural Practices to Improve Yield Potential of Early Season Soybean Production Systems", which is located at the Virginia Tech Agriculture Research & Extension Center, Suffolk. His work is evaluating row spacing, plant population, and variety selection to achieve optimum yields of the soybean component in the various cropping systems under investigation in the main study. Dr. Holshouser is also looking at measurements of leaf area index (LAI) and/or light interception (LI) of a soybean canopy. They are good predictors of the proper row spacing and plant population that are needed for different soil types, cropping systems, and climatic conditions. In another cooperating study, Dr. Holshouser is determining the influence of late-season N and boron (B) applications to soybeans.

Dr. Gail Wilkerson of the Crop Science Department at North Carolina State University is the principal investigator on a cooperative study entitled "Precision Weed Management Using Variable Rate Application Technology." She and her students are developing software and field scouting programs to generate variable rate herbicide application maps for pre-emergence, pre-plant incorporated, and post-emergence herbicide applications.

Dr. Bill Kenworthy and Mr. Ron Mulford are principal investigators with the cooperative study at the University of Maryland Lower Eastern Shore Research & Education Center, Poplar Hill Facility, Quantico. They are engaged in determining the most efficient and cost effective row width for corn and soybeans in a rotation of no-till and minimum tillage single crop soybean and corn grown on potentially droughty soils.

In addition, Dr. Greg Roth with the Pennsylvania State University is evaluating starter fertilizers, hybrid selection, and plant populations for obtaining maximum economic yields on rainfed soils in Pennsylvania. This work will develop a package of management practices for low water-holding capacity soils.

The ultimate success of the research will be when an improved production practice or crop management technique has been developed and the research team has approved its adoption for use in the main study. For example, the development of a measurement for soybeans shows promise as a good predictor of the proper plant population needed for different soil types. This might provide the geo-referenced information needed to effectively use variable rate seeding techniques. Another objective is to develop scouting techniques and software programs that will allow the use of variable rate herbicide applications. The team anticipates that both these research achievements may be tested in the main study beginning in the year 2000. BC

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***Acknowledgements** – This project is supported through cooperation of PPI and FAR, with major FAR-directed support from the United Soybean Board, AlliedSignal, Fluid Fertilizer Foundation, and Alliance Agronomics.*