Introduction

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Louisiana is blessed with some of the most fertile and productive soils in the world. The climate is ideal for the production of a wide variety of winter and summer agronomic crops.

Rainfall across the state averages about 50 inches – although seasonal rainfall distribution usually is less than ideal, especially for summer crops. The summer production season often experiences high temperatures and periods with soil moisture deficits. Rainfall often averages less than one-third of the evaporative demand of crops. Significant drought conditions occur during most years on soils with low water-holding capacity such as the silt loam soils of the Macon Ridge region in northeast Louisiana. Successful farmers have implemented crop production practices that maximize the availability of natural rainfall and/or rely on supplemental moisture from irrigation to ensure profitable yields.

During the winter months, rainfall generally exceeds the evaporative demand and the water infiltration rate of soils. Therefore, large amounts of rainfall are lost as surface runoff. Much of the annual rainfall comes from intense thunderstorms, which causes soil erosion rates to be excessive on some fields. When soil erosion exceeds natural soil-forming processes, the long-term productivity of the soil is compromised. Stated another way, the soil-loss tolerance of the site has been exceeded.

The crop production systems used by farmers across the southeast United States during most of the 20th century included intensive tillage for weed control, suppression of other pests, remediation of compacted soil layers and seedbed preparation conducive to accurate planting with conventional planting equipment used at the time. Although tillage was useful for these purposes, farmers and scientists observed that intensive tillage for crop production was adversely affecting soil productivity by depleting soil organic matter. Perhaps most important, tillage buries plant material and crop residue and dramatically increases soil erosion. Numerous studies and farmer experiences confirmed that intensive tillage also encourages rapid decomposition of crop residue and organic matter and has a negative long-term effect on soil structure or tilth. This effect normally is reflected in crusting of the soil surface after rainfall events, reduced water infiltration rates and significantly reduced soil water-holding capacity.

Crop seedling establishment problems due to surface crusting are common when rainfall precedes plant emergence while slow water infiltration rates exacerbate droughty conditions and increase the need to purchase and operate expensive irrigation equipment. Furthermore, more fertilizer is needed to replace essential plant nutrients that are removed from the field by soil erosion and decomposition of organic matter – a major source of plant-available nitrogen.

As the cost of fossil fuels escalated, the cost of operating tractors for tillage operations became a major drain on production budgets already affected by declining prices for commodities and skyrocketing equipment costs. Many progressive farmers saw reduced tillage and various conservation tillage systems as potential ways to dramatically reduce fuel , labor and equipment expenses during tough economic times. Many farmers experienced unexpected benefits from reduced tillage systems, including more timely planting and harvesting on poorly drained alluvial clay soils that are difficult to manage under conventional spring tillage systems.

Due to the successes of reduced tillage systems, most Louisiana farmers significantly reduced the total amount of tillage used for crop production. In addition, many have performed their tillage operations at times of the year (late summer and early fall) that minimized the negative effects. This adoption gave rise to the phrase "stale seedbed system," which is defined by the practice of applying most tillage and bedding operations as soon as crop harvest is completed. This application timing allows native annual winter vegetation to become established before winter – thereby providing a protective plant cover to minimize erosion.

Prior to the mid-1990s, adoption of conservation tillage was hampered by several factors. One of the most important issues was poor suitability of equipment to plant seed accurately in heavy plant residue. Over the past 20 years, however, most equipment manufacturers have successfully designed planters and other equipment that perform adequately even in heavy residue. Another impediment to the adoption of conservation tillage was the limited availability of effective pesticides to control key pests in agronomic crops, especially weeds, diseases and insects. The development of effective and broad-based weed and insect management programs based on novel transgenic technologies, such as Roundup Ready and Bollgard, had a major influence on the adoption of conservation tillage by making several major pests much easier to manage without tillage.

Among the other factors that increased adoption of conservation tillage systems was the greater awareness among those in agriculture and the general public that water runoff and soil erosion from agricultural fields was having negative effects on surface water quality across the state and nation. Public concerns about the environmental effects of agriculture were strongly addressed in the conservation compliance provisions of the 1985 Food Security Act (federal farm bill). Under this landmark legislation, farmers were required to develop an approved conservation plan for all highly erodible fields by January 1, 1990, and the deadline for fully implementing the plans was January 1, 1995. Farmers who failed to comply with these new rules could lose eligibility for most U.S. Department of Agriculture farm support programs.

The implementation of the 1985 farm bill resulted in a heightened awareness of soil and water conservation, and many farmers began to adopt proven soil and water conservation practices. Furthermore, teams of agricultural researchers in Louisiana and across the southern United States collaborated with U.S. Department of Agriculture (USDA) Natural Resources Conservation Service scientists, extension professionals, private crop consultants and farmers to develop comprehensive conservation tillage systems that addressed most of the problems associated with these systems. Over the next 20-25 years, agronomic and pest management researchers across the country continued to generate data showing that conservation tillage systems maintained or improved soil organic matter, improved water availability to crops and significantly reduced nonpoint water pollution from agricultural fields. Many of these studies also demonstrated that crop yields and profits were equal to conventional tillage systems.

Also over the past 20 years, several educational programs were developed and delivered as cooperative endeavors by the LSU AgCenter, NRCS and several private crop consultants. This joint educational effort was instrumental in helping farmers in Louisiana implement conservation tillage or some form of reduced tillage system on most of the cropland acreage in Louisiana over the past couple of decades.

Although great progress has been made in implementation of reduced tillage and conservation tillage, erosion and loss of soil quality continues to be a significant problem on many fields across the state. The reasons are varied and include resistance by some farmers to adopt new methods and technologies for fear that unexpected problems will develop and be impossible or expensive to manage. Another reason is that reduced tillage and conservation tillage generally require a greater level of understanding of agronomic and pest management inputs to achieve the desired results.

The purpose of this publication is to provide up-to-date information on agronomic and pest management practices for southern row crops in conservation tillage systems. Many of these recommendations will help producers and private crop consultants implement conservation tillage and other soil-conserving practices to maintain efficient and economical production while minimizing negative effects on soil and water quality. The discussions are based on scientific research and applied experience with these systems under Louisiana's unique soil and environmental conditions. Major emphasis also will be given to identifying and managing current and future threats from a variety of economically important weed, disease and insect pests that may be influenced by soil and residue management practices.