Influence Of Irrigation, Cover Crop And Nitrogen Rate On Corn Yield On Upland And Mississippi River Alluvial Soils

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Although limited tillage research has been conducted in Louisiana, no-till and minimum tillage research for cotton on the alluvial clays of the Mississippi River and Macon Ridge have shown promise, when compared to the more traditional tillage practices. The inclusion of winter cover crops in combination with conservation tillage was found to be an important component of the systems. Minimum-tillage systems reduce soil erosion, especially on the sloping silt loam soils of the Macon Ridge; increase soil organic matter; reduce soil moisture evaporation; and modify soil temperature. A cover crop such as wheat may produce a moisture-conserving mulch which may lower the number of irrigations needed to maximize yield. The use of a leguminous cover crop, i.e. crimson clover, contributes biologically fixed nitrogen (N), thus reducing the N fertilizer requirement and the potential for polluting ground water with nitrate-N. The objective of this experiment was to evaluate the influence of irrigation, cover crop, and N rate on corn yield on upland and alluvial soils.

Field experiments were conducted on an upland Gigger silt loam at the Macon Ridge Research Station in Winnsboro, LA and on a Mississippi River alluvial Sharkey clay soil at the Northeast Research Station near St. Joseph, LA to evaluate the influence of irrigation, cover crop, and N rate on corn yield. Two irrigation treatments, 1.5-inch soil moisture deficit (SMD) and a 3.0-inch SMD, were evaluated at Winnsboro. The 1.5-inch SMD was considered a well-watered treatment and the 3.0-inch SMD was considered a moderately well-watered treatment. The irrigation scheduling was determined using the Arkansas Irrigation Scheduler. Four cover crop treatments were evaluated, native vegetation, wheat, Austrian Winter Peas (AWP), and a blend of wheat and AWP. Nitrogen rates were 0, 100, 150, and 200 lb N/acre. Nitrogen fertilizer source used was 30-0-0-2 and was injected at approximately the 6-leaf growth stage. Cover crops were planted November 4, 2008 at St. Joseph and November 5, 2008 at Winnsboro at the following seeding rates: wheat (Terral LA841) – 90 lb/acre, AWP - 65 lb/acre, and the blend of wheat – 50 lb/acre plus AWP – 40 lb/acre. Each cover crop in the blended treatment was planted separately. Cover crops were burned-down at each location on March 23, 2009. Pioneer brand (PB) 31G71 was planted April 7, 2009 at each location no-till into the cover crop residue at a seeding rate of 30,000 seed/acre. Yield was determined on the two middle rows of four-row plots and reported at 15.5% grain moisture. Leaf samples were collected at early silking for N determination. The experimental design was a completely randomized block design with three replications. Recommended cultural practices as prescribed by the LSU AgCenter were followed.

At Winnsboro, there were four irrigations For the moderately well watered 3.0-inch SMD and six irrigations for the well watered 1.5-inch SMD (Table 1). Rainfall for June at each location was well below the long-term norm. Average yield was 137.7 bu/acre for the 1.5-inch SMD and 122.6 bu/acre for the 3.0-inch SMD. For each irrigation regime, the highest yield occurred when corn followed AWP and the lowest yield occurred following wheat. There were significant cover crop by N rate interactions for yield at each irrigation level. Yields for the no-N controls for the 1.5-inch SMD treatment were 66.3 bu/acre following native vegetation, 45.0 bu/acre following wheat, 95.0 bu/acre following AWP, and 4.7 bu/acre following the blend of wheat plus AWP. Similar trends occurred for the 3.0-inch SMD. When following AWP, optimum N rate occurred between 150 and 200 lb/acre. Whereas, there was a linear trend for responses to N rate for the other three cover crops.

Yields were lower in the dryland trial on the Sharkey clay at St. Joseph (Table 2). This was primarily due to the extremely dry June (0.2 inches of rain). Average yields were similar when corn followed native vegetation, AWP, and wheat + AWP. Similar to Winnsboro, the lowest yield occurred when corn followed wheat. There was a significant cover crop by N rate interaction for yield. Yields in the no-N controls ranged from 12.9 bu/acre following wheat to 46.1 bu/acre following AWP. Optimum N rate following AWP was between 100 and 150 lb/acre. Yields generally continued to increase with N rate when corn followed native vegetation, wheat, and wheat + AWP.

In summary, results for this one-year study on both the upland and alluvial soils indicate that optimum N rate may be lowered by the use of a leguminous cover crop such as AWP. Irrigation efficiency was not improved when corn followed wheat on this upland soil. Treatment effects on plant tissue N will be discussed. Δ

Table 1. Influence of cover crop and nitrogen rate on corn yield at two soil moisture deficits on an upland Gigger silt loam soil at Winnsboro, LA.

Cover crop	Nitrogen rate	Yield 1.5-inch SMD	Yield 3.0-inch SMD
	lb/acre	bu/acre	
Native	0	66.3	56.5
	100	133.0	122.7
	150	169.7	140.5
	200	186.7	160.0
	Average	**138.9**	**119.9**
Wheat	0	45.0	28.7
	100	90.7	89.7
	150	153.7	141.0
	200	189.3	164.3
	Average	**119.7**	**105.9**
Austrian Winter Peas (AWP)	0	95.0	106.3
	100	160.3	151.7
	150	194.3	166.3
	200	207.7	172.3
	Average	**164.3**	**149.2**
Wheat + AWP	0	44.7	45.0
	100	111.0	108.0
	150	162.3	144.3
	200	193.0	164.3
	Average	**127.8**	**115.4**
LSD(0.10):			
Cover crop (CC)		**6.0**	**11.5**
Nitrogen (N)		**6.0**	**11.5**
CC x N		**12.0**	**23.1**

Table 2. Influence of cover crop and nitrogen rate on corn yield on an alluvial Sharkey clay soil at St. Joseph, LA.

Cover crop	Nitrogen rate	Yield
	lb/acre	bu/acre
Native	0	38.7
	100	125.0
	150	124.4
	200	144.2
	Average	**108.1**
Wheat	0	12.9
	100	86.1
	150	108.5
	200	124.3
	Average	**83.0**
Austrian Winter Peas (AWP)	0	46.1
	100	127.5
	150	141.4
	200	135.8
	Average	**112.7**
Wheat + AWP	0	19.0
	100	107.2
	150	132.0
	200	157.9
	Average	**104.0**
LSD(0.10):		
Cover crop (CC)		**10.8**
Nitrogen rate (N)		**9.0**
CC x N		**18.0**