Demonstrate Delayed Planting of Corn in Order to Maximize Biomass and Nitrogen Fixation of Preceding Cover Crop – On-Farm Site

CIG: 68-7217-15-019

Abstract

Normally, producers in Louisiana want to plant corn in March to avoid drought and heat sensitive growth stages in the later part of June and July. However, terminating cover crops in February and early March does not allow cover crop biomass and biologically fixed N to reach its maximum potential.

To address this issue, a three year study was conducted to evaluate the impact of delayed planting on corn yields in order to maximize biomass and nitrogen fixation of the preceding cover crop.

The three year study found that pounds of dry matter and nitrogen from biological fixation increased as the cover crop termination date was delayed until the end of March. However, in two of the three years, corn yields decreased when planting dates where in April. Also, in 2017 southern leaf rust pressure increased as planting date was delayed. Planting dates for optimum corn yields and cover crop termination dates for optimum maximum biomass production did not coincide. Depending on year and time of termination, cover crops contributed between 59-178 pounds of nitrogen per acre from biological nitrogen fixation.

Background:

Cover crops have shown to provide a variety of benefits with agroecosystems. These include reduced soil erosion, increased biological diversity (e.g., microbes, insects, and birds), increased nutrient cycling and biological nitrogen fixation, increased soil organic matter, improved weed control, and increased crop yields. Also, winter annual cover crops are of benefit if residues remain on the soil surface as mulch. They may enable crop production to be sustained on erodible land. Vegetative mulches increase infiltration of rainfall and reduce evaporation of soil water, resulting in more water being available for use by the crop. Furthermore, decomposing legume residues contribute organic matter and biologically fixed N to the soil/plant system. Estimates of the nitrogen contribution from legume cover crops vary widely, with the majority of estimates falling between 40-165 pounds of nitrogen per acre. However, it has proven difficult to match peak production of winter annual cover crop species with preferred spring planting dates for corn. Normally, producers in Louisiana want to plant corn in March to avoid drought and heat sensitive growth stages in the later part of June and July. Terminating cover crops in February and early March does not allow cover crop biomass and biologically fixed N to reach its maximum potential. Todays, hybrids are better adapted to withstand heat stress when compared to older hybrids. This project primarily addresses the topic of delaying corn planting in the spring to maximize biomass and nitrogen fixation of the preceding cover crop.

Objectives:

1. To demonstrate delayed planting of corn will not reduce yields in a cover crop system.
2. Quantify and measure the biomass production and total N accumulation at three different termination dates.

Materials/Methods:

In 2016, 2017, and 2018, cover crops were planted during the month of October in a dryland field at the David Smith farm near Deridder which is located in Beauregard parish. Soil type was a Caddo-Messer complex. Prior to planting, a soil test was taken for phosphorus, potassium, sulfur, and zinc. Field was fertilized based on the recommendations for these nutrients. In 2016, cover crop mixture consisted of tillage radish, cereal rye, and crimson clover at 5, 40, and 10 pounds per acre, respectively. In 2017 and 2018, crimson clover was planted at 17 pounds per acre. Seeding method was broadcast on the surface of the soil.

Cover crop was terminated on three different dates to compare biomass production, percent nitrogen content, and corn yield at harvest. Plot sizes were 12 rows by 958 feet in length. Prior to herbicide application, biomass production was measured by taking hand clippings in one square meter in eight different locations for each plot or termination date. Samples were dried in an oven and dry matter production was determined. Percent nitrogen content was determined by sending samples to the LSU soil testing laboratory in Baton Rouge. Corn hybrid planted was Terrell 28R10 at 30,000 plants per acre. Row spacing was 30 inches. Once corn reached the two-three leaf stage, 180 pounds of nitrogen per acre was knifed into the soil. Depending on the year, corn was harvested between the last week of August and the first week of September.

Results:

Pounds of dry matter and nitrogen from biological fixation increased as the cover crop termination date was delayed until the end of March. However, in 2016 and 2017 corn yields decreased when planted in the month of April. Also, in 2017 southern rust pressure was present in the second and third planting dates. In 2018 yields were higher for the two later planting dates. Mainly due to rainfall amounts being limited in 2018 and were too late to benefit the middle of March planting date (Tables 1, 2, and 3).

Table 1. Cover crop termination and corn planting dates, cover crop (lbs dry matter/acre, % N content, and lbs N/acre from biological N fixation) and corn yield, 2016.

Termination date	Planting date	Pounds dry matter/acre	% Nitrogen content	Pounds N per acre	Corn yield Bu/acre
2/26	3/15	2,124	2.88	61.2	185
3/15	3/29	2,754	3.13	86.1	191
3/29	4/8	4,209	2.76	116.2	173

Table 2. Cover crop termination and corn planting dates, cover crop (lbs dry matter/acre, % N content, and lbs N/acre from biological N fixation) and corn yield, 2017.

Termination date	Planting date	Pounds dry matter/acre	% Nitrogen content	Pounds N per acre	Corn yield Bu/acre
3/16	3/23	2,289	2.6	59	164
3/30[1]	4/1	5,616	3.2	178	141
4/10[1]	4/17	6,668	2.6	173	100

[1]Heavy southern rust pressure was present in the April 1st and April 17th planting dates.

Table 3. Cover crop termination and corn planting dates, cover crop (lbs dry matter/acre, % N content, and lbs N/acre from biological N fixation) and corn yield, 2018.

Termination date	Planting date	Pounds dry matter/acre	% Nitrogen content	Pounds N per acre	Corn yield Bu/acre
3/12	3/15	2,389	4.7	112	133
3/25	3/28	3,476	3.4	118	147
4/5	4/6	4,341	3.1	135	148

Conclusions:

In two of the three years, corn yields were reduced when planted later than the month of March. Also, in 2017, southern rust reduced yields when corn was planted after the middle of March. A hybrid that has tolerance to southern rust should be selected when planting after the middle of March. Depending on year and time of termination, cover crops contributed between 59-178 pounds of nitrogen per acre. Planting dates for optimum corn yields and cover crop termination dates for optimum maximum biomass production did not coincide.

Demonstrate Delayed Planting of Corn in Order to Maximize Biomass and Nitrogen Fixation of Preceding Cover Crop – Research Station Site

To augment or support the funded on farm demonstration, a study was conducted in 2015-2016 at the Dean Lee Research and Extension Center located near Alexandria. This study compared three different planting dates with and without cover crops. Cover crops were planted on October 20, 2015 in a dryland field. Each treatment was replicated four times. Soil type was a Coushatta silt loam. Prior to planting, a soil test was taken for phosphorus, potassium, sulfur, and zinc. Field was fertilized based on the recommendations for these nutrients. Cover crop mixture consisted of Austrian winter pea, Abruzzi cereal rye, and hairy vetch clover at 40, 20, and 20 pounds per acre, respectively. Seeding method was broadcast on the surface of the soil.

Cover crop was terminated on three different dates to compare biomass production, percent nitrogen content, and corn yield at harvest. Termination dates were March 8, March 17, and April 7, 2016. Plot sizes were 8 rows by 100 feet in length. Prior to herbicide application, biomass production was measured by taking hand clippings in one square meter in four different locations for each plot or termination date. Samples were dried in an oven and dry matter production was determined. Percent

nitrogen content was determined by sending samples to the LSU soil testing laboratory in Baton Rouge. Planting dates were March 21, April 18, and May 10, 2016. Corn hybrid planted was Dekalb 62-08 at 36,000 plants per acre. Row spacing was 38 inches. Once corn reached the two-three leaf stage, 200 pounds of nitrogen per acre was knifed into the soil. Harvest date was September 2, 2016.

Results:

As expected, pounds of dry matter increased as termination date was delayed. Percent nitrogen content ranged between 1.5 and 2.3 %. Pounds of nitrogen per acre was 31, 46, and 41 for the first, second, and third planting dates, respectively. Corn yields decreased as planting date was delayed into April and May. Corn yields for the second planting date were higher with a cover crop planted; however, corn yields were less with cover crops for the first and third planting dates (Table 1).

Table 1. Cover crop termination and corn planting dates, cover crop (lbs dry matter/acre, % N content, and lbs N/acre from biological N fixation) and corn yield, 2016.

Cover crop termination date	Corn planting date	Cover crop	Pounds dry matter/acre	% Nitrogen content	Pounds N per acre	Corn yield Bu/acre
3/8	3/21	Yes	1354	2.3	31.0	134
3/8	3/21	No	--			143
3/17	4/18	Yes	2295	2.0	46.0	120
3/17	4/18	No	--			111
4/7	5/10	Yes	2862	1.5	41.0	84
4/7	5/10	No	--			105

Conclusions:

Corn yields were reduced as planting date was delayed. However, biomass production more than doubled between the first and third termination dates. Cover crops contributed between 31-46 pounds of nitrogen per acre depending on termination date.

In the fall of 2016, this study was initiated again with the cover crop planting; however, the cover crop was not successfully established due to the heavy amounts of rainfall that was received after planting.

Determine Optimum Nitrogen Rates for Corn Following Crimson Clover Cover Crop

In 2017 and 2018, a nitrogen rate study was included to show the benefits that cover crops provide or contribute to the nitrogen requirements for corn. Each year, cover crops were planted during the month of October in a dryland field at the David Smith farm near Deridder which is located in Beauregard parish. Soil type was a Caddo-Messer complex. Prior to planting the cover crops, a soil test was taken for phosphorus, potassium, sulfur, and zinc. Field was fertilized based on the recommendations for these nutrients. Crimson clover was planted at 17 pounds per acre. Seeding method was broadcast on the surface of the soil.

Prior to planting, the crimson clover was terminated to obtain biomass production, percent nitrogen content, and corn yields at harvest. Prior to herbicide application, biomass production was measured by

taking hand clippings in one square meter in eight different locations for each plot or termination date. Samples were dried in an oven and dry matter production was determined. Percent nitrogen content was determined by sending samples to the LSU soil testing laboratory in Baton Rouge.

Corn hybrid planted was Terrell 28R10 at 30,000 plants per acre. Row spacing was 30 inches. Once corn reached the two-three leaf stage, nitrogen applications were applied. Four nitrogen rates were compared: 100, 125, 150, and 175 pounds per acre. Plot sizes were 12 rows by 958 feet in length. Each nitrogen rate was replicated three times in a randomized complete block design. Harvest dates were between the last week of August and the first week of September.

Table 1. Nitrogen rates and corn yields for 2017 and 2018.

N/lbs/acre	Yield; bushels/acre @ 15.5%, 2017	Yield; bushels/acre @ 15.5%, 2018
100	174.7	155.7
125	175.3	153.3
150	174.7	153.3
175	173.0	155.7

Table 2. Cover crop termination and corn planting dates, cover crop (lbs dry matter/acre, % N content, and lbs N/acre from biological N fixation), 2017 and 2018.

Year	Cover crop termination date	Corn planting date	Pounds dry matter/acre	% Nitrogen content	Pounds N/acre
2017	3/30	4/1	5,616	3.2	178
2018	3/25	3/28	3,416	3.4	118

Results:

In both years, no differences were found in yields across all four of the nitrogen treatments which included the grower standard of 175 pounds of N (Table 1).

In 2017 and 2018, cover crops provided 178 and 118 pounds of nitrogen for the corn crop, respectively (Table 2). Based on the average yields of 175 bushels per acre for this producer's farm and the nitrogen requirements of corn (1 pound of nitrogen per bushel of corn produced), no nitrogen could have been applied in 2017 and 57 pounds of nitrogen could have been applied in 2018 and yields would have been the same as the 175 N rate. Based on nitrogen costs of 40 cents per pound. This would represent a savings in nitrogen costs of $70 (175 x .40) and $47 (175 - 57 = 118 x .40) an acre for 2017 and 2018, respectively.