USING WINTER LEGUME MULCHES AS A NITROGEN SOURCE FOR NO-TILLAGE CORN AND GRAIN SORGHUM PRODUCTION

J.W. Breman and D.L. Wright
Agronomy, Quincy and Madison County Extension, Madison

ABSTRACT

Nitrogen (N) fertilizer continues to be an expensive but necessary part of grain sorghum and corn production. Recent research has shown that winter legumes could provide most if not all nitrogen required for these grain crops produced no-tillage. The purpose of the no-tillage grain sorghum and corn demonstration/farm trial was to shaimanagement required and grain yield results using adapted legumes to provide N. Grain sorghum demonstration was conducted on an Fuquay loamy sand soil at the county high school. 'Vantage', 'Nova 11', 'Cahaba White', and 'Vanguard' vetch and 'Florida 301' wheat plots were established November 1981. 'Funks 522 DR' sorghum was no-tilled into these plots June 1982. N rates of 9 pounds per acre were used on vetch plots and 89 pounds per acre on the wheat plot. A corn demonstration was conducted on an Alaga loamy sand. 'Vantage' vetch and 'Tibbee' crimson clover plots were established November 1982. 'Northrup King PX 95' and "RingAround 1102' corn was no-till planted into the legume mulches and corn stubble March 1983. N rates of 104 and 219 pounds per acre were used on plots.

On the sorghum demonstration, highest grain yields were obtained by applying 89 pounds N per acre on the wheat stubble plot (62 lb/A). Grain yields from vetch plots ranged from 58 bu/A for 'Nova II' to 18 bu/A for 'Vanguard'. 'Nova II' probably was the only cost effective vetch variety.

On the corn demonstration, highest grain yields were obtained on corn stubble with 219 pounds N per acre (152 bu/A) with Northrup King PX95. Yields were depressed on both vetch (103 bu/A) and crimson clover (124 bu/A) at the same N fertilizer rate in spite

of an estimated 84 pounds and 133 pounds N fixed per acre by vetch and crimson clover, respectively. Yields were depressed from competition of legume mulch regrowth after paraquat applications.

INTRODUCTION

Winter legume mulches have been studied for their value as nitrogen sources in no-till sorghum (Touchton et a1 1982) and corn (Wright and Stanley, 1982). Use of early maturing winter legume mulches resulted in grain yields demonstrating legumes could provide most, if not the entire nitrogen needs of sorghum and corn grain crops.

In North Florida, Wright and Stanley (1982) reported higher yields for corn planted into 'Tibbee' crimson clover mulch. Vetch has also been used as a mulch for no-till corn as far north as North Carolina (Hudson, 1982). Nova 11, Cahaba White, Vantage, and Vanguard were four new nematode resistant varieties released by Auburn which looked promising (Donelly 1982).

There was a need to make grain producers in a north Florida county aware and familiar with using winter legumes as nitrogen sources for grain sorghum and corn no-tillage production.

The purpose of the no-tillage sorghum and corn demonstrations/ farm trial was to show the management required and grain yield resulting from using adapted legumes to provide N to grain sorghum and corn crops.

MATERIALS AND METHODS

Demonstration I:

A demonstration of sorghum no-tilled into stubble of four vetch varieties and one wheat variety was conducted during the 1981 through 1982 growing seasons at the Madison County High School FFA demonstration area to insure high visibility. The site is at the entrance of the school.

The soil was originally a Fuguay loamy sand (Arenic Plinthic Paleudult). Soil pH was 6.9. Soil test recommendation was to apply 30 pounds phosphorus and 160 pounds potash per acre. Five hundred pounds of a 0-10-30 analysis fertilizer were applied and harrowed in November, 1981.

Vantage, Nova 11, Cahaba White and Vangaurd vetch varieties were inoculated with rhyzobia and planted at the rate of 20 pounds seed per acre November, 1981. Florida 301 wheat was planted December, 1981 at the rate of 90 pounds seed per acre. All vetch varieties were allowed to develop seed for the following year. Wheat had also matured by June, 1982.

"Funks 522 DR' sorghum was no-tilled into vetch and wheat stubble at 9 pounds seed per acre rate June, 1982. Concept treated seed was used so metalachlor and paraquat was broadcast after planting at the rate of 1.5 and 0.5 pounds active ingredient. per acre, respectively.

Sorghum was side-dressed with a 3-9-18 analysis fertilizer at the rate of 300 pounds per acre July, 1982. Sorghum no-tilled into wheat stubble received an additional 80 pounds nitrogen per acre.

September, 1982 sorghum plots were hand harvested. Two acres 2.75 feet wide by 27.5 feet long were harvested per plot. Grain heads were threshed with a stationary thresher. The grain yield weighed and percent moisture recorded. Yields were corrected to 15.5% moisture.

Demonstration II:

A farmer/cooperator was selected in an area of intensive irrigated corn production to conduct a demonstration of corn no-tilled into vetch and crimson clover mulch during the 1982-83 growing season. The farmer had a center pivot irrigation system to insure adequate water to the crop and a paved road bordered one side of the field which insured high visibility. The soil was

identified as an Alaga loamy sand soil (thermic quartzipsamment). The soil pH average 6.6. Soil tests recommended applying 210 pounds nitrogen, 35 pounds phosphorus and 70 pounds potash per acre.

November 1982, Vantage vetch and Tibbee crimson clover were inoculated with rhyzobia and drilled at the rate of 20 pounds seed per acre into corn stubble that had been harrowed. Plot size was 2.12 acres for each variety. No fertilizer was applied to the vetch and crimson clover plots during the winter growing season.

March 1983, 'Northrup King PX 95' arid 'Ring Around 1102' corn was no-till planted in four row replications over the legume mulches and the remainder of the field (which was in corn stubble).

An attempt at killing the legume mulch was made by broadcasting paraquat at the rate of 0.5 pounds active ingredient per acre after planting. An area 6.5 feet by 6.5 feet of paraquat killed mulch was harvested, overdried, weighed and analyzed for percent nitrogen at the state laboratory to estimate amount nitrogen provided by crimson clover and vetch mulches. Fertilizer was applied at the rate of 54 pounds nitrogen, 24 pounds phosphorus and 102 pounds potash per acre over the entire field. Atrazine plus crop oil was broadcast at the rate of two pounds active ingredient and one gallon 80/20 crop oil per acre over the entire field for weed and legume cover crop control April 1983. The same month 115 pounds nitrogen was applied to the field except the legume plots. A fina1 application of 50 pounds nitrogen was made in May over the entire field including the legume mulch plots.

Plots 12 feet wide by 1190 feet long of the two corn varieties planted into corn stubble, vetch mulch and crimson clover were harvested in August with a combine. Grain weight and moisture were recorded. Yields were corrected to 15.5% moisture.

Grain Sorghum Demonstration. Vanguard vetch growth did not look promising. As shown in sorghum grain yields in Table 1, Vanguard vetch was probably not well adapted. Sorghum planted into Nova II vetch mulch yielded the most grain of all four vetch varieties (58 bu/A). This was only four bushels less grain than sorghum receiving an additional 80 pounds N per acre (62 bu/A). It cost $22.40 less per acre to produce sorghum planted into Nova II mulch than using an additional 80 pounds N on sorghum planted into wheat mulch. Sorghum planted into Nova II mulch was the most cost effective of the mulches. Sorghum planted into Vantage and Vanguard vetch mulches yielded 16 and 14 bushes less per acre than sorghum which received an additional 80 pounds N per acre. At 1982 sorghum grain prices of $1.80 to $2.00 per bushel, it would have been cost effective to have applied additional N to increase yields of sorghum planted into Vantage and Vanguard vetch mulches.

Corn Demonstration. Spring 1983 was unusually cool and wet. Paraquat did not effectively kill the vetch and clover plots. Corn seedlings were shaded by vigorous legume regrowth in spite of an application of atrazine. This was reflected in lower corn grain yields of Northrup King PX95 corn planted into vetch and crimson clover mulches, compared to the planting into corn stubble at the 219 pound N fertilizer rate (See Table 2). This was in spite of the high amounts of N measured in the vetch and clover mulches. (See Table 3). Evidence of stand loss, corn smut infection and atrazine

injury of corn plants were also more pronounced in the legume mulch plots than in the rest of the field. In this trial, corn grain yields were apparently depressed by competition from the legume mulches rather than from a lack of N.

The results of these demonstrations showed that research using adapted cool season legumes as a nitrogen source for sorghum and corn grain crops is applicable to the North Florida area provided the legume mulch is killed before the grain crop emerges. Possibly more research needs to be done in this area before planting corn into legume mulches becomes a reliable cropping practice. Another area of research may be the reliability of using reseeding legumes in a multi-cropping system with grain sorghum or perhaps summer annual grass forages. One of the major problems using winter legumes as a N source is the cost of legume establishment. The cost of establishing the legume is about the cost of the N produced. By allowing reseeding legumes to mature and reseed each year before planting the summer annual crop, this cost can be reduced. Such a multicropping scheme has already been shown to be reliable over a three year period with grain sorghum production. (Touchton et al. 1982).

Finally the results of these demonstrations showed producers in their own county new research that could help reduce production costs, energy costs, and soil erosion. Management of legumes as well as the grain crops were demonstrated through an annual farm tour, newsletters, radio programs, newspaper articles, small plot demonstrations at the county high school entrance, and on farm trial signs

to maximize visibility and adoption of no-till practices.

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TABLE I. Grain yield of sorghum as affcctcd by applied nitrogen and cover crop.

Cover Crop	Applied N, lbs./A	
	9	89
Vetch:	Grain Yield bu/A	
Vantage	46*	--
Nova II	58	--
Cahaba White	48	--
Vanguard	18	--
Whca*t*:		
Florida 301	--	62

* Means of two sampled areas per cover crop.

TABLE 2 Corn grain yields as affected by corn varieties, applied nitrogen and cover crop

Cover Crop	Corn Variety	Applied N	Grain Yield
		lbs/A	bu/A
Vetch	RA*	104	72
	NK	104	63
	NK	219	103
Crimson Clover	RA	104	73
	NK	104	87
	NK	219	124
Corn Stubble	NK	219	152

* Corn varieties were R of Aroun 1102 and Northrup King PX95

TABLE 3. Estimated nitrogen fixed by vetch and crimson clover cover plots.

Cover Crop	Nitrogen Fixed
	lbs./A
Vetch	84
Crimson Clover	133