EVALUATION OF COVER CROPS FOR NO-TILL CORN SILAGE PRODUCTION IN LOUISIANA

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Materials and Methods

Research was initiated in 1982 to evaluate the potential. of winter legume cover crops ahead of corn (~~Zea maize~~) grown for silage production. Tibbie crimson clover (Trifolium incarnatum), Mt. Barker subterranean clover (Trifolium subterraneum), and Nova **II** common vetch (Vicia sativa) were planted November **10,** 1982. Wheat (Triticum aestivum) and fallow plots were included as checks. Cover crops were planted as main plots in a randomized block design with four replications. The experiment was conducted at Baton Rouge, La. on a Mississippi alluvial silty clay loam soil (Commerce/Mhoon series) with surface pH near 6.0 (increasing with depth). Fallow and wheat plots were split with, and without the application of 30 lbs. of N per acre as ammonium nitrate on March 4, 1983.

On March 14, 1983, Funk hybrid G-4611 corn was planted in 0.72 m rows using three drills of a Moore no-till grain drill. At this planting the cover crop plots were split into 9-row sub-plots for three different herbicide spraying patterns: (1) broadcast spraying, (2) 15" bands centered on the rows, and (3) no spraying. Paraquat and atrazine were sprayed in a volume of 240 1 per hectare (25 gallons per acre) at a rate of 0.56 and 3.36 kg ai/ha (0.5 and 3 lbs. ai/acre), respectively. The legume subplots were 7 meters long and the wheat and fallow subplots were 3.5 meters long. The corn was re-planted on April 21, 1983. For the April planting date all subplots received a band spraying of Paraquat ahead of the drill with Furadan applied in the row at a rate of 1.2 kg ailha.

The cover crops were sampled on March 14 and April 21, 1983 from 0.093 square meter areas using a shear and frame. Samples were taken from undisturbed areas on March 14 and from previously unsprayed sub-plots on April 21. The April 21 samples were analyzed for Kjeldahl nitrogen content by the Forage Quality Laboratory of the L.S.U. Southeast Research Station, Franklinton, La.

When 12 inches tall in late May, corn was sidedressed with 70 kg-N/ha supplied as liquid fertilizer (URAN-32) injected mid-way between the rows. At this time an attempt was made to control a serious infestation of johnsongrass with a hand spraying of Poast (sethozydim) directed in the row middles. Corn silage samples were harvested on July 28 and July 29, 1983. Samples were cut from a 3 meter length of a center row. These samples were separated into corn and johnsongrass components and the fresh weight of each component was obtained. Number of plants per sample and number of ears per sample were also recorded. These components were then re-combined and passed through a grinding machine and sampled for quality analysis. The composite silage samples (corn and johnsongrass) were analyzed for moisture content and Kjeldahl nitrogen. Ears were picked from an adjacent 3 meter length of row and were dried at 60 degrees C to determine grain yield.

Results and Discussion

The dry matter production of the cover crops on both sampling dates and the crude protein and total above ground nitrogen yield of the April sampling date are reported in Table 1.

Table 1. Cover crop dry matter and nitrogen yields from corn cover crop study.

		Yield (kg/ha)			
		March 14	April 21	April 21	Crude
Species	Variety	DM	DM	N	protein[@]
Crimson	Tibbie	860	5020	124	15.5*
Sub	Mt. Barker	2230	3790	143	23.5
Vetch	Nova II	2800	3700	107	18.0*
Wheat	Coker 762 - N	1570	2075	23	7.4
Wheat	Coker 762 + N	1630	3970	51	7.7
fallow	- N	605	910	21	14.1
fallow	+ N	345	915	23	16.3
L.S.D.	(0.05)	1012	1130	37	4

* Mean of only 2 samples, mean used to estimate N yield of plots with missing crude protein values.

@ air dry basis

Common vetch produced the greatest early growth. It was interesting to note the poor early growth from the crimson clover relative to subclover when the species were planted in November. The winter of 1982 was milder than average in Louisiana. For the April sampling date, dry matter production was ranked as follows: Crimson > Sub = Wheat + N = Vetch > Wheat - N ≧ Fallow ± N. Crimson clover and wheat + N appeared to produce the largest proportion of their dry matter yield during a short period late in the spring. N fixation by the legumes and nitrogen recovery by wheat and weeds as measured by the yield of nitrogen per hectare was highest for subclover followed by crimson clover and vetch. Overall the subclover fixed the largest amount of nitrogen and retained by far the highest crude protein concentration of all the cover crops.

Visually the wheat appeared to respond to the March application of nitrogen, while the fallow areas (mainly annual bluegrass *Poa annua*) did not respond. This was reflected in the dry matter and nitrogen contents of the wheat and fallow plots at the April sampling date. Nitrogen fertilized wheat produced twice the nitrogen yield as unfertilized wheat but no differences were found between fallow treatments with and without fertilizer nitrogen. The fallow weeds were not effective in recovering applied fertilizer nitrogen. The crude protein percentage of the wheat was not effected by the application of nitrogen to the cover crop. The increased uptake was due to increased dry matter production.

The March 14 planting resulted in a stand failure. It appeared as though the corn germinated and emerged through the crops and it was pruned at the soil surface by insects or birds. Definative observations on this point, however, were not made and the effect could have also been due to kolines (allelopathy). At the time of the April replanting, stand counts were made of the existing corn plants. The mean stand count reported as plantsfha were strongly influenced by cover crop and were as follows: 29340, 12325, 4910, 2100, and 1785 plants/ha for the fallow, wheat, crimson, sub, and vetch treatments, respectively. The fallow treatment had by far the least vegetation and produced the best stand, but still not a satisfactory one. The re-planting was successful in most cases. Seed was not always well placed into the soil in the previously unsprayed plots due to inadequate adjustment of downward pressure on the coulter openers. At harvest the plant populations were: 57950, 53600, 46050, 43790 and 40015 plantsfha for the fallow, crimson, vetch, wheat and subterranean plots, respectively, with an LSD (0.05) of 11930.

Corn silage dry matter yield, plant population, moisture content at harvest, and total silage nitrogen uptake were significantly influenced by cover crop and spraying treatments. Percent corn in the silage and percent crude protein were influenced by cover crop treatments. Grain yields were low and were influenced only by spraying treatment. A summary of the results is reported in Tables 2 and 3. The crimson clover cover crop resulted in the greatest silage dry matter production. Corn silage produced following subclover had the highest crude protein concentration. Nitrogen uptake by corn following the various cover crops ranged from 38 to 83 kg-N/ha, much less than expected. The greatest recovery of nitrogen was for the three legume cover crops which averaged 78 kg-N/ha whereas the wheat and fallow treatments only averaged 49 kg/ha uptake. The low recovery of the applied fertilizer N and nitrogen contained in the cover crops at planting may be due to the fact that this was the first year for both legume cover crops and no-till corn planting at this location. Traditionally these fields have produced corn silages of lower nitrogen content than might be expected at other locations.

There was a statistically significant interaction of cover crop **by** spraying treatment on the percentage of corn in the silage sample and the percent crude protein of the silage samples. Examination of the data indicated that the interaction was mainly due to the different response of the wheat and the subclover treatments. When wheat (with or without preplant nitrogen) was not sprayed, corn only constituted 42% of the silage sampled and the silage averaged only 4.5% crude protein. On the other hand, when subclover was not sprayed, corn constituted 92% of the silage sampled and averaged 8.2% crude protein. The unsprayed subclover plots could visually be identified from all the other plots during the growing

Table 2. Corn silage yield and quality analysis as affected by cover crop.

Cover Crop	Dry matter Mg/ha	% Moisture at harvest	% Corn	N uptake (kg-N /ha)	% Crude protein*
crimson clover	10.1	59	63.2	83	5.0
Subclover	7.8	69	72.1	77	6.6
Common vetch	9.0	63	63.2	74	5.2
Wheat - N	6.9	66	56.8	50	4.6
Wheat + N	7.2	63	56.3	56	4.8
fallow - N	5.6	65	69.1	38	4.1
fallow + N	6.9	63	80.2	53	4.6
LSD (.05)	2.0	5.1	12.4	19	0.7

* dry matter basis

Table 3. Corn silage yield and corn grain yield

Spray 5 weeks prior to planting	Dry matter silage yield Mg/ha	Plants/ha	% Moisture at harvest	Grain yield* (kg/ha)
Broadcast	9.3	53710	60	2225
Strip	7.4	52260	65	1690
None	6.3	41095	66	1095
LSD (0.05)	1.3	7810	3.4	618

* 13% moisture

season due to the absence of johnsongrass. Although the stand was poor, the corn in these plots was also vigorous. It was considerably retarded in maturity compared to all the other treatments and was harvested before its optimum dry matter and grain yield had been achieved. It is felt that if the difficulties encountered in establishing a stand can be overcome, a subclover cover crop may be very beneficial to corn silage production.

Next year, the experiment is being modified in that subclover will be the only legume cover crop tested. The fallow treatments without nitrogen will be maintained. Wheat will be replaced with a conventional tillage treatment which will include fall sub-soiling. The broadcast, strip, and no-spray treatments will be applied about 3 weeks prior to expected planting date. Several rates of nitrogen fertilizer will be applied to subplots within the spray treatments to determine the nitrogen contribution of the clover to the system.