Choosing a Legume Cover Crop for No-Till Corn

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Abstract

Winter annual legume cover crops were established to provide cover crop residue and a nitrogen source for no-till corn. Spring legume residue nitrogen was greatest in both species of vetch and peas. Greatest grain and silage yields also were produced from treatments of vetch and pea residue. No one selection of legume residue was found to be superior, but hairy vetch consistently survives the winter in Western N.C. and produces sufficient residue and N for good to excellent crop yields.

Introduction

The potential use of legume cover crops in the southeastern U.S. has been well documented in popular press and scientific literature (Hoyt and Hargrove, 1986). Legume residues have been shown to produce over 180 lbs/acre of nitrogen during their growing season (Hoyt, 1987) and reduce fertilizer input by as much as 90 lbs N/acre (Ebelhar et al., 1984; Hargrove, 1986; Touchton et al., 1982). This experiment was designed to determine which legume residue would contribute to greater grain and silage yields if no nitrogen was applied.

Methods

All legume cover crop treatments received no addition of nitrogen fertilizer. All legumes treatments were planted in early October the previous year of the experiment. Standard labeled herbicides were applied as well as phosphorus and potassium at soil test recommended rates. All four years of experiments were conducted at the Mtn. Hort. Crops Research Station (near Asheville, N. C.) on Typic Hapludult soils. Corn (Dekalb 689) was no-till planted in mid-May each year at 28,000 plants/acre. All bare soil plots had winter weeds killed in mid-April, with the legume cover crops killed 1 to 6 days after planting. All plots were harvested in late September or early October. All treatments received 4 replications in a randomized complete block arrangement. Legumes were planted at seeding rates of 30, 30, 40, 40, 20, 15, and 15 lbs/acre for hairy vetch, bigflower vetch, caley peas, A. winter peas, crimson clover, sub. clover, and berseem clover, respectively. Rainfall was inconsistent throughout the four years of testing and probably did not influence yield reduction among the legume residue treatments (Table 1).

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Table 1. Rainfall during the summer growing season. 1985-1988.

Year	Month			
	May	June	July	August
	----------inches/month----------			
1985	2.0	1.6	6.3	9.5
1986	5.0	1.3	.7	6.6
1987	2.5	13.3	2.7	3.1
1988	1.6	.8	3.1	2.9

Results

Various legume cover crop treatments were planted each of four years to determine residue effect on corn grain and silage yields. Because no nitrogen was applied with the residue treatments, nitrogen became a key element for corn growth in these experiments. Corn grain and silage yield differences among the various legume residue trcatments thus were related to N relcase from the residue.

Nitrogen content of the legume cover crops at planting are listed in Table 2. All species of both peas and vetch produced greater quantities of N in the above-ground biomass than the clover legume species. Both subterranean and berseem clover produced lower amounts of N as compared to vetch or pea species, and generally lower N than crimson clover.

Hairy vetch was chosen to represent the legume of choice for Western N. C. for producing N and cover residue. For this rcason, all yields are in proportion to the hairy vetch residue treatment corn yield (176, %, 106, and 118 bu grain/acre and 25, 12, 15, and 15 tons silage/acre for the years 1985, 1986, 1987, and 1988, respectively).

Table 2. Nitrogen content of the legume cover crop.

Cover Crop	Nitrogen Content 1985	1986	1987	1988
	----------lbs N/acre----------			
Hairy Vetch	101	175	138	168
Bigflower Vetch	92	121	126	163
A. Winter Pea	106	131	143	232
caley Pea		203	151	86
Crimson Clover	102	119	115	68
Subterranean Clover		120	86	
Berseem Clover	81		67	

Grain yields measured in 1985 reflect the higher yield attained from the hairy vetch residue treatments and how the other vetch and pea residue contributed to a similar yield as hairy vetch residue (Figure 1). Even though crimson clover residue N content was similar to hairy vetch N content (101 and 102 Ibs N/acre for hairy vetch and crimson clover residue, respectively), vetch residue has a much lower C N ratio (not shown) and released more N than the crimson clover residue. Berseem clover produced the least amount of N in above-ground biomass and in corn grain yields.

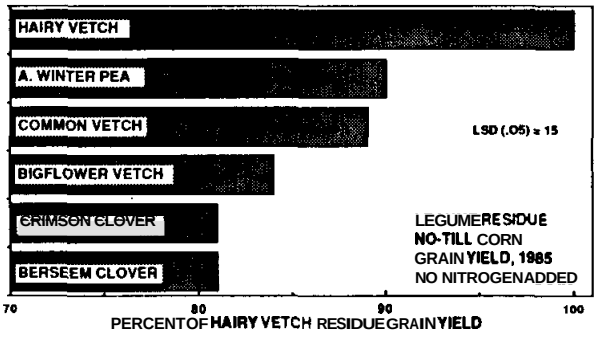

Figure 1. No-Till Corn Grain Yields as Influenced by Legume Cover Crop Residue, 1985.

Corn silage yields for 1985 produced similar trends as grain yie1ds;with vetch and peas producing greater yields than the various clover treatments (one exception to this was the lower silage yield from common vetch as compared to the grain yields) (Figure 2).

Greatest grain yields produced from the legume residue treatments in 1986 was again from the hairy vetch residue treatment (Figure 3). Bigflower vetch and caley pea residue treatments had similar yields (97 and 96 % of the yield attained by hairy vetch, respectively) as the hairy vetch residue treatment, with crimson clover grain yield at 89 % of the hairy vetch residue treatment yield. Although subterranean clover had similar residue N as crimson clover and bigflower vetch, grain yields were lower than those treatments and 24 % lower than the hairy vetch residue treatment yield. Bare soil with no N added produced grain yields similar to the subterranean clover residue treatment. Adding 90 Ibs N/acre to a bare soil treatment increased yields to those similar to hairy vetch residue treatment. Thus, the use of hairy vetch cover crop residue in 1986 was similar to adding 90 lbs N/acre to bare ground.

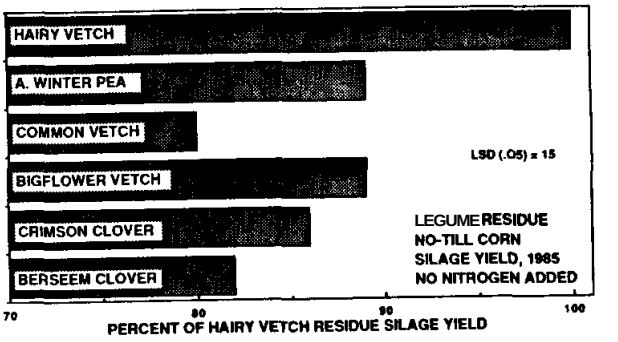

Figure 2. No-Till Corn Silage Yields as Influenced by Legume Cover Crop Residue, 1985

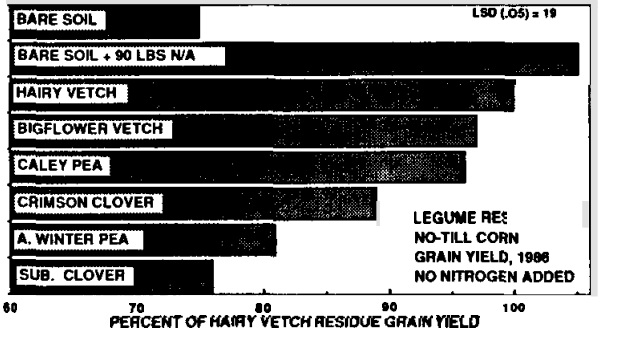

Figure 3. No-Till Corn Grain Yields as Influenced by Legume Cover Crop Residue, 1986.

Silage yields for 1986 showed a similar pattern for the legume residue treatments as in grain yields, but the bare soil treatment yield dropped to 65 % and the bare soil + 90 Ibs N/acre yield decreased to 88 % of that produced by the hairy vetch residue treatment (Figure 4).

Greatest grain yields in 1987 were produced in legume treatments that contained both A. winter and caley pea residues and bigflower vetch residue (114, 112, and 111 % of the hairy vetch residue treatment, respectively) (Figure 5). Crimson and berseem clover

residue treatments produced grain yields similar to the hairy vetch residue treatment, while arrowleaf and subterranean clover produccd yields slightly lower (possibly due to the lower N content in the residue).

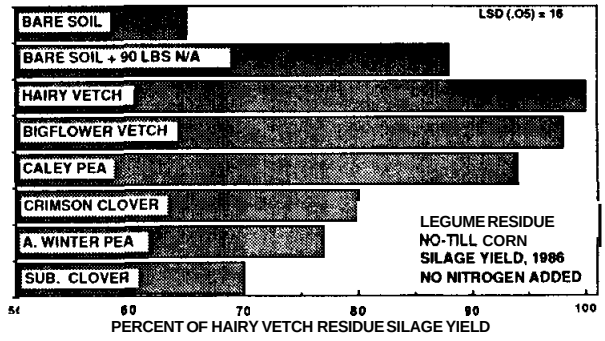

Figure 4. No-Till Corn Silage Yields as Influenced by Legume Cover Crop Residue, 1986.

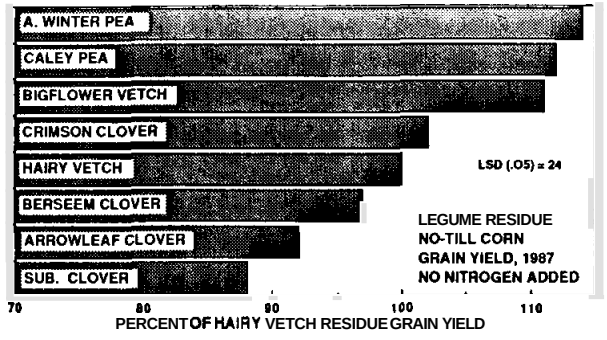

Figure 5. No-Till Corn Grain Yields as Influenced by Legume Cover Crop Residue, 1987.

Corn silage yields for 1987 show a different pattern of response to legume residue as compared to grain yields (Figure 6). Clearly, A. winter pea residue produced the greatest silage yield of all legume residue treatments. Next, a group of four legume residues were similar (caley pea, bigflower and hairy vetch, and crimson clover residue treatments). Lowest in silage yields were berseem, arrowleaf and subterranean clover residue treatments (these legumes are marginal for Western N.C. in winter survival and generally produce lower biomass and N content in the spring).

The fourth year of these experiments produced trends similar to the three previous years. A. winter peas, bigflower and hairy vetch, and caley pea residue all produced similar (statistically) grain yields (Figure 7). Crimson clover residue was lower and similar to bare soil + 0 N /acre, while bare soil + 90 lbs N/acre was similar to the highest legume residue and 14 % higher than the vetch residue in grain yields. The bare soil + 180 Ibs N/acre treatment increased yields 28 % higher than thc hairy vetch residue treatment.

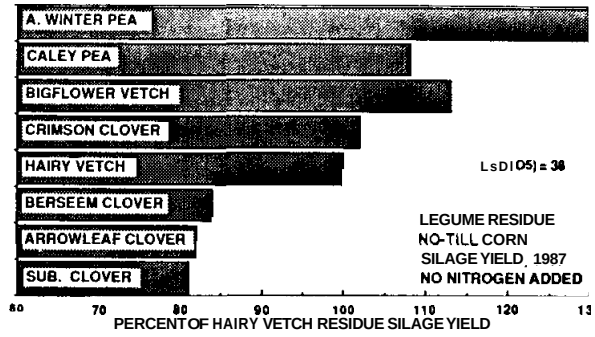

Figure 6. No-Till Corn Silage Yields as Influenced by Legume Cover Crop Residue, 1987.

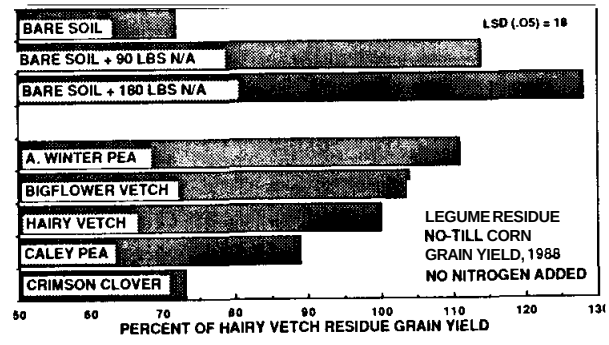

Figure 7. No-Till Corn Grain Yields as Influenced by Legume Cover Crop Residue, 1988.

Corn silage yields produced by the legume residue treatments showed a similar pattern as grain yields (Figure 8), with all legumes in the same order and the bare soil + the various N rates at similar percentages as in the grain yield (Figure 7).

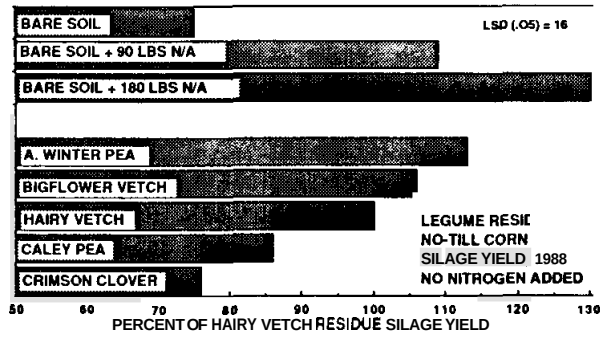

Figure 8. No-Till Corn Silage Yields as Influenced by Legume Cover Crop Residue, 1988.

Summary

Various legume residues were compared for grain and silage utilization in no-till corn. All pea or vetch residue treatments produced grain and silage yields that in one year or another proved as good or better than the rest. Although a clear superior choice was not obvious, any of the selected pea or vetch residue would be beneficial in producing no-till corn and would be dependent on which selection grew best at any one location. Hairy vetch has consistently survived the winter in Western N.C. and produced sufficient residue and N for good to excellent corn crop yields. Thus, if nitrogen contribution is a main factor for selecting a legume for no-till corn production, hairy vetch would be a top selection for this region.

References

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