# EFFECTS OF LEGUME COVER CROPS ON YIELD OF NO-TILL CORN

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Legume cover crops can be used to provide the advantages associated with a mulch in no-till corn production, while also supplying a significant quantity of biologically fixed nitrogen (N). In Kentucky, it was estimated that a hairy vetch cover crop provided biologically fixed N equivalent to approximately 80 to 90 lb/acre of fertilizer N in addition to mineralized soil N (Ebelhar et al., 1984). Mitchell and Teel (1977) found grain yields of no-till corn that was planted into a cover crop mixture of hairy vetch and spring oats to be equivalent to yields obtained with 100 lb/acre of fertilizer N.

Nitrogen is usually the most limiting plant nutrient in corn production and applications of large quantities of inorganic N fertilizers are required to obtain economical yields. As the price of N fertilizers increases, it is reasonable to believe that increasing numbers of farmers will use legume cover crops In no-till corn production to supply a portion of the N requirement. The objectives of this study were to determine the effects on no-till corn of 1) winter annual legume cover crops as compared to a rye cover crop and to a winter cover of corn stalk residue alone, 2) N fertilizer management for each cover treatment, and 3) method of seeding the cover crop.

## MATERIALS AND METHODS

This experiment was established in the fall of 1979 at the West Kentucky Research and Education Center at Princeton, Kentucky and is still being conducted. Cover crops of hairy vetch (Vicia villosa), big flower vetch Vicia grandiflora), and rye (Secale cereale) were planted into no-till corn each fall. Two planting methods were used -- overseeding into no-till corn about mid-September and drilling into no-till corn residue about mid-October following harvest of the corn. Seeding rates were 35 lb/acre for the two vetches and 3 bu/acre for rye. The cover crop treatments were compared to a cover of corn residue from the previous year. Nitrogen fertilizer at rates of 0, 45, and 90 lb/acre N as ammonium nitrate was applied as a split-plot treatment. The soil was a Zanesville silt loam, with slope ranging from about 1 to 3%.

In late May each year, corn was planted into the standing cover crops or corn residue using a no-till planter. The varlety of corn was Pioneer 3184 in 1980 and Pioneer 3535 in 1981-1983. When the corn was planted, the experimental area was sprayed with a mixture of 2 pt/acre of paraquat, 2.5 lb/acre of Bladex, 2.5 lb/acre of Lasso and X-77 surfactant in 45

gallons water/acre to kill the cover crops and provide weed control for the corn. N fertilizer treatments were surface-applied broadcast at corn planting.

Cover crop samples were harvested before the corn was planted to determine their dry matter yields and N content. Corn grain was harvested from 25 feet of each of the two center rows in each plot in early October.

## RESULTS AND DISCUSSION

1980. Yields of cover crops were not affected by the method of planting, but hairy vetch produced approximately 4 and **5** times, respectively, more dry matter than big flower vetch and rye (Table **1).**

Table 1. Dry matter yield of cover crops at corn planting for 1980.

| Cover crop | Yield, lb/acre |
|---|---|
| Hairy vetch | 1956 a* |
| Big flower vetch | 490 b |
| Rye | 383 b |

* Means followed by the same letter are not significantly different at the 5% level of probability based on LSD.

Corn grain yield (Fig. la) was significantly influenced by an interaction between cover treatment and applied N fertflizer. At 0 and 45 lb/acre applfed N, corn yields with hairy vetch were greater than wfth all other cover treatments. Since hairy vetch produced 4 to 5 times greater dry matter than big flower vetch or rye (Table **1),** this could be attributed to additional N supplied and soil water conserved by the mulch. Corn yields converged at 90 lb/acre fertilizer N for all cover treatments, apparently as a result of soil moisture deficiency limiting corn yields to a greater extent than available N. The 1980 growing season was a drought year.

1981. Hairy vetch significantly outyielded both big flower vetch and rye, and rye outyielded big flower vetch (Table 2). Planting the cover crops by overseeding was superior to drilling in terms of yfeld and N content.

Corn grain yields for 1981 are shown in Fig. lb, and as in 1980 the response to fertilizer N was dependent upon cover treatment. Water was not as limiting, and corn yield with big flower vetch and hairy vetch cover treatments were very similar. Based on corn yield with 0 N, both vetch cover treatments produced approximately 40 to 50 bu/acre more grain than corn residue or rye treatments. Yields at 0 fertilizer N with hairy vetch and big flower vetch treatments were estimated to be comparable to yields obtained with corn residue at rates of 70 and **52** lb/acre of fertilizer N, respectively.

Table 2. Dry matter yield and N content of cover crops at corn planting for 1981.

| Cover crop | Yield | %N | N content | Planting method | Yield | N content |
|---|---|---|---|---|---|---|
| | lb/acre | | lb/acre | | ---lb/acre--- | |
| Hairy vetch | 5304 a* | 3.7 | 196 a | Overseeded | 4691 a | 133 a |
| Big flower vetch | 3051 c | 4.1 | 125 b | Drilled | 3623 b | 109 b |
| Rye | 3981 b | 1.0 | 40 c | | | |

* Means within columns followed by the same letter are not significantly different at the 5% level of probability based on LSD.

1982. Overseeded hairy vetch produced greater yields of dry matter and produced 50 lb/acre more N in the above-ground portion when overseeded than when drilled. Planting method did not significantly influence nitrogen content of big flower vetch or rye (Table 3).

Table 3. Dry matter yield and N content of cover crops, 1982.

| Cover crop | Planting method | Yield, lb/acre | %N | N content, lb/acre |
|---|---|---|---|---|
| Hairy vetch | Overseeded | 2900 a* | 3.9 | 112 a |
| | Drilled | 1608 bc | 3.8 | 61 b |
| Big flower vetch | Overseeded | 1910 bc | 3.5 | 66 b |
| | Drilled | 1915 b | 3.6 | 70 b |
| Rye | Overseeded | 1363 cd | 1.0 | 13 c |
| | Drilled | 1028 d | 1.0 | 11 c |

* Means within columns followed by the same letter are not significantly different at the 5% level of probability based on LSD.

Corn grain yield in 1982 responded to applied N similarly for all cover treatments, although yield was dependent on cover treatment (Fig. lc). This suggests that soil moisture was not limiting, since the corn responded to the additional N available from hairy vetch and big flower vetch, even when 90 lb/acre of fertilizer N was applied.

1983. Dry matter production of hairy vetch was significantly greater than big flower vetch or rye, and big flower vetch yield was greater than that of rye. Nitrogen content of the cover crops coincided with their yields (Table 4).

Unfortunately, severe drought conditions persisted throughout the 1983 growing season, resulting in extremely low grain ylelds (Fig. ld). it is interesting to note that at the 0 N rate, corn yield responded to hairy vetch and big flower vetch treatments, whlle added N produced only a

slight response with these two cover crops. There was a greater, but still small corn yield response to applied N with the corn residue and rye treatments. This trend suggested that both N and soil water were limiting, but soil water was the major limiting factor in those treatments.

Table 4. Dry matter yield and N content of cover crops,1983.

| Cover crop | Yield, 1b/acre | %N | N content, lb/acre |
|---|---|---|---|
| Hairy vetch | 2618 a* | 3.4 | 89 a |
| Big flower vetch | 1644 | 3.6 | 60 b |
| Rye | 972 c | 1.1 | 10 c |

* Means within columns followed by the same letter are not significantly different at the 5% level of probabllity based on LSD.

## SUMMARY

Legume cover crops are capable of supplying a portlon of the N required by no-till corn in addition to providing the benefits usually associated with a mulch. In some years of this study, overseeding resulted in greater yields of certain cover crops, probably due to the earlier planting dates, allowing more growth to be made prior to the onset of winter. Years when soil moisture was less limiting, the additional N supplied by legume cover crops was more evident in terms of corn yield. The quantity of N potentially available to no-till corn from legume cover crops was dependent on dry matter yield and %N of the cover crop in question.

## REFERENCES

Ebelhar, S.A., W.W. Frye, and R.L. Blevins. 1984. Nitrogen from legume cover crops for no-tllllage corn. Agron. J. 76:51-55.

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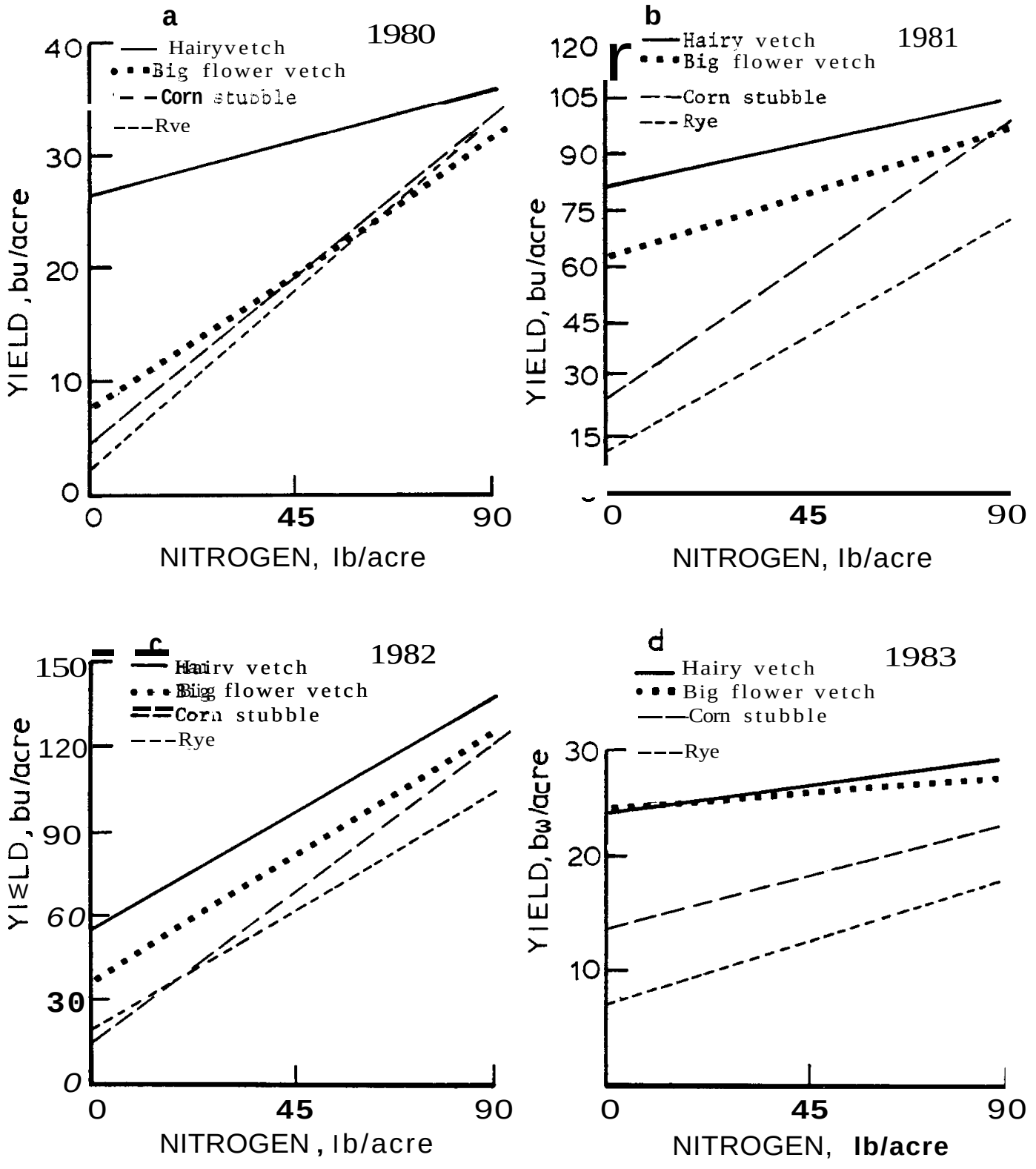


Fig. la–d. Effect of cover treatment and applied nitrogen fertilizer on corn grain yields: 1980 - 1953.