Rye Cover Crops in No-till Corn Production

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Field studies have been conducted for several years in Ohio to determine the effects of including a rye cover crop in no-till production situations. These studies were conducted at two locations, on a moderately well drained Canfield silt loam at Wooster, and a very poorly drained, but tiled, Hoytville silty clay at Hoytville.

At Wooster, no-till corn was planted into corn or soybean residue, with or without a fall-seeded rye cover crop (2 bu/A seeding rate). Individual plots received 200 lb N/A as either anhydrous ammonia or UAN (28-0-0). Rye was killed immediately after corn planting using herbicide combinations containing either paraquat or glyphosate. Rye was normally 30-40" high at planting. All N x cover crop combinations were replicated three times.

A similar experiment at Hoytville contained all N x cover crop treatments, but was conducted only in a corn-soybean rotation, in keeping with the normal recommendation made for no-till corn on the Hoytville soil.

No major N source x cover crop interactions were noted during the four study years, and as such, the effect of rye on corn yield in Table 1 represents both anhydrous ammonia and UAN treatments. In most site-years, rye had no effect on yields; however, in four cases, the presence of rye cover reduced corn yields. These yield reductions were associated with reduced stands on the rye covered plots. In 1983, at Wooster, corn yields were improved by the presence of rye in soybean residue, probably a function of improved moisture conservation in an extremely dry year. An overall assessment of results, however, would indicate that the use of a rye cover crop is not warranted when sufficient residue from the previous crop is present.

Perhaps surprisingly, there was no effect of N source on yield. Data in Table 2 show results from Wooster averaged across cover treatments and years. Despite the lack of effect on yield, UAN treatments showed lower ear leaf N contents than ammonia treatments in both rotations. The differences in leaf N content indicated greater N utilization from ammonia than UAN; however, the quantities of N available due to the 200 lb N/A rate were sufficient to prevent yield reduction in UAN treatments.

The effects of the rye cover crop on two selected soil chemical properties are shown in Tables 3-4. These data were collected in Autumn, 1985, after four years of treatment application, and have not yet been subjected to detailed statistical analysis. There are some aspects of these data, however, which appear evident without statistical interpretation.

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Organic carbon (Table 3) exhibits the expected stratification seen in no-till systems, at both locations. There is no evidence of increasing carbon content due to inclusion of rye in the well drained Canfield soil at Wooster. In the more poorly drained Hoytville soil, which is wet for a greater part of the year than the Canfield, there is an indication that a portion of the organic matter produced by the rye is maintained in the soil profile.

Exchangeable K (Table 4) also exhibits stratification in both soils. Rye appears to increase the levels of exchangeable K in the upper 2 inches of each soil, but seems to have little if any effect on levels lower in the profile sampled. The tendency for rye to increase 0-8 inch exchangeable K levels is questionable.

Other soil properties including soil pH, Bray and Kurtz P_1 extractable P, exchangeable Ca, and exchangeable Mg have also been determined, but have not been sufficiently prepared for presentation at this time.

In summary, it appears that the rye cover crop has little place in no-till situations characterized by adequate existing levels of crop residue, unless the rye has some value as a crop, itself. In addition, it appears that rye can affect some soil chemical properties in a relatively short period of time, but that certain effects may be soil dependent.

Table 1. Effect of rye cover crops on corn yields at Wooster and Hoytville.

	Wooster						Hoytville		
	Corn residue			Soy residue			Soy residue		
Year	No rye		Rye	No rye		Rye	No rye		Rye
	bu/A								
1982	195		182	202		198	146		152
1983	105		110	108	*	126	123	*	104
1984	182	*	166	195		191	192		196
1985	169	*	146	199		199	162	*	139

* Means significantly different.

Table 2. Effect of N source on corn grain yield and ear leaf N content at Wooster.

Rotation	Yield		Leaf N		
	Ammonia	UAN	Ammonia		UAN
	bu/A		%		
Continuous corn	158	156	3.14	*	2.97
Corn - Soy	177	178	3.22	*	3.04

* Means significantly different.

Table 3. Distribution of organic carbon as affected by rye cover.

Depth	Wooster		Hoytville	
	No rye	Rye	No rye	Rye
-in-	%			
0-8	1.54	1.58	2.18	2.34
0-2	1.88	1.84	2.43	2.50
2-4	1.57	1.54	2.12	2.28
4-6	1.49	1.57	2.13	2.22
6-8	1.40	1.44	2.13	2.22

Table 4. Distribution of exchangeable K as affected by rye cover.

Depth	Wooster		Hoytville	
	No rye	Rye	No rye	Rye
-in-	lb/A			
0-8	182	187	452	474
0-2	286	319	694	774
2-4	181	191	406	416
4-6	152	160	368	366
6-8	148	148	366	356

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