REPLACING HERBICIDES WITH HERBAGE: POTENTIAL USE FOR COVER CROPS IN NO-TILLAGE

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INTRODUCI1ON

Recent changes in farm legislation require up to 50% ground cover after planting to qualify for subsidies. Leaving previous crop residue will not meet ground cover requirements in many cases. Cover crops are needed to meet subsidy requirements.

Weed-suppressing cover crops may allow reduction of herbicide use within no-tillage production systems. Using allelopathic cover crops where needed to meet conservation requirements could reduce herbicide use with essentially no additional cost. Additionally, cover crops could potentially replace preemergence herbicides in areas where ground water contamination risk is high. Much work has been done on weed suppression by certain cover crops. Weed suppression by cover crops has ranged from poor to good.

The objectives of these experiments are to determine weed suppression by several species of cover crops and their potential use as a herbicide replacement or supplement in no-tillage corn and cotton production.

MATERIALS AND METHODS

Winter annual cover crops of rye, crimson clover, subterranean clover, and hairy vetch were established on bedded plots in the fall of 1991 at Clayton and Rocky Mount, North Carolina. The soil types were Johns sandy. loam at Clayton and Norfolk loamy sand at Rocky Mount. Additional treatments of no-tillage without cover and conventional tillage were also established. Corn and cotton were planted in separate experiments at both sites in the spring of 1992. Cover crops were killed in all experiments with 2.0 Ib/A glyphosate + .25% X-77 applied 2 weeks prior to planting. Glyphosate was also applied to the no-tillage without cover plots to desiccate weedy vegetation. Conventionally tilled plots were disked and bedded immediately prior to planting. Treatments of preemergence (PREE), postemergence (POST), PREE plus POST, and untreated herbicide applications were established in cover crop plots after corn and cotton were planted. The PREE herbicide treatment for the corn experiments was 1.2 lb/A atrazine + 2.0 lb/A metolachlor. The POST treatment was 1.5 lb/A ametryn + 25% X-77 directed when corn was 18 to 30 inches tall. The PREE treatment for cotton at Clayton was 15 lb/A metolachlor + 1.5 lb/A fluometuron. The PREE treatment for cotton at Rocky Mount was 2.0 lb/A metolachlor + 1.5 lb/A fluometuron. The POST treatment in cotton at both locations was an early postemergence directed application of 2 lb/A MSMA + 2 lb/A fluometuron + 5% surfactant and a late postemergence directed application of 1 lb/A cyanazine + 2 lb/A MSMA + 5% surfactant. The POST treatment also included an over-the-top application of .188 lb/A sethoxydim + 1 qt/A surfactant at both postemergence application timings. The resulting experimental design was a 6x4 factorial randomized complete block split plot design with four replications. Whole plots were the cover crop treatments and subplots were the herbicide treatments.

Weed control ratings in the corn experiments were taken approximately 45 days after planting and 21 days after postemergence applications. Yields were taken in the fall of 1992.

Weed control ratings in the cotton experiments were taken approximately 30 and 90 days after planting. Yields were taken in the fall of 1992.

Predominant broadleaf weeds at both locations were pigweed species and common lambsquarters. Predominant grass species were large crabgrass at Clayton and broadleaf signalgrass at Rocky Mount.

RESULTS AND DISCUSSION

Early-season weed control was good to excellent for both broadleaf and grass weed species in cotton and corn at both locations with the PREE treatment (Table 1). Rye was the only cover crop species to consistently provide fair to good weed suppression without additional herbicide. Subterranean clover and crimson clover also provided weed suppression, although inconsistent across locations and crop. Hairy vetch provided little or no weed suppression and was not

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		Corn				Cotton			
		Herbicide Treatment[1]				Herbicide Treatment			
		PREE		Untreated		PREE		Untreated	
		Weed Species[2]				Weed Species			
Site	Cover Crop	Brdlf.	Grass	Brdlf.	Grass	Brdlf.	Grass	Brdlf.	Grass
		Percentage Control				Percentage Control			
Clayton	Rye	100.0	100.0	85.0	78.8	100.0	99.3	87.5	76.3
	Crimson Clover	100.0	92.5	67.5	67.5	91.8	***88.8***	***68.8***	75.0
	Sub. Clover	100.0	93.3	95.0	**75.0**	94.3	95.5	67.5	57.5
	Hairy Vetch	97.8	90.0	17.5	17.5	97.3	95.3	21.3	30.0
	Yo-Tillage	98.8	95.0	22.5	20.0	98.5	**88.0**	0.0	0.0
	Conventional	99.3	**95.8**	**0.0**	**0.0**	99.3	**95.5**	**0.0**	**0.0**
	LSD (p = 0.05)		Broadleaf = 9.5 Grass = 11.0				Broadleaf = 10.0 Grass = ***8.8***		
Rocky Mount	Rye	96.3	97.0	***88.8***	92.5	95.5	95.5	77.5	85.0
	Crimson Clover	95.0	92.0	63.8	60.0	93.8	87.5	71.3	46.3
	Sub. Clover	98.8	98.8	***75-0***	63.8	96.5	93.8	75.0	71.3
	Hairy Vetch	97.5	98.8	***68.8***	70.0	93.8	91.3	42.5	10.0
	No-Tillage	96.3	97.5	28.8	30.0	97.8	96.5	**36.3**	45.0
	Conventional	93.8	98.8	0.0	**0.0**	95.3	**88.0**	0.0	0.0
	LSD (p = **0.05)**		Broadleaf = 10.2 Grass = 13.2				Broadleaf = 11.5 Grass = 14.0		

[1] PREE herbicide treatments include metolachlor (1.5 lb/A at Clayton; 2 lb/A at Rocky Moult) + 1.5 lb/A fluometuron applied preemergence in cotton and 1.2 lb/A atrazine + 2.0 lb/A metolachlor applied preemergence in corn.

[2] Broadleaf **ueed** species at both sites uere predominantly pigweed species and common lambsquarters. Predominant grass **ueed** species uere large crabgrass at Clayton and broadleaf signalgrass at Rocky Moult.

significantly better than no-tillage without a cover crop in half of the experiments.

All PREE, POST, and PREE + POST applications provided good to excellent late season broadleaf weed control at both locations in corn (Table 2). POST and PREE + POST treatments also provided excellent grass weed control. Late-season grass weed control was reduced in the crimson clover, subterranean clover, and hairy vetch at the Clayton location with the PREE herbicide treatment only compared with other herbicide treatments. Rye and subterranean clover were the only cover crops providing better than 50% suppression of broadleaf weeds without any PREE or POST herbicide application. These two cover crops also provided late-season grass suppression at the Rocky Mount location.

Only POST and PREE + POST herbicide treatments gave good to excellent control of both grass and broadleaf weeds across all cover crop treatments in cotton at both locations (Table 3). Grass and broadleaf control with the PREE only treatment were poor to fair at the Clayton location in all cover crop treatments. Broadleaf weed control in PREE treatments at the Rocky Mount location was good to excellent in all cover crops except rye and grass control, which was acceptable only in the no-tillage treatment. Broadleaf weed control was inconsistent across locations in untreated herbicide plots, and grass control failed.

Untreated herbicide plots gave no cotton lint yield at either location (Table 4). Highest yields within all cover crop treatments were with the PREE + POST herbicide application at both locations except hairy vetch at the Rocky Mount location, Consistently highest yields were in the conventional-tillage plots.

Interactions between cover crops and herbicide treatment were not significant for corn yield. Corn yields in PREE, POST and PREE + POST herbicide plots were significantly higher than the untreated plots at both locations (Data not shown). Yields were not significantly different between cover crops at either location.

SUMMARY

Cover crops continue to be inconsistent in weed-suppressing abilities. Cover crops may he detrimental to herbicide activity in some situations. Additional mechanical or chemical weed control must be applied to provide effective control and profitable yields.

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Table 2. Late-season weed control ratings in corn at Clayton and Rocky Mount, NC.

		Herbicide Treatment[1]							
		PREE		POST		PREE + POST		UNTREATED	
		Weed Species[2]							
Site	Cover Crop	Brdlf.	Grass	Brdlf.	Grass	Hrdlf.	Grass	Brdlf.	Grass
		Percentage Control							
Clayton	Rye	983	95.0	993	96.8	100.0	100.0	83.0	36.3
	Crimson Clover	93.0	66.0	993	96.0	100.0	98.5	413	33.8
	Sub. Clover	88.8	68.8	99.0	98.8	99.0	99.8	66.3	32.5
	Hairy Vetch	Y63	77.5	97.5	92.8	100.0	98.8	10.0	25.0
	No-Tillage	98.8	92.3	96.8	96.0	100.0	100.0	10.0	18.8
	Conventional	97.3	88.0	90.0	91.3	99.8	99.5	0.0	0.0
	LSD (p = 0.05)		Hroadleaf = 9.4				Grass = 12.5		
Rocky Mount	Rye	98.8	94.8	98.0	943	99.5	98.0	68.8	725
	Crimson Clover	96.0	94.8	97.3	94.8	99.8	100.0	46.3	22.5
	Sub. Clover	95.8	96.0	98.0	95.5	100.0	100.0	67.0	61.8
	Hairy Vetch	99.0	98.5	98.5	96.8	99.3	98.5	36.3	50.0
	No-Tillage	99.3	99.5	99.0	97.5	99.5	97.8	17.5	18.8
	Conventional	99.3	98.8	97.5	95.0	100.0	100.0	0.0	0.0
	LSD (p = 0.05)		Broadleaf = 13.2				Grass = 17.5		

[1] Herbicide treatments include 12 lb/A atrezine + 2.0 lb/A metolachlor applied preemergence (PREE) and 1.5 lb/A arnetryn + .25% surlactant applied postemergence directed (POST).

[2] Broadleaf weed species at both sites were predominantly pigweed species and common lambsquarters. Predominant grass weed species were large crabgrass at Clayton and broadleaf signalgrass at Rocky Mount.

Table 3. Late-season weed control ratings in cotton at Clayton and Rocky Mount, YC.

		Herbicide Treatment[1]							
		PREE		POST		PREE + POST		UNTREATED	
		Weed Species[2]							
Site	Cover Crop	Brdlf.	Grass	Brdlf.	Grass	Brdlf.	Grass	Brdlf.	Grass
		Percentage Control							
Clayton	Rye	62.5	***63.8***	***99.8***	**99.8**	***99.8***	100.0	85.0	32.5
	Crimson Clover	52.5	18.8	89.5	98.3	100.0	100.0	40.0	18.8
	Sub. Clover	56.3	26.3	92.3	**95.3**	99.8	99.8	65.0	16.3
	Hairy Vetch	56.3	27.5	89.3	98.8	100.0	100.0	10.0	6.3
	No-Tillage	70.0	***23.8***	88.3	96.5	100.0	100.0	12.5	0.0
	Conventional	71.3	41.3	95.3	97.8	100.0	***99.8***	12.5	0.0
	LSD (p = 0.05)		Broadleaf = 14.5				Grass = 10.0		
Rocky Mount	Rye	67.5	40.0	100.0	100.0	100.0	100.0	40.0	27.5
	Crimson Clover	87.5	36.3	100.0	100.0	100.0	100.0	41.3	13.8
	Sub. Clover	86.3	60.0	***99.8***	***99.8***	100.0	100.0	57.5	15.0
	Hairy Vetch	***88.8***	66.3	95.0	100.0	100.0	**100.0**	50.0	12.5
	No-Tillage	100.0	95.0	100.0	100.0	100.0	100.0	25.0	***0.0***
	Conventional	**90.0**	62.5	100.0	***99.8***	95.0	100.0	0.0	0.0
	LSD (p = 0.05)		Broadleaf = 16.7				Grass = 13.1		

[1] Herbicide treatments include metolachlor (1.5 lb/A at Clayton; 2 lb/A at Rocky Mount) + 1.5 lb/A fluometuron (PREE) and sequential applications of 2 lb/A MSMA + 2 lb/A fluometuron + .5% surfactant applied early postemergence directed and a late postemergence application of 1 lb/A cyanazine + 2 lb/A MSMA + .5% surfactant (POST). POST treatments included -188 lb/A sethoxydim + 1 qt/A surfactant applied at both postemergence application timings.

[2] Broadleaf weed species at both sites were predominantly pigweed species and common lambsquarters. Predominant grass wed species were large crabgrass at Clayton and broadleaf signalgrass at Rocky Mount.

Table 4. Cotton lint yields at Clayton and Rocky Moult. NC.

Site	Cover Crop	Herbicide Treatment[1] PREE	POST	PREE + POST	UNTREATED
		Cotton Lint Yield (lbs./a)			
Clayton	Rye	739	931	1088	0
	Crimson Clover	0	301	430	0
	Sub. Clover	0	608	981	0
	Hairy Vetch	0	947	1148	0
	No-Tillage	0	621	1467	0
	Conventional	243	1206	1612	0
	LSD (p = 0.05) = 312				
Rocky Mount	Rye	337	414	419	0
	Crimson Clover	293	345	409	0
	Sub. Clover	757	625	921	0
	Hairy Vetch	779	639	748	0
	No-Tillage	1236	1364	1460	0
	Conventional	433	1159	1254	0
	LSD (p = 0.05) = 313				

[1] Herbicide treatments include metolachlor (1.5 lb/A at Clayton; 2 lb/A at Rocky Mount) + 1.5 lb/A fluometuron (PREE) and sequential applications of 2 lb/A MSMA + 2 lb/A fluometuron + .5% surfactant applied early postemergence directed and a late postemergence application of 1 lb/A cyanazine + 2 lb/A MSMA + .5% surfactant (POST). POST treatments included .188 lb/A sethoxydim + 1 qt/A surfactant applied at both postemergence application timings.