Comparative Effects of Tillage on Winter Annual Forage Production

David Lang[1]

Introduction

Production of winter annuals in the Southeast provides a valuable source of high quality forage (1,6). Production practices normally include disking of land summer fallowed and cultipacking to facilitate direct seeding (9). Altematively, a winter annual may be overseeded into an existing sod (5,10). Winter annual production into a prepared seedbed will generally provide earlier grazing and will tend to yield more compared to overseeding (3, 4,10, 11, 13).

Sod-buster provisions of the 1985 Farm Bill may limit the degree of disking permitted for winter annual seedbed preparation (12). Seeding directly into the residue of the previous winter annual plus summer annual weeds consisting mainly of crabgrass *(Digitara sanguinalis)* and broadleaf signalgrass *(Bracharia platyphylla)* may provide a suitable practice. The objective of this study was to compare yield of winter annuals planted with and without tillage into a crabgrass residue.

Materials and Methods

Summer annual weed growth was promoted by irrigation in June. 1988. The dominant species was crabgrass (Digitara *sanguinalis).* Weed growth was clipped in July and Aug. but not removed. On 14 Sept. 1988 plots were clipped and herbage removed and one-third of the plots were roto-tilled with a Troy-hilt rear tine implement. Paraquat was applied 26 Sept. 1988 to another third of the plots while another third was left unsprayed and untilled. 'Walken' oats *(Avena sativa).* 'Marshall' ryegrass *(Lolium multiflorum),* Tyfon *(Brassica rapa* x *B.pekinensis)* and a combination of oats and tyfon were seeded on 27 Sept. 1989 with a Tye Pasture Pleaser no-till drill. Yield evaluations were made on 5 Dcc. 1988 and 10Mar. 1989. An adjacent field was disked and fallowed throughout the summer for a small grain for forage trial which included 'Walken' oats and 'Marshall' ryegrass. The clean-till plots were seeded on 10 Oct. 1988 and harvested on 19 Dec. 1988, 18 Jan. 1989 and 13 Mar. 1989.

Results and Discussion

Soil fertility levels were generally adequate in both experiments (Table l). Abundant rainfall and very favorable temperatures occurred during the time of the experiments (Table 2). Over 3 inches of rain fell during the week after seeding the no-till test and over 2 inches fell following seeding of the clean till test. The lowest temperature of the period occurred 10 Feb. 1989 at 18°F and 17°F on 24 Feb. 1989. Only minor frost damage was observed on any of the species tested. Annuals seeded into crabgrass had lower stands than those seeded into rototilled plots (Table 3). Due to the warm weather from planting until first frost 7 Nov. 1988, crabgrass continued to grow and comprised 25% of the untreated soil plots. This resulted in a higher dry matter percentage on 5 Dec. harvest and indicated that crabgrass contributed considerably to the yield of sod-seeded plots.

Yield of annuals on 10 Mar. were higher in the rototill or crabgrass with paraquat plots compared with untreated crabgrass plots (Table 4). Other researchers have generally found that winter annuals growing in a prepared seedbed yield almost twice as much as sod-seeded annuals and provide grazing 2-4 months earlier (3.4). Winter annuals seeded into summer annual residues, however, may not be as severely affected, compared with seeding into a permanent sod. Ryegrass seeded into broadleaf signalgrass residues were able to be harvested in Dec. and Feb. while ryegrass seeded into bermudagrass sod could not be harvested until March (2).

Table 1. Soil fertility levels of no-till and clean till experiments.

	pH	P	K	Ca	Mg
		-- Extractable	Nutrient	levels	(lbs/A) --
Clean Till	5.1	161 H +	88 L	2918 H^+	78 M
No Till	5.8	111 H	170 H	2672	80 M

[1]Department of Agronomy. Mississippi State University. Mississippi State. MS 39762.

Table 2. Weekly Weather from Sept., 1988 to Mar., 1989 at Mississippi State, MS.

Week Ending	Air Temperature Max	Min	Rainfall	Date of Minimum Below Freezing
	°F		-inches.	
Sept. 7	80	61	1.62	
Sept. 14	86	79	0.27	
Sept. 21	86	72	2.30	
Sept. 28	83	66	0.24	
Oct. 5	63	57	3.74	
Oct. 12	68	44	0.00	
Oct. 19	74	45	0.81	
Oct. 26	67	46	1.25	
Nov. 2	66	47	0.24	
Nov. 9	76	50	0.52	32°F on 11/7
Nov. 16	70	48	1.16	
Nov. 23	62	36	2.25	32°F on 11/18
Nov. 30	63	37	1.14	27°F on 11/29
Dec. 7	59	29	0.00	24°F on 12/6
Dec. 14	50	31	0.23	29°F on 12/10
Dec. 21	55	34	0.04	21°F on 12/18
Dec. 28	66	42	1.42	30°F on 12/28
Ian. 4	54	37	2.88	25°F on 12/29
Jan. 11	60	42	2.09	32°F on 1/5
Jan. 18	54	35	5.17	26°F on 1/17
Jan. 25	60	34	0.02	25°F on 1/22
Feb. 1	66	42	1.16	32°F on 1/27
Feb. 8	45	32	0.87	21°F on 2/7
Feb. 15	64	39	0.03	18°F on 2/10
Feb. 22	51	41	2.41	30°F on 2/22
Mar. 1	49	31	3.05	17°F on 2/24
Mar. 8	52	37	0.79	30°F on 3/7
Mar. 15	77	45	0.00	30°F on 3/9
Mar. 22	69	44	1.75	
Mar. 28	69	49	1.40	32°F on 3/28

Table 3. Effect of tillage on % stand of winter annuals established as of 5 Dec. 1988.

Tillage[1]	Stand	D. M.	Crabgrass[2]
	%	%	-lb/A-
Rototill	96 A	13.9 B	1 B
Paraquat	96 A	14.3 B	48 B
Residue	84 B	26.6 A	310 A
LSD 05	8	3.7	115

[1]Means followed by the same letter within each column were not significantly different.

[2]Crabgrass yields were estimated visually

Table 5 presents yield date for each species tested. Yield reductions were observed at the first harvest in the crabgrass plots, but yields were equivalent in each tillage treatment on 5 Dec. due to the growth of crabgrass (Table 3). Yields on 10 Mar. reflected an advantage for the rototilled plots, compared with either crabgrass plot, particularly with ryegrass or oats. Oats seeded into paraquat treated crabgrass yielded similarly to oats seeded in rototilled plots while ryegrass grew best when seeded into rototilled plots.

Oats and ryegrass yielded twice as much in the clean-till

Table 4. Overall effect of tillage on yield of winter annuals.

Tillage	Forage Yield Dec. 5	March 10
	lbs/A	
Rototill	1119	984 A
Paraquat of Crabgrass residue	1177	803 A
Crabgrass residue	1185	586 B
LSD 05	NS	185

Means followed by the same letter within each column were not significantly different.

Table 5. Effect of tillage on various winter annuals.

Winter Annual	Tillage	Forage Yield Dec. 5	March 10
		lbs/A	
Oats	Rototill	1108	1372
	Paraquat	1044	1281
	Residue	1333	793
Ryegrass	Rototill	988	1445
	Paraquat	968	935
	Residue	778	692
Oats & Tyfon	Rototill	1152	718
	Paraquat	1214	679
	Residue	1598	551
Tyfon	Rototill	1228	400
	Paraquat	1076	316
	Residue	1071	307
Overall LSD 05		243	213
Comparisons:			
Rototill vs. sod		NS	***
Paraquat vs. Residue		NS	**

Table 6. Yield of Oats and Ryegrass seeded into a prepared seedbed compared with No-Till.

	Walken Oats			Marshall	Ryegrass	
	Dec.	Jan.	Mar.	Dec.	Jan.	Mar.
	lbs/A					
Clean Till[1]	1375	1925	2231	2079	2069	2267
No-Till[2]	1044	0	1281	968	0	935

[1]Clean Till had 500 lbs 13-13-13 at seeding.

[2]No-Till had 500 lbs 13-13-13 at seeding plus 50 lbs N as Ammonium Nitrate on 11/12/88.

(summer fallow) plots compared with even the rototilled plots in the no-till experiment (Table 6). The rototilled plots contained decaying residue of crabgrass that may have released an inhibiting factor into the soil. Many possibilities exist including nitrogen deficiency due to microbial tie up, oxygen deficiency due to microbial decay, or release of toxins during decay (7.8). Any or all of these of factors may

be adversely affecting the growth of no-till seeded winter annual forage crops.

Establishment of winter annuals without tillage offers the opportunity to extend the grazing season of warm season permanent sods. Limitations exist, however, and each needs to be understood in order to be alleviated. Once these limiting factors are understood then cultural practices can be recommended and information vital to plant breeders can be used to improve winter annual forage production.

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