Sweetpotato Response to Cover Crops and Conservation Tillage

Herby Bloodworth and Mike Lane
Jamie L. Whitten Plant Materials Center
Coffeeville, MS

Introduction

Corn (*Zea mays* L.) was one of the first crops to be grown successfully with no-tillage (NT). As technology advanced and new herbicides were developed, other crops such as soybean [*Glycine max* (L.) Merr.] and sorghum [*Sorghum bicolor* (L.) Moench] have been extensively planted using NT. Once thought that intensive tillage was required for maximum yields, cotton (*Gossypium hirsutum* L.) has now been shown to respond favorably to NT (Bloodworth and Johnson, 1992).

Sweetpotato [*Zpomoeabatatas* (L.) Lam.] is considered to be a highly erodible crop. Fields are disked and hipped multiple times in order to prepare the seedbed. Soil disturbance at harvest decreases the amount of crop residue remaining on the soil surface. Soil loss from sweetpotato production has been estimated to be up to 22 tons/acre (USDA-NRCS, Jackson, MS).

With escalating production costs and the need for soil conservation, farmers are interested in the effects of NT and cover crops on alternative crops such as sweetpotato. This study was initiated to determine how NT and cover crops affected sweetpotato growth and development.

Materials and Methods

This study was conducted at the Jamie L. Whitten Plant Materials Center near Coffeeville, MS, from 1991 to 1994. Plots were four rows (40-inch row spacing) 25 feet in length. Soil types were Oaklimeter silt loam (Coarse-silty, mixed, thermic Fluva quentic Dystrochrepts) in 1991-1992, and Grenada silt loam (Fine-silty, mixed, thermic Glossic Fragiudalfs) in 1992-1994. Plots were rotated to a different field each year. Experimental design was a randomized complete block with two or four replications. Analysis of variance was used to determine if significant differences occurred (P ≥ 0.05). Duncan's Multiple Range Test (DMRT) was used to separate means that did differ significantly (Steel and Torrie, 1960).

Seedbeds for the cover crops were prepared by disking twice (2X), hipping 2X, and lightly harrowing. P and K were broadcast-applied according to soil test results for sweetpotato. Cover crops were broadcast planted on Nov. 6, 1991 at 20, 30, 90, and 90 lb/A for crimson clover (*Trifolium incarnatum* L. var. 'Tibbee'), hairy vetch (*Vicia villosa* L.), rye (*Secale cereale* L. var. 'Elbon'), and wheat (*Triticum aestivum* L.), respectively. Diclofop methyl (Hoelon@) was applied at 0.75 lb ai/A on Dec. 17, 1991 to all plots to control ryegrass (*Lolium multiflorum* Lam.). Seeding rates were reduced to 15, 20, 60, and 60 lb/A for crimson clover, hairy vetch, rye, and wheat, respectively, in 1992 and 1993. Planting dates were Oct. 8, 1992 and Oct. 28, 1993. Legume seeds were inoculated with the proper rhizobia prior to planting each year. Disking 2X, hipping, and harrowing in the spring served as a conventional tillage (CT) check. Canopy cover was determined by visually estimating the amount of cover in each plot. Dry matter (DM) yields were determined by hand harvesting 4 square feet in each plot prior to cover crop termination. Native cool season weeds varied from year to year but mainly consisted of henbit (*Lamium amplexicaule* L.), chickweed [*Stellaria media* (L.) Cyrillo], and cutleaf eveningprimrose (*Oenothera laciniata* Hill). Cover crops were chemically killed using glyphosate (Roundup@) applied at 2.0 lb ai/acre on approximately April 15 of each year.

Prior to transplanting, glyphosate was applied at 1.0 lb ai/A to control surviving weeds. On approximately June 5 of each year, slips of 'Jewel' were transplanted at an in-row spacing of 16 inches. Ammonium nitrate was broadcast applied at 150 lb/A to rye, wheat, native cover, and CT plots at planting. Crimson clover plots received 60 lb/A ammonium nitrate. Sethoxydim (Poast@) at 0.19 lb ai/A was applied postemergence to control grass weeds. Plots were hand-weeded each year as needed to control broadleaf weeds. Conventionally tilled plots were cultivated twice each year. Potato yields were determined by hand harvesting a middle row in each plot, air drying to an uniform moisture content, weighing, and grading. Harvest dates were Sept. 15, 1992, Sept. 28, 1993, and Oct. 27, 1994. Yield data were not analyzed because of low yields because of excessive competition from yellow nutsedge (***Cyperus esculentus*** L.) and severe browsing by deer in 1994.

Results and Discussion

Because of excessive soil moisture from January to early

Herby Bloodworth, **Conservation Agronomist, J.L. Whitten Plant Materials Center, Rt 3, Box 215A, Coffeeville, MS 38922 (Phone: 601-675-2588; Fax: 601-675-8649). Mike Lane, Manager, J. L. Whitten Plant Materials Center, Coffeeville, MS.**

March, canopy cover ratings and dry matter yields were not recorded in 1992. However, canopy cover was adequate by mid-April (data not presented). In 1993, canopy cover of native weeds was significantly higher in March and April than cover from rye or the legumes (Table 1). Rye and wheat increased canopy cover during February and March of 1994 more than the other species. Bloodworth et al. (1993) reported that soil loss could be reduced up to 75% when cover crops were planted with cotton. In their study, soil loss was greater with native cover due to variation in volunteer stands of cool season weeds.

Though not evaluated in this study, surface residues have been shown to have beneficial effects other than reducing soil loss. Bond and Willis (1971) and Moody et al. (1963) reported higher soil moisture levels associated with high residue levels. Moody et al. also reported lower soil temperatures and a higher rate of growth and yield for corn when planted into mulched plots. In 1994 of this study, crimson clover and hairy vetch produced significantly higher dry matter yields than rye or native weeds (Table 2). High legume DM yields could decrease the need for commercial N fertilizers in sweetpotato production.

No unusual problems occurred at planting or during the potato growing seasons except in 1994. Soil moisture levels at planting were extremely low in all plots, which resulted in the transplanter's closing wheels leaving the roots of many slips exposed. We did notice that the wheat and rye plots held soil moisture better in 1994 than the other species, resulting in better planter operations. However, sweetpotato stands in the cover crop plots were comparable to those in the CT plots where the closing wheels worked as they should. No modification had been done to the transplanter to adapt it to NT use.

No significant differences were found between cover crops and tillage for sweetpotato yields (50 pounds per bushel) in any year (Table 3). In a North Carolina study, NT potatoes (species not specified) with cover crops produced yields equal to or higher than the state average (Hoyt, 1984). Buxton (1981) reported higher infiltration rates in potato (species not specified) fields where high amounts of residue from cereal grains had been produced. He stated that moderate compaction in the plow layer affected yield more than quality.

Table 1. Cover crop canopy cover, by dates, 1993-1994.

	Canopy cover					
	1993			1994		
Cover croD	**2/02**	**3/01**	**4/06**	**2/01**	**3/11**	**4/08**
			%			
Crimson clover	19'	8cd	35b	21b	25b	73
Hairy vetch	22	7d	40b	6c	8c	65
RYe	26	13bc	32b	49a	55a	83
Wheat	21	15ab	45b	47a	65a	79
Native weeds	20	20a	60a	5c	26b	84

[1] Means within a column not followed by a common letter are significantly different as determined by DMRT (P>0.05).

Table 2. Cover crop dry matter yield, 1993-1994.

	DM yield	
Cover crop	**1993**	**1994**
	lb/acre	
Crimson clover	3,338[1]	477a
Hairy vetch	4,079	422a
Rye	3,867	2602b
Wheat	3,892	3,490ab
Native weeds	2,900	2,248b

[1] Means within **a column** not followed by a common letter are significantly different as determined by DMRT (P>O.O5).

Table 3. Sweetpotato yields by cover crop and tillage, 1992-1993.

Cover crop/ tillage system	**1992**			**1993**		
	Canner	**#1**	**Total**	**Canner**	**#1**	**Total**
	bu/acre			bu/acre		
Crimson clover	223[1]	47	270	69	74	143
Hairy vetch	260	57	317	66	107	173
RYe	244	93	337	72	75	147
Wheat	195	58	253	74	56	130
Native cover	206	36	242	68	92	170
Conv. till	244	46	290	*55*	74	129

[1] Means within a column not followed by a common letter **are** significantly different as determined by DMRT (P>0.05).

Conclusions

This study was to determine if sweetpotato could be successfully grown in a NT system and how cover crops affected plant growth. Results showed that NT sweetpotato produced similiar yields and quality to CT sweetpotato. Cover crops did not influence yield and quality.

Producers facing narrow profit margins may not use cover crops when deliberating how only yield will be affected. However, cover crops' ability to decrease soil erosion, conserve soil moisture, and decrease weed competition should be considered.

Future research should be focused on how much tillage is necessary to maintain high sweetpotato yields, N fertilizer requirement of sweetpotato following legume cover crops, new transplanter designs, and the effects of herbicides used in sweetpotato production on cover crops.

Note: Mention of a trademark or proprietary product does not imply endorsement by the USDA-NRCS.

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