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# Establishment Methods of Sweetpotato in a Conservation Tillage System

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## ABSTRACT
With escalating production costs and the need for soil conservation, sweetpotato [*Ipomoea batatas* (L.) Lam.] farmers are interested in the effects of conservation tillage production. A three year study comparing soil disturbance and planter modifications for minimum tilled sweetpotatoes was conducted at the USDA-NRCS Jamie L. Whitten Plant Materials Center, Coffeeville, MS on a Grenada silt loam (Fine-silty, mixed, thermic Glossic Fragiudalfs). Management systems included 1) paratill plowing to a depth of 12 inch two weeks before planting, 2) planter modification (shank with a 6 inch sweep set to run 6 inch deep in front of the sword opener), 3) planter modification + cultivation, 4) no-till (no adjustments to planter), and 5) conventional tillage [disk twice (2X), hip 2X, lightly harrow and cultivate 2X]. No significant differences were found for plant growth or sweetpotato total yield between management systems.

## INTRODUCTION
Sweetpotato grown with conventional tillage systems is considered to be a highly erodible crop. Fields are disked and hipped multiple times to prepare seedbeds and harvesting techniques incorporate crop residue remaining on the soil surface. Annual soil loss from sweetpotato production has been estimated to be as great as 22 tons/acre (USDA-NRCS, Jackson, MS). Advancements made with no-till corn, cotton, and soybean have made it possible to produce sweetpotatoes in limited tillage systems.

Transplanting vegetables into no-tilled soils has been evaluated since 1970 (Moschler et al., 1971; Morrison et al., 1973). Major factors limiting the adoption of no-till transplanted vegetables are inconsistent yields, lack of precision transplanters, and the lack of effective registered herbicides. Morse et al. (1993) stated that transplanters must meet five conditions to satisfy a farmer's requirements. These are: 1) be strong enough and heavy enough to transplant in adverse soil conditions, 2) transplant in heavy residue with minimum soil disturbance, 3) till a narrow band of soil to allow the transplanter to function properly, 4) maintain root-soil contact for the transplant by firming the disturbed soil, and 5) apply fertilizers and pesticides precisely.

Conservation tilled sweetpotato has been shown to produce yields comparable to conventionally tilled sweetpotato (Bloodworth and Lane, 1995). In their study, dry conditions resulted in many transplants having to be reset by hand because of insufficient down pressure on the closing wheels. Therefore, using an unmodified transplanter was not suitable in dry soil conditions for no-till sweetpotato. The objective of this study was to determine if planter modifications were necessary and the amount of soil disturbance needed to maintain high sweetpotato yields.

## MATERIALS AND METHODS

This study was conducted at the USDA-NRCS Jamie L. Whitten Plant Materials Center near Coffeeville, MS on a Grenada silt loam (Fine-silty, mixed, thermic Glossic Fragiudalfs). Management systems included 1) paratill plowing to a depth of 12 inch two weeks before planting, 2) planter modification (shank with a 6 inch sweep set to run 6 inches deep in front of the sword opener), 3) planter modification + cultivation, 4) no-till (no adjustments to planter), and 5) conventional tillage [disk twice (2X), hip 2X, lightly harrow and cultivate 2X]. Experimental design was a randomized complete block with four replications. Plot size was four, 40 inch rows 25 feet long. Plots were moved to a new location in each year of the study. Analysis of variance was used to determine if significant differences occurred ($P \leq 0.05$) and LSD was used to separate means that differed significantly (Steel and Torrie, 1960).

Wheat (*Triticum aestivum* L.) was broadcast planted in October each year beginning in 1994 on all plots as a cover crop at 90 pounds per acre. Seedbed preparations included disking 2X, paratill plowing, hipping 2X, and lightly harrowing. Gramoxone® was applied at 0.75 lb ai/acre to burndown the wheat in all plots in April of each year.

Conventional tillage (disking 2X and hipping 2X) and paratill plowing operations were performed four weeks before planting date. Conventionally tilled plots were also lightly harrowed before planting. Fertilizer (0-43-245) was broadcast applied prior to planting. Slips of 'Beauregard' were transplanted on approximately June 1 for all years, weather permitting, using a Holland® transplanter with an in-row spacing of 16 inches. The transplanter was modified by making planter units non-floating. This was done to exert more downpressure on the press wheels for all systems.

Dacthal® was applied preemergence at 7.5 lb ai per acre. Poast® was applied at 0.25 lb ai/acre two weeks after planting for grass control. Plots were hand hoed to control broadleaf weeds. Nitrogen as ammonium nitrate was applied at 50 pounds per acre when vines started to run. Plots designated to be cultivated were cultivated twice.

Plant populations were determined by counting the number of plants per ten feet of row two weeks after planting. Yields were determined by hand harvesting a center row of each plot in September for all three years.

## RESULTS AND DISCUSSION

The soil was very friable during planting in 1995 and the sweetpotato slips were established successfully. However, we did experience a problem in the paratill plowed plots where the transplanter tended to plant on the side of the row. One week without a rain is not enough time for rows to settle. In 1996 and 1997, paratill plowing was conducted two weeks before planting. Transplanter modification was able to handle the wheat residue and to open/close the soil around the slips.

In 1995, the growing conditions were extremely dry from mid-July until harvest. However, soil moisture levels remained in the adequate range especially in the conservation tilled plots. Weeds were easily controlled by both chemical and mechanical methods. No detectable variations in plant growth and development were found between management systems during the 1995 (Table 1) or 1996 (Table 2) growing season.

In 1995, paratill plowing tended to increase sweetpotato yields but no significant differences were found (Table 1). In 1996, no-till yields were the highest of all treatments but no significant differences were found (Table 2). Bloodworth and Lane (1995) reported lower total yields but there were also no differences in yield between no-till and conventional tilled sweetpotatoes.

**Table 1. Plant population and sweetpotato yields, by grade and total, 1995.**

| Management Method | Plants / acre | ------------- U.S. No. 1 | Yield lb/acre Canning | ------------- Total |
|---|---|---|---|---|
| Paratill | 9474 | 13679 | 16875 | 30554 |
| Planter modification | 9474 | 10634 | 16724 | 27358 |
| Planter mod. + cultivation | ---- | 7390 | 13597 | 20987 |
| No-till | 9474 | 10719 | 11882 | 22601 |
| Conventional tillage | 8494 | 9771 | 20213 | 29984 |
| LSD (0.05) | NS | NS | NS | NS |

**Table 2. Plant population and sweetpotato yields, by grade and total, 1996.**

| Management Method | Plants / acre | ------------- U.S. No. 1 | Yield lb/acre Canning | ------------- Total |
|---|---|---|---|---|
| Paratill | 13068 | 7214 | 10944 | 18158 |
| Planter modification | 12088 | 8497 | 10742 | 19239 |
| Planter mod. + cultivation | 11761 | 9932 | 10062 | 19994 |
| No-till | 12741 | 10174 | 11807 | 21981 |
| Conventional tillage | 10781 | 10260 | 10644 | 20904 |
| LSD (0.05) | NS | NS | NS | NS |

The PMC received over 19 inches of rain during May and June of 1997. Extremely wet conditions delayed planting of the sweetpotatoes slips until late June. Heavy wildlife damage to these plants in early fall resulted in poor growth and plant performance. These two factors led to extremely low yields for all treatments resulting in no number ones and very little canning quality sweetpotatoes (data not shown).

Data from this study supports that of Bloodworth and Lane (1995) that high yields can be maintained when sweetpotato is planted using conservation tillage. Simple modifications to a conventional transplanter must be made to plant slips in high residue environments. This can be accomplished by adding a shank with a sweep set to run six inches deep in front of the sword opener. Regardless of the tillage system used, adequate down pressure on the press wheels is essential to seal the soil around transplants.

**LITERATURE CITED**

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NOTE: Mentioning a trade name of a product does not imply endorsement by the USDA Natural Resources Conservation Service (NRCS) or by the Jamie L. Whitten Plant Materials Center.



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