2003 BELTWIDE COTTON CONFERENCES, NASHVILLE, TN – JANUARY 6-10

COMPOSTING OF COTTON GIN WASTE FOR A WHOLESALE NURSERY

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Abstract

Cotton gin waste (CGW) is a disposal problem for gins in Southeastern Virginia. A wholesale nursery in the area needs a new source of compost for their potting mix. This project was undertaken to demonstrate that windrow composted CGW is a satisfactory product for the nursery. Composting began in mid October and was completed in 10 weeks. Plans are to conduct a greenhouse study beginning February 2003 to evaluate composted CGW in a potting mix to grow Marigolds and Impatiens.

Introduction

Cotton gin waste (CGW) is a disposal problem for gins in Southeastern Virginia. One gin land applies all of their waste, and others allow it to naturally compost in storage piles. This partially composted waste is given to contractors (where it is used to as a soil amendment for reseeded construction sites) or to individuals for home and farm use.

Little return is gained from the CGW. In fact, management of this material is an expense to the gin.

A large wholesale nursery located within 35 miles of one of the gins needs a new source of bulk compost for their potting mix. Their current supplier would rather sell bagged compost to the lawn and garden market because of the higher profit margin in this market. Consequently, the nursery is seeking a reliable new supply.

Will windrow composted CGW meet the nursery's need for the compost used in their potting mix? Obviously, the nursery cannot use partly composted material that will finish composting in the pot and thus compete with the plant. Also, there is concern that some chemical residue is present in the CGW that will be detrimental to the plant.

This project was funded by the five gin owners and Cotton Incorporated to produce windrow composted CGW and conduct a greenhouse test to determine the performance of plants grown in this material. Plans are to begin the greenhouse test in February 2003.

Materials and Methods

CGW was delivered to the composting site, a sod field, using live-bottom van trailers. The windrows were built by allowing the material to fall from the rear of the van as the truck was driven forward. After a clump of the material fell, the truck was driven forward 8 to 10 ft and the live bottom operated to cause another clump to fall from the rear. The resulting windrow was approximately 10 ft wide and 4 ft high. One 40-ft van trailer produced a windrow approximately 150 ft long. Four loads gave four windrows.

Windrow Turning

The windrows were turned with a tractor-towed windrow turner (Figure 1). This machine was built using the frame of a swing-tongue mower-conditioner. The design came from Mr. Brad Callis, a farmer composting dairy waste in Hartford, Wisconsin. The mower-conditioner frame was donated to the project by CNH, New Holland, PA, and the roller (agitator) was installed by Commonwealth Gin, Windsor, VA. (The roller was one of the beaters from a module feeder.) Total width of the machine was approximately 10 ft.

The roller was powered with a hydraulic motor (same motor used on the mower-conditioner) through a No. 80 roller chain drive. The chain drive was enclosed in a sheet metal housing to prevent the waste from accumulating in the chain drive. The hydraulic pump was PTO driven.

Preliminary tests showed that roller adequately agitated the windrow when driven at 120 rpm. The relief valve in the hydraulic circuit was set on 3500 psi. The hydraulic ports on the tractor activated two cylinders used for the following operations.

1. Swing the frame so that it was offset to operate beside the tractor.
2. Raise and lower the roller.

The composting was begun on Oct 15. The management plan called for the windrows to be turned three times per week for four to six weeks and once per week for the next four weeks. The actual turning schedule is given in Table 1. It was a very wet fall and certain scheduled turnings were missed.

Irrigation of Windrows

A 2600-gal tank on a tandem axle trailer (Balzer Model 2600 Standard) used to spread swine lagoon liquid was used to add water to the windrows. The only modification to this machine was to replace the nozzle on the outlet pipe. The original nozzle had a deflector plate, and the manufacturer supplied a new nozzle without the deflector plate.

To add water, the tank trailer was pulled down the alleyway between the windrows. The pump rpm was set such that arc of water exiting the nozzle hit on top of the windrow. If the pump speed was set too high, the stream of water overshot the top and hit on the far side. With a little practice, this simple system worked satisfactorily.

The manager of the composting operation was instructed to add water whenever a handful of the compost felt dry. Because of the frequent rainfall during the fall, water was added only twice.

Temperature Measurement

Thermocouples (Type T) were taped to a wooden dowel inserted into the windrow. The bottom thermocouple (B) was placed 10 cm above the ground. The middle thermocouple (M) was placed at mid depth (approximately 60 cm above the ground), and the top thermocouple (T) was placed approximately 10 cm below the top surface (110 cm above the ground). These thermocouples were connected to a data logger (Campbell Scientific Model CR-10) placed in a weather station on the site.

Sample Collection

Grab samples were collected at 30 days and 60 days from the bottom, middle, and top of the windrow. These samples were sealed in plastic bags and transported back to the laboratory where they were weighed and oven dried for 48 hours at 100 °C to determine moisture content. The dried samples were sent to A&L Eastern Laboratories, 7621 Whitepine Road, Richmond, VA 23237 for the following analysis.

1. Total Solids
2. Total Kjeldahl nitrogen
3. Phosphorus
4. Potassium
5. Sulfur
6. Calcium
7. Magnesium
8. Sodium
9. Iron
10. Aluminum
11. Manganese
12. Copper
13. Zinc

Greenhouse Test

Plans are to transport 2 yd^3 of finished, screened compost to the Horticulture Department, Virginia Tech and begin the greenhouse study on 1 Feb. Marigolds and Impatiens, quick-growing plants sensitive to disease and toxicity, will be used to test the product.

Results and Discussion

The windrows formed by material falling from the rear of the live-bottom van trailer smoothed into a uniform windrow after only one pass with the turner. Height of the roller was approximately 10 cm above the ground. Hydraulic pressure was measured at 1500 psi when the turner was under full load.

The turner needs to be at least 0.6 m wider. The outboard wheel plowed through the far edge of the windrow (Figure 2). Also, the turner has no provision for pushing, or sweeping, the material back into the windrow after it spreads out behind the turner. The front-end loader on a backhoe was used to re-pile the material after turning. If the turner is used for more extensive studies, it should be modified to rebuild the windrows after turning.

Temperature data measured for the first 30 days is given in Figure 3. After 3 days the temperature at the bottom of the pile increased to the 60 – 70 °C range and stayed in this range for the next 27 days, indicating that vigorous microbial activity was taking place. The temperature in the top of the pile fluctuated widely as expected. Average temperature in the top of windrow appeared to be around 40 °C.

At the end of 60 days, temperature did not increase after turning. Any additional composting after 60 days is expected to be minimal. Plans are to continue to turn the windrows once a week until the compost is harvested for the greenhouse test with Marigolds and Impatiens.

Visual inspection of the compost showed it to be a dark, humus-like material with some partly broken down particles. It is expected that this material will have to be screened before it is used in a potting mix.

Pending success of the greenhouse test, this project will have demonstrated that windrow composted CGW can be marketed to a wholesale nursery. Generation of income from CGW will benefit the ginners specifically and the Virginia cotton industry in general.

Acknowledgments

Appreciation is expressed to the five Virginia gin owners and Cotton Incorporated for the funding for this project. The mower-conditioner frame that was modified to build the windrow turner was donated by CNH, New Holland, PA, and this support is gratefully acknowledged. Also, appreciation is expressed to Mr. Mike Ellis for his management of the composting part of the project.

Table 1. Actual turning schedule for windrow composting of CGW during 2002 – 03 season.

Day No.	Days Between Turning
3	3
6	3
8	2
10	2
21	11
28	7
32	4
38	6
50	12
56	6
63	7

Figure 1. Windrow turner built by replacing the disc cutters on a swing-tongue mower-conditioner with a spiked roller. (Frame donated to the project by CNH, New Holland, PA and modified by Commonwealth Gin, Windsor, VA.)

Figure 2. Windrow turner shown turning windrow after 30 days of composting.

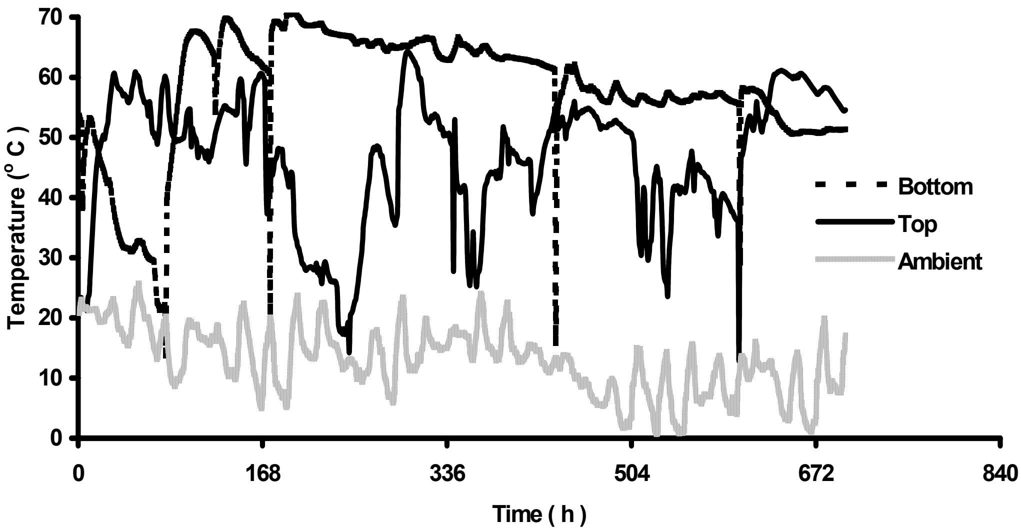

Figure 3. Temperature measured in CGW windrows during first 30 days of composting.