

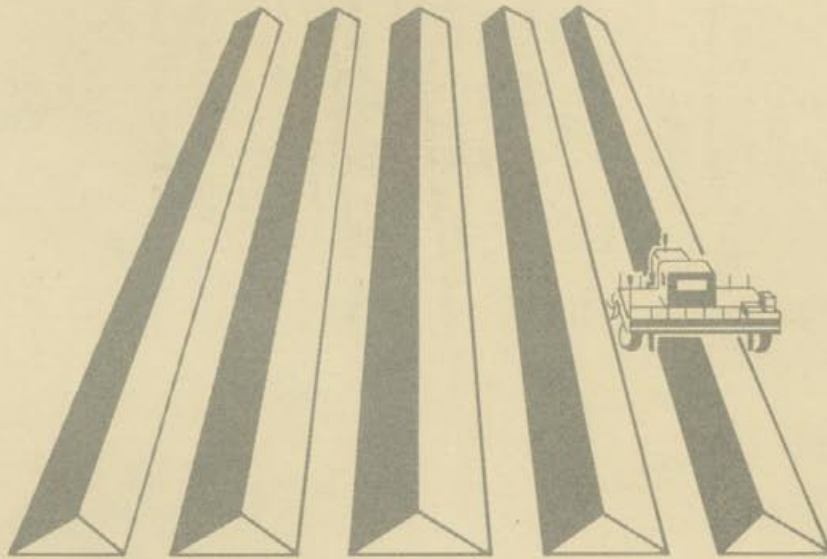
---

# GIN WASTE

---

UTILIZATION ALTERNATIVES

---



# INTRODUCTION

by W. Stanley Anthony, Research Leader, USDA, ARS, U.S. Cotton Ginning Research Laboratory, Stoneville, MS; J. Alex Thomasson, Agricultural Engineer, USDA, ARS, U.S. Cotton Ginning Research Laboratory, Stoneville, MS; William D. Mayfield, National Program Leader, Cotton Mechanization and Ginning, USDA Extension Service, Memphis, TN; and Gary Huitink, Extension Agricultural Engineer, AR Cooperative Extension Service, Little Rock, AR.

Waste disposal is a nuisance and an additional cost for most gins. Cotton gin trash or waste is somewhat awkward to handle and requires gin yard space. However, innovative gin owners and others have demonstrated that gin waste has value for such things as livestock feed, gin dryer heat, activated charcoal, building material, power generation, soil amendment, etc.

Gins handling machine-picked cotton accumulate from 100 to 150 pounds of waste per bale of ginned lint while stripper-cotton gins yield about 700 pounds. For 15,000 bales per year, the volumes of gin waste produced are about 750 tons for picked cotton and 5,250 tons for stripper cotton.

In 1989, about one-fifth of the cotton gins in the Mid-South were incinerating waste (Table 1). However, implementation of environmental regulations will eliminate incineration of gin waste by 1995 unless new incineration technology is developed. Thus, there is an immediate need for a viable alternative to incineration.

For most ginneries, returning gin waste to the soil is the most attractive option. The best method depends on the gin location,

Method	AR	LA	MO	MS	TN	MidSouth
Incineration*	19.2	21.0	3.2	27.7	2.3	19.2
Contract Haul	0.0	4.4	3.2	2.7	7.9	3.1
Dump	12.7	8.0	6.3	12.1	9.6	10.7
Spread	38.3	20.7	63.3	30.6	21.0	32.6
Personal Use	15.5	22.7	10.7	13.5	34.1	17.8
Compost	3.4	10.7	4.8	4.5	9.9	5.9
Feed	8.3	4.6	5.1	6.3	12.9	7.3
Other	2.6	8.0	3.2	2.7	2.3	3.5

\*Incineration of gin trash will be eliminated by 1995 because of new environmental regulations.

Table 1. Disposal method percentages for responding gins by state, 1989 season.

yard space, available labor, and management interests. Gin waste provides organic material, improves soil tilth, increases the soil water-holding capacity and may retard soil erosion and reduce soil-surface crusting.

Research and field experience show that gin waste improves the growth and yield of many plants/crops. Dryland cotton yields were maintained or increased as much as 36 percent where various rates of unprocessed gin waste were applied.

Raw gin trash contains about 25 pounds of nitrogen (N), 12 pounds of phosphorous (P), and 25 pounds of potassium (K) per ton dry weight. Composting cuts the volume in half and thereby doubles the fertility value per ton. Composting stabilizes these primary nutrients in an organic form that is readily available to plants. There are several methods of handling gin waste.

## Spreading Raw Gin Waste on Soil

Ginneries have several alternatives for spreading gin waste. It can be spread on farm land at the

rate of 1 to 18 tons per acre depending on soil test recommendations. The raw gin trash can be incorporated with a tillage implement. The ability of this tillage tool to incorporate the waste may limit the application rate. Raw gin waste can also be dumped and stock-piled on unused farm land and spread after it decomposes.

Adding raw gin waste on top of the soil surface offers the additional benefit of retarding soil erosion. However, increased infestations of insects, diseases, and especially weeds are likely. A problem with "clumping" is possible when gin waste is incorporated with the soil, which could make even distribution of the material difficult.

Typically, cyclones separate the gin waste from conveying air and drop it into a trash house or hopper. If gin waste must be handled with a loader, a grapple attachment is helpful. Trailers or trash beds on trucks can be used for hauling and spreading (Fig. 1 and 2). Trash can be hauled to fields by tractors with trailers, dump trucks or spreader trucks.

## Temporary Gin Yard Storage

If adequate space is available on the gin yard, gin waste can be piled and stored on site. This reduces labor and management requirements for gin waste disposal until after the ginning season. The main drawback to this system is the possibility of fire in the pile, which could lead to serious smoke problems, threats to machinery and property, and possible problems with environmental regulatory agencies.

A long auger-conveyor can be suspended on posts and used to form an extended pile of gin waste as it falls from a cyclone (Fig.3). The density of gin trash piled in this manner will average less than 8 lb/ft<sup>3</sup> of dry trash. A spray system can be suspended to apply water which will reduce dust and increase the moisture content to about 40%, causing it to compost more rapidly. Adding a surfactant to the water will improve penetration into the pile. Water should be added to the pile while the gin is running. Thoroughly wet trash piles will get hot, but not hot enough to self ignite. Dry trash piles and those where surfactants are not used to insure complete wetting have a higher risk of containing smoldering fires that may have been ignited in the harvesting or ginning process or in other ways.

Too much water can cause an anaerobic condition resulting in offensive odors. If this condition develops, the amount of water applied to the pile should be reduced and the pile should be stirred to replenish oxygen.

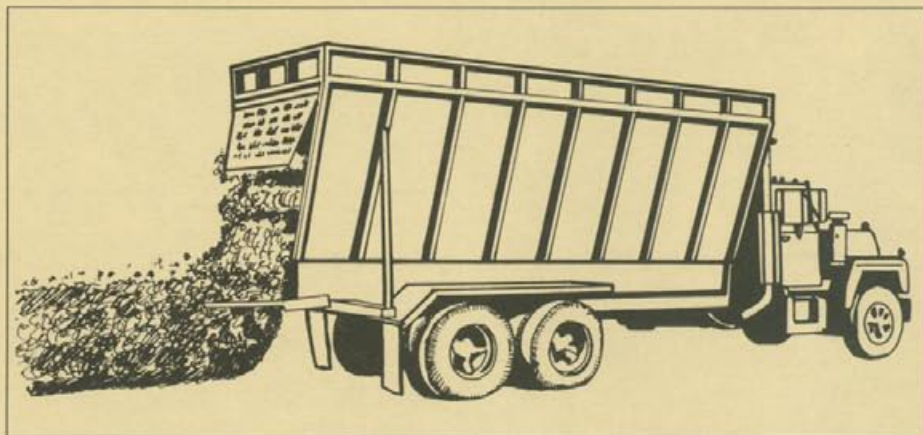


Figure 1. Truck trash bed for spreading gin waste.

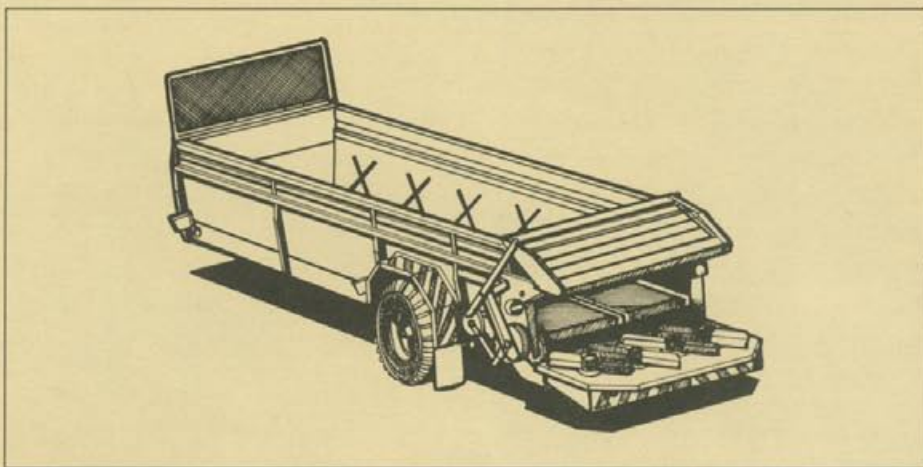


Figure 2. Smaller waste spreader for applying gin waste to crop land.



Figure 3. Elevated auger used to drop trash into a pile at the gin.

Monitor the pile after a rain to see if water has caused sections to become too soggy. If some mixing can be done, oxygen will be added to aid decomposition.

Mixing is also helpful in reducing viable weed seed and certain cotton plant pathogens.

After the ginning season, the remaining material can be picked

up with a front end loader and loaded onto a truck or trailer. It can then be used in the same manner as raw or fully composted gin waste.

## Composting

Composting uses microorganisms such as bacteria and fungi to reduce complex organic materials into a friable, soil-like material. Managed composting breaks cellulose and other plant parts down into stable organic compounds. The process can be either aerobic (Fig. 4), in which the microbes use oxygen to digest the material, or anaerobic, where inadequate oxygen is present. The end products of composting are stable organic matter and gases. Aerobic composting of gin waste is preferable because the gases produced are primarily carbon dioxide which is harmless and odorless. Anaerobic composting produces methane and hydrogen sulfide, which is known for its offensive rotten-egg smell. Cotton gin waste is an ideal source of organic matter for composting because it contains a large amount of surface area per unit volume as well as a substantial amount of oxygen in its dry state, and its carbon to nitrogen ratio is good.

Raw gin waste can be transported in trailers or dump trucks from the gin to the composting location and then unloaded in windrows, preferably on pavement, but at least on well-drained land to facilitate access and mobility during wet weather. Water can be added from a truck or irrigation system.

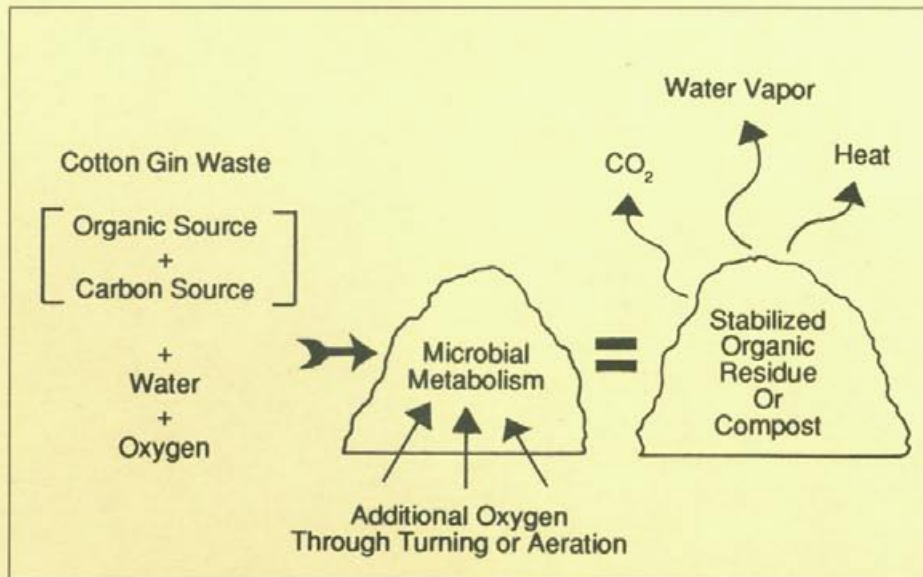


Figure 4. The aerobic composting process.



Figure 5. Gin waste arranged in windrows for managed composting.

## Well Managed

Well managed composting gin waste requires an adequate supply of land, equipment, water, and labor. An effective method for fully composting gin waste is to form windrows on well-drained soil (Fig. 5), add water to maintain the moisture content at approximately 60%, and to mix thoroughly at intervals. This will require 500-1,000 gallons of water per ton of dry trash. Typical windrows are 10-foot-wide

and 5-foot-high, and are triangularly shaped. About 15 feet is required between the windrows to allow turning. Specialized equipment is available to properly manage the compost (Fig. 6), or general purpose equipment can be used. If water is added appropriately and the pile mixed weekly for the first month, the gin waste should be fully composted in two to three months. Temperatures within the 130-150°F range support aerobic

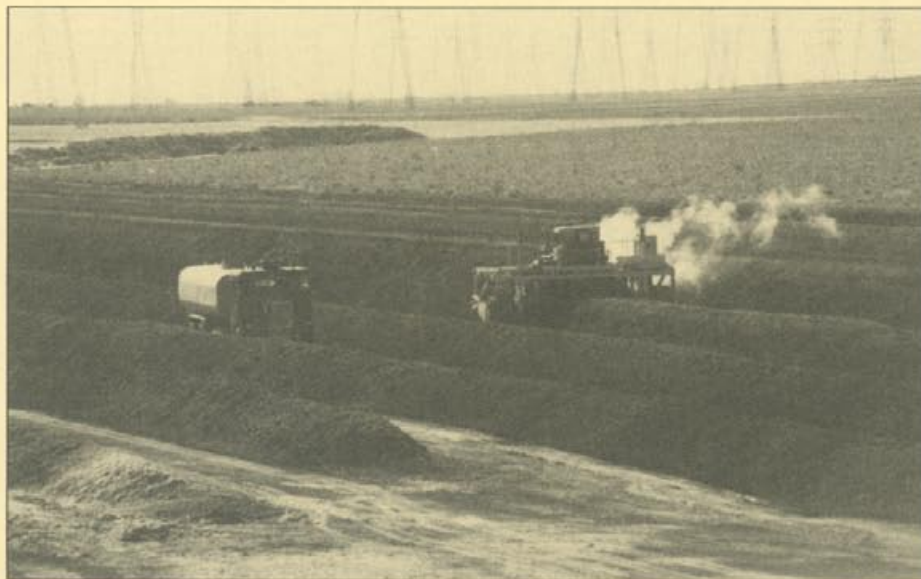


Figure 6. Specialized equipment for adding water and turning the windrows.

Bale Volume (machine- picked)	Land Required* (acres)	Maximum Water Requirements (gallons)	Diminished Water Requirements (per inch rain)
5,000	3.3	375,000	25,000
10,000	6.9	750,000	50,000
15,000	10.0	1,125,000	75,000
20,000	13.3	1,500,000	100,000
30,000	20.0	2,250,000	150,000
50,000	33.0	3,750,000	250,000

\*Assuming 10ft. by 5ft. windrows spaced 15ft. apart.

Table 2. Land and water requirements for managed composting of cotton gin waste.

microorganisms. Temperatures can get up to 180°F at which virtually no weed seeds, insects, or disease organisms can survive. The end product of well managed composting is an excellent soil amendment.

### Reduced Management

Accumulating gin waste in windrows or large piles and allowing it to decompose naturally can be used successfully in the rainbelt. The benefits of this form are that less labor and no water other than rain are required. The drawbacks are that more time is required to obtain stable organic matter, and weed, insect, and disease infestations

can remain a problem. Temperature is the main factor in destroying these organisms, and the slow decomposition of gin waste may not generate sufficient heat to completely alleviate these problems. Piles or windrows should be mixed thoroughly after rains. This will mix oxygen into the pile, cause temperatures to increase, and speed composting.

Estimated land and water requirements for managed composting operations for different sized gins are given in Table 2. For example, a picker-cotton gin with a yearly volume of 10,000 bales requires about 7 acres of land and up to 750,000 gallons of water, depending on the rainfall

received. Each inch of rainfall during composting would supply about 50,000 gallons of the total water requirement.

### Utilization

Fully composted gin waste has many uses. It loads easily with a loader bucket. Since compost is "fortified" compared to gin waste, it should be used carefully to avoid excessive rates or undesirable effects on growing plants. Using a spreader bed, it can be applied to fields very uniformly.

However, the value of compost is greater if a commercial market can be developed. Possible uses include compost as a portion of transplanting soils or potting mixes, as a landscaping media or use as a soil/turf amendment for lawns, athletic fields and golf courses, etc.

### Compressing, Moving, and Storing

Gin waste can be baled in a rectangular hay baler, cotton press, or module builder (Fig. 7). Table 3 provides typical densities of gin waste. Compressing the waste makes it easier to move to another site. However, moduling gin waste has been reported to be an unattractive alternative. First, the density of moduled gin waste (10 to 23 lb/ft<sup>3</sup>) is greater than that of seed cotton which will overload a module truck unless smaller modules are built. Second, excessive amounts of sand and dirt in the material can damage moduling and hauling equipment. A flat-bed truck can be used to transport bales of trash, or a conventional module mover or truck can be used to

transport modules to a temporary storage location. This method allows large quantities of gin waste to be transported at once.

Bales and modules could be allowed to decompose and then be spread on farm land after the ginning season. Estimates of the number of modules which would be built at different sized gins are shown in Table 4.

### Livestock Feed

Feeding cotton gin waste to cattle is a good alternative in certain areas. It is a good roughage with a moderate protein and energy value, depending on the amount of immature seed in the mixture. Pesticide residues from certain persistent compounds prohibit this use. Check the labels of all products used on the cotton crop to verify that waste can be fed without traces accumulating in the meat. Lactating dairy cows should not be fed gin waste.

### Summary

Suitable gin yard space and labor limit the methods of utilizing waste on soil for specific gins. Gin location and market development limit other methods of utilizing gin waste. Other possibilities have been investigated and merit consideration for certain gins. However, most gins currently find soil use a practical, environmentally-acceptable approach. Compost and unprocessed gin waste have advantages for improving plant productivity. Stewardship of the environment and potential liabilities from pesticide residues must be strongly considered.

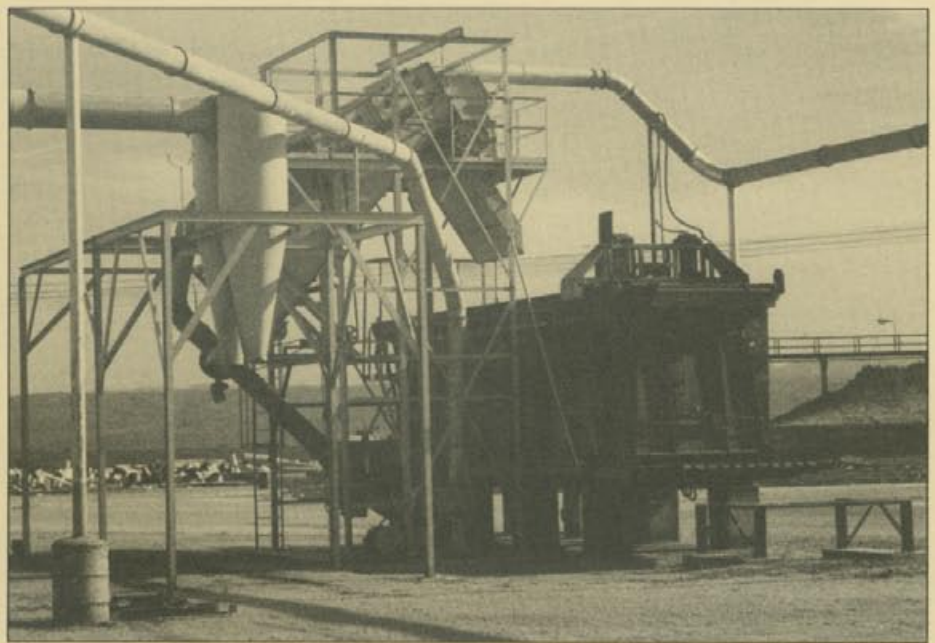


Figure 7. Module builder used to compress reclaimed lint and can also be used to compress gin trash.

Gin Waste Form	Density, Lbs/ft <sup>3</sup>
Loose gin run	3-7
Chopped gin run	5-7
Ground	13
Compacted module	20-23
Cubed	26-32
Pelleted	35-40
Compost	30-35*

\*At 40% moisture content, wet basis.

Table 3. Approximate densities of gin waste.

Bale Volume (machine-picked)	Number of Modules
5,000	38
10,000	75
15,000	113
20,000	150
30,000	225
50,000	380

Assuming a density of 20 lbs/ft<sup>3</sup>

Table 4. Number of gin waste modules which would be produced at different size gins.