COMPOST OPERATORS FORUM

Photo by J. Putman

Plastic contaminants can be seen in reject material from a half-inch trommel screening of the final product.

What Does Plastic Cost A Yard Trimmings Composter?

Some straightforward calculations help to identify the costs of accepting feedstocks in plastic versus compostable bags. Factors to consider include debagging, disposal of plastic and a better price for clean compost.

Rod Tyler

HAVE you ever stopped to figure out what it costs a composting facility to accept yard trimmings in plastic bags? Recently, I spoke with the director of a solid waste agency looking for custom compost services. He suggested that composting was a better deal than landfilling because the tip fee at the compost site was lower than the fee at the local landfill. I gently reminded him that the "cost" to the agency, that is the fee for the compost site, was not really the true cost of composting It can be much more expensive to compost, and composting has many more variables to manage on a day to day basis than landfilling. Yet many people requiring solid waste service view composting as a cheaper alternative based on tip fees alone. Unfortunately, composters may be locked in to keeping their tip fees lower than a landfill's.

One of the variables to manage is the "container" in which a feedstock arrives at the site. Perhaps the most problematic to yard trimmings composters is the plastic bag. Sometimes operators — especially those running private facilities that bid on municipal contracts — may feel that to be competitive in responding to proposals, they have to accept yard trimmings in plastic bags. If they decide to take them, it is critical that the related handling and processing costs are factored in, starting with debagging.

The introduction of compostable bags adds a new twist to determining the handling and processing costs. Generally speaking, compostable bags are more expensive than their polyethylene counterparts. But to be fair, there also can be significant savings by using them. These include: 1) a higher market price for the finished compost (because there are no plastic

contaminants); 2) a general reduction in processing costs from the avoidance of debagging and separation of plastic and compost at the time of screening; 3) recovery of more material to sell; and 4) reduction in disposal cost of the "overs" that are contaminated with plastic.

This article is designed to help compost operators analyze and compare the costs associated with accepting yard trimmings in plastic versus compostable bags. It factors in debagging both mechanically and manually.

Debagging Equipment

Based on my experience and the experience of others, the best debagging machines do not work with much more than 75 percent effectiveness. Debagging equipment can cost from $5,000 to several hundred thousand dollars depending on the size of the operation. Use of debagging equipment still can leave operators with a throughput issue — another variable that needs to be managed by site personnel.

Reportedly, the throughput of debaggers ranges from five to 20 tons/hour, which means the higher end machines can realistically process about 160 tons/day (or about 400 cubic yards (cy)/day). This is adequate for smaller operations, but for larger commercial sites with volumes often over 1,000 cy/day, it is easy to understand how a debagging backlog can occur.

Throughput becomes a larger issue during hectic times. For example, when summer grass clippings are in full swing, debagging of plastic bags can present a major barrier to an efficiently run compost site. The problem with the planning phase of most operations is that they design around the average day rather than the worst day one can possibly imagine. If your site is expected to take in 200 cy/day, plan a worst case scenario for 500 and see how you do.

Many debaggers often leave about 25 percent of the plastic in the composting feedstock. Plastic pieces in screened compost obviously are not well accepted in the marketplace and create a lower quality for the end product. On the other hand, plastic pieces passing into the overs pile only concentrates them more as they are recirculated into new yard trimmings coming into the facility until a point of contamination exists which is totally unacceptable. Considering the capital costs of all the other equipment necessary to run a commercial compost site, operators need to make sure the purchase of debagging equipment will give them the payback they expect. With such a low recovery percentage experienced with mechanical debaggers, many composters have decided to completely ban plastic bags or only accept paper bags.

Debagging also has other associated costs. The ranges for equipment and throughput assume employees will be working with the material. Hourly wages, insurance, and especially workman's compensation are all costs to consider when debagging plastic bags at compost sites. Other real but forgotten costs normally incurred due to plastic in the composting process are equipment cleaning (i.e., bags wrapping around windrow flails), site debris and litter cleanup and — most notably — disposal for plastic contained in "overs."

For example, Fred Thompson with Indian Summer Recycling North of Detroit, Michigan, claims the company spent almost $20,000 on landfill fees (not including hauling) for plastic materials separated from its compost operation last year. For his type of facility, which accepts yard trimmings in bulk, plastic bags and compostable bags, this is an annual expense that stands to rise as other sites decline to take plastic bags. This reality has led Thompson and his crew to consider other options, including banning plastic bags at their site in favor of accepting bulk, paper and biodegradable bags at a lower tip fee. According to Thompson, less revenue from a lower tip fee will still be more profitable than paying for the cost of plastic disposal.

Depending on the amount of overs experienced by each compost site, the cost savings achieved by using compostable bags in place of plastic bags will vary.

Tracking The Savings

To more accurately evaluate the cost of plastic versus compostable bags, the first step is to calculate the cost of debagging relative to the amount of overs that have to be disposed. I surveyed numerous operations for their debagging costs and it ranged from $1.50 to $3.00/ton mechanically and $6 to $8/ton manually. For this paper, average debagging costs of $2.25/ton mechanically and $7/ton manually were used for the savings projections. (Operators should insert their own numbers here to analyze their specific situations.)

Consider the collection of yard trimmings in 30-gallon bags, holding an average of 33 lbs/bag. In this case, there will be 60 bags in one ton of yard trimmings. For mechanical debagging, the cost associated will be: $2.25 ÷ 60 bags = $.0375/bag (3.75¢ per bag). For manual debagging, the cost would be $7.00 ÷ 60 = $.1166/bag (11.7¢/bag). Again, these are costs that the composter will incur and should be added to the cost of the bag itself for a fair comparison.

The second cost to consider is the savings from recirculating the materials. Theoretically, there will be more compost to sell when compostable bags are used because more of the material will end up in the sale pile and less will go to the landfill as contaminated. I have been all over the country viewing compost sites that accept yard trimmings in plastic bags and most of these operators will agree that conservatively 20 percent of the compost — even at the best sites — will end up in the overs pile. (Again, your situation may be different, so use corresponding numbers for your site in the calculations.)

Depending on the amount of overs experienced by each compost site, the cost savings achieved by using compostable bags in place of plastic bags will vary. Additional factors impacting the amount of savings are hauling and landfill disposal costs and other locally relevant fees. Table 1 shows the calculations for a per bag savings rate (i.e. how much could be saved if a compostable bag were used despite its higher cost). A specific range of overs and tip fees (including hauling costs) for disposal of material are provided.

According to these calculations, the per bag cost of landfilling overs appears to stay the same even if the volume of feedstocks taken in daily increases. This is because the number of bags involved will increase thereby maintaining the per bag cost. For example, if the daily average intake is 40 tons, and the average overs are 20 percent, the per bag cost remains the same for each differing disposal cost (i.e., $50/ton). A total of 40 tons will involve, on average, 2,400 bags (40 x .2 = 8 tons x $50 = $400 ÷ 2,400 = 16.67¢/bag. This is the same unit cost as for 20 tons and 35 tons/day, respectively.

Table 1. Per bag disposal cost of overs waste at a facility accepting 20 tons/day and debagging manually*

	Disposal Cost Per Ton					
	$25	$35	$50	$60	$75	$100
	Disposal Cost Per Bag					
% Overs	(¢)	(¢)	(¢)	(¢)	(¢)	(¢)
2.5	1.0	1.4	2.0	2.5	3.0	4.0
5	2.1	3.0	4.0	5.0	6.25	8.33
10	4.2	6.0	8.33	10.0	12.5	16.67
15	6.3	8.75	12.5	15.0	18.75	25.0
20	8.3	11.67	16.67	20.0	25.0	33.3
25	10.4	14.5	21.0	25.0	31.25	41.67
30	12.5	17.5	25.0	30.0	37.5	50.0

*To calculate your situation, use this formula: daily disposal cost ÷ total bags. This calculation is based on 20 tons of material being received each day on average. Assuming there are 60 bags/ton, 1,200 bags are taken in each day.

Finally, the third "savings" can be calculated — the extra revenue received from having more high quality compost to sell at better prices. However, for the sake of comparison in the final numbers that follow, we have used a very generic sales price of $10/ton (or about $5/cy) as the finished compost sales price. This is probably well below market value for most quality composts, but should be readily obtainable in most markets today. Table 2 shows what happens as the value of the product increases with varying rates of overs production. Eventually, there will be some overs to dispose (rock, other contaminants), but these are normally found to be less than five percent in operations without plastic.

It is easy to see how extra product will end up as extra cash if the compost site has an effective marketing program. Even at generic prices ($5/cy) and normal overs percentages (20 percent), the annual increase is $8,000. For a facility accepting 1,000 cy/day (about 400 tons) during peak season, this would equate to $160,000 in extra revenues from additional sales (400 tons x 20 percent x 2 cy/ton x 200 days x $5/cy sales).

The Bag End of Costs

How can we compare substituting compostable bags for plastic bags? There are really three cost areas representing three different stakeholders when the compostable bag issue is considered — the consumer, who generates most bagged yard trimmings; the local government which provides solid waste collection and disposal; and the composter, who has to deal with what comes into the site.

Regarding compostability, paper bags have long been the standard as far as their ability to compost and the time it takes for them to degrade. Paper bags, however, are bulky and difficult to store. They do not hold up well in moist or wet weather, and their contents are not visible to the hauler. Biodegradable and compostable plastic bags can overcome some of those disadvantages and are making some headway in the marketplace (see "Moving Towards Consensus On Degradable Plastics," p. 64). However, composters who have become frustrated by the confusion over biodegradable plastics may still only trust paper bags.

From the consumers' perspective, compostable bags — including paper — can cost from 20 to 50 cents/bag, depending on size, mil thickness and manufacturer. Normal garbage bags, made out of generic polyethylene (plastic) can range from 10 to 20 cents/bag and normally range from 30 to 40 gallons in size.

In an average community, most homes will use one bag per week. Although variable, this estimate includes several bags per week during heavy grass and leaf collection season, and no bags per week when there is snow on the ground. Assuming the average cost for a 30-gallon polyethylene bag is 10 cents and the average cost for a 30-gallon biodegradable bag is 32 cents, at 52 bags/resident/year, there's an average price difference of 20 cents/bag, That means each resident will typically pay about $10.40 more for compostable bags each year, or less than 25 cents/week.

If collection and hauling costs are identical for both biodegradable and plastic bags, the other key cost comparison relates to debagging costs (and disposing of overs) and will vary significantly depending on whether debagging is done manually (average 11.67 cents/bag) or mechanically (average 3.75 cents/bag).

Using manual debagging, biodegradable bags become cost-effective when the per bag cost of the overs is equal to 10.33 cents. This threshold is reached when disposal costs (tip fees plus hauling) are $35/ton and overs average 20 percent. As the disposal cost increases, the threshold is reached at even lower levels of overs production (i.e., at $50/ton, the threshold is reached at 15 percent overs).

With mechanical debagging (3.75 cents/bag), biodegradable bags become cost-effective when the per bag cost of the overs is equal to 18.25 cents. This threshold is reached for mechanical debagging when disposal costs are $50/ton and overs average 25 percent. At the average (20 percent) level of overs, the break even threshold level is not reached until disposal costs equal $60/ton.

Biodegradable bags are more profitable if the majority of the numbers fall in the category of 20 percent overs and $50 tip fees or higher. The benefit of lower costs to compost site

Table 2. Total dollars returned annually for recycling overs into quality compost

	Market Sales Price for Quality Compost						
% Overs	5 ($/cy)	10 ($/cy)	15 ($/cy)	20 ($/cy)	25 ($/cy)	30 ($/cy)	35 ($/cy)
2.5	1,000	2,000	3,000	4,000	5,000	6,000	7,000
5	2,000	4,000	6,000	8,000	10,000	12,000	14,000
10	4,000	8,000	12,000	16,000	20,000	24,000	28,000
15	6,000	12,000	18,000	24,000	30,000	36,000	42,000
20	8,000	16,000	24,000	32,000	40,000	48,000	56,000
25	10,000	20,000	30,000	40,000	50,000	60,000	70,000
30	12,000	24,000	36,000	48,000	60,000	72,000	88,000

This calculation based on 20 tons of material being received each day on average. We assumed one ton equals two yards of finished compost. (Tons x %Overs x 2 yards per ton x $/cy x 200 work days per year).

operators could lead to a reduced tip fee in order to provide an incentive for the use of more costly biodegradable bags. Assuming a composter's tip fee is $30/ton, it follows that — minus all debagging and associated costs — the net tip fee is really only $15.75/ton. (This would be determined by subtracting a $2.25/ton debagging cost, a $10/ton overs disposal cost (based on a 20 percent overs disposal rate and $50/ton landfill tipping fees) and $2/ton lost revenue from sales (based on a sale price of $10/ton).

In effect, an operator could afford to reduce their tip fee by some amount (less than indicated above, which is $14.25) to provide an incentive for the use of biodegradable bags. For some operators, like those who experience tip fees of $75 or over, it would be possible and economically beneficial to purchase the bags and give them to residents (complete subsidization) since the costs of avoidance by eliminating debagging would exceed the additional costs of the bags. Pay me now or pay me later. For the communities, reduced tip fees should mean lower fees and taxes charged for solid waste disposal. ■

Rod Tyler is the principal of Green Horizons, a consulting firm based in Medina, Ohio (rodndon@gte.net). He also is the national field representative with The Composting Council.

What's Your Experience With Plastic?

BioCycle will send survey questionnaires to a number of compost facility operators asking their opinions/experiences on dealing with plastics. What are policies about accepting plastic bags? What methods — manual and/or mechanical — are used for handling and debagging? What are the most effective ways of managing this material?

Responses will be tabulated and reported in a coming Compost Operators Forum. Readers who do not receive a survey but would like to, or who would like to contribute a tip or anecdote, should send them to: Plastic Experiences, BioCycle, 419 State Ave., Emmaus, PA 18049. Fax: 610-967-1345. E-mail: biocycle@aol.com.

Operators' Exchange

Biological Controls Used To Manage Flies At Compost Sites

Many large-scale composters are managing fly populations with biological controls that cinclude releasing fly parasites, trapping adult flies, eliminating breeding areas and encouraging natural predators. Fly parasites are tiny wasps that hunt where flies breed, then reproduce inside fly pupae, killing the developing fly. San Joaquin Composting of Lost Hills, California, which cocomposts biosolids, food residuals and yard trimmings at an 80-acre facility, does not use any fly sprays — relying instead on fly parasite releases, traps and sanitation. The facility operator, Craig Smith, recommends releasing 100,000 fly parasites every other week. He begins releasing the fly parasites when he notices adult flies (usually in March). He uses 5-gallon fly traps baited with fermented products to reduce adult flies in the warmer months. San Joaquin Composting also hs a continual sanitation program. They use front end loaders to scrape rows and drain wet areas.

Fly populations can be managed at composting sites using natural predators such as the Spalangia endius wasp, shown above resting on a fly pupa.

In the case of San Joaquain Composting, flies breed in the uncomposted raw materials and come into the operation in food waste materials. Flies do not reproduce in windrows which are being turned regularly and heat up by the composting process.

At its Watsonville, California site, Sunland Garden Products composts over 100,000 cubic yards per year. Manager Mike Brautovich reports that between 50,000 to 100,000 fly parasites are released weekly to complement their trapping and sanitation programs.

Brautovich stresses starting the fly parasite program early (March) and boosting fly parasite numbers in July. However, beginning and ending the parasite program depends a lot on the micro and macro climates on your operation. The life cycle of the fly dramatically shortens as the termperatures reach 80 degrees in the fly habitat. For example, a warm sunny spot on a static pile may reach 80 degrees in March even though the ambient temperatures are below 70 degrees.

The life cycle of the fly may be 15 days in 70 degrees temperatures; however, at 85 degrees, the fly life cycle may be 10 days. Therefore, if raw materials can begin the composting process within 10 days, flies will be greatly reduced.

Concerning the economics of using biological controls, costs are comparable to chemically-based fly ash control. Compost facilities such as the one at San Joaquin are spending $100 to $200 per month for four-to-six month programs. Cost for 50,000 fly parasites range from $40 to $55 plus shipping (about $10).

— Cindy Douglas
Rincon-Vitova Insectaries
Ventura, California

Compost Operators' Exchange is the perfect place to exchange ideas, experiences, problems, etc. with your fellow project managers. We'll publish your comments on topics like aeration, pile height, feedstock management, moisture control, etc. in coming issues. Write, fax or E-mail your comments, information requests and methods to:

Compost Operators Exchange
BioCycle
419 State Avenue
Emmaus, PA 18049
Fax number 610-967-1345
E-mail address:
biocycle@aol.com

Reprinted From:
March, 1998

BIOCYCLE
JOURNAL OF COMPOSTING & ORGANICS RECYCLING
419 State Avenue, Emmaus, PA 18049-3097
610-967-4135 • www.biocycle.net