

Erosion Control and Environmental Uses For Compost

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INTRODUCTION

For the last ten years, the use of compost in environmental applications and markets has been increasing at a steady rate. Although environmental uses for compost appear to be an absolutely huge market, there are limited numbers of successful programs that have tapped this great market potential. Still, it is clear that with the invention of pneumatic application equipment, i.e., 'blower trucks', the future use of compost in some of these environmental applications will only increase.

Environmental applications include slope stabilization and erosion control, stormwater filtration, vegetation establishment, and replacement of silt fence with compost filter berms. Filter berms will be the focus of this paper, however we want to briefly point out the advantages of using compost in these other applications.

SLOPE STABILIZATION

In many slope situations, there is no real need to establish vegetation if a layer of mulch is effective in preventing erosion. But how long will the compost or composted mulch last? Will annual applications be required? The norm is to try and establish vegetation, regardless of the severity of the slope. As a result, using compost for slope stabilization and erosion control has met some barriers in the field in that it may not be readily accepted unless seeding is performed on top of the compost layer.

Using both seed and compost applications may or may not be more cost effective than current practices. Certainly, in severe cases where vegetation has not been able to established, compost may be the ONLY option left to try. In these cases, the state, county or local governing body will gladly try anything to keep from repairing the drastically eroding slope every single year. Our experience has shown the local officials will be glad to try any newfangled erosion control materials on their worst possible sites. This truly offers the composting industry a unique chance to quickly show how effective erosion control is with compost. In fact, our marketing motto for erosion control products has now become... "Give us your worst nightmare".

STORMWATER FILTRATION

Stormwater filtration is a relatively new use for compost. Although only a few commercial systems exist, the promise of using compost in filter systems lies in the effectiveness of capture rates compost offers compared to other filter systems. The added benefit is that compost can normally be purchased locally, is annually renewable, and there are good long term odds that this use will also become more mainstream in the next

10 years. This will be further enhanced by recent focuses on water quality and quantity issues in most of our growing communities.

VEGETATION ESTABLISHMENT

For vegetation establishment, compost is perhaps the number one soil amendment when used for turf. For other vegetation establishment, hydroseeding is still king. However, recent comparisons of costs for hydroseeding vs. vegetation establishment with compost and seed applied via a blower truck have proven favorable. In fact, if this combination proves to be as successful in the field as on paper, it will eventually replace part of the hydroseeding market. After all, what would you rather have – a hydroseeded lawn or a lawn seeded with ¼” of compost? For other environmental applications, like the slopes mentioned earlier, seeding is even more tedious than turf, so the likelihood of compost use increasing in these applications is nearly 100%.

FILTER BERMS REPLACE SILT FENCES

Silt fence has been used for erosion control on slopes and around the edges of construction sites for years. It is obviously the accepted standard. (By the way, who invented this stuff and is she now retired in a warm ocean climate somewhere?) Silt fence is used on nearly 100% of construction projects in the US, but there are some inherent problems with it's use. First, it just does not work as well as we originally thought it did. In fact, most officials at the state level will agree that it really does not work at all. Yet it continues to be used and is considered the standard for our environmental containment of silt and sediment.

Silt fence, by the way, is also a product made from petroleum resources, is hard to install properly, and is quite often left abandoned on job sites. Further, it prevents natural migration of aquatic animals like turtles and salamanders from area to area as they are disturbed during the construction process. In developing communities that are sensitive to endangered species or aquatic life, this has recently become a bigger issue of concern. Last but not least, silt fence, if it is picked up after construction is completed, needs to be properly disposed of in a landfill. What a waste.

HISTORICAL PERSPECTIVE

Compost, when properly installed in long filter berms, actually works better than silt fence in the function both were intended to perform: Keep both suspended and settleable solids out of our water sources when moving on the surface. Perhaps a historical review may help at this point.

In 1993, Bill Stewart conducted research which showed surprising results in a number of erosion applications on a local roadway that had extremely steep slopes. The research (regarded as one of the first major sources of info on this topic) also showed how ineffective silt fence was. In 1994, the Maine Waste Management Agency tested

compost in Kennebec County to determine if the results were predictable. This followed with Clyde Walton from Maine DOT to be one of the first to specify compost filter berms on DOT projects in 1996. In 1997, USEPA recognized the use of compost for erosion control and specifically the use of filter berms as important methods to reduce environmental problems associated with erosion. CalTrans has been working on many projects for the last ten years and now has a very progressive program.

So why are we still using silt fence? Until the advent of the blower trucks, accessibility and efficient application of compost or composted mulch was hard to achieve. Manual application on 2:1 slopes would be nearly impossible. Application of filter berms around construction sites would require a bobcat, loader or other equipment and would simply be less efficient. However, the blower trucks are now becoming popular in nearly every major city in the US and with them comes the possible services relating to efficient applications of organic materials.

Reasons to use filter berms:

The compost amends native soil, assisting in vegetation establishment
The berms can be easily be incorporated into native soil when the job is completed, which means less hassles at the end of long projects
Incorporated material left on site provides better organic matter levels for seeding/planting
Filter berms are less expensive than silt fence
Filter berms are more effective in removing sediment and clearing up our waterways
Filter berms are more effective at removing chemical compounds from runoff
Compost is an annually renewable resource, all organic, and 100% natural

Reasons NOT to use silt fence:

Silt fence is ineffective in removing sediment and chemicals from runoff
Silt fence is hard to keep up during construction projects
Silt fence is often left on site after construction and is unsightly
Silt fence is a non-recycled material and needs to be landfilled
Silt fence allows a certain level of environmental damage on every project it is used on

How Organic Materials prevent erosion

What is so special about compost or composted mulch that allows it to perform the filtering function? Most experts in the field have noted they are surprised that filter berms hold up under heavy rains. When filter berms are used in combination with slope protection via a layer of compost or composted mulch, you can expect minimal erosion.



Filter berm at the top of a slope with compost

There are two main reasons these two applications assist in reducing erosion. First, filter berms reduce the speed of water flowing on a given slope. By preventing speed of water, which reduces also the speed of soil particles tumbling down the slope, overall displacement of other soil particles is reduced. Many applications have tried a series of filter berms down the slope which has worked well to slow the water down long enough to reduce erosion of the slope.

A layer of compost or composted mulch applied to the slope acts like a ‘wet blanket’ or a ‘wet deck of cards’ scattered randomly over the surface. Remember, soil particles are normally round and roll easily once displaced by water. As they gain speed and momentum, they displace other soil particles which channel together in faster moving water and this creates small rills. Rills lead to channels and channels lead to gullies. The rounder the soil, steeper the slope and greater quantity of water, the more erosion.

Compost and composted mulch prevents the soil from rolling or gaining this momentum and therefore covers it like a blanket. A secret of success in the field is making sure that water is not able to ‘get under the blanket’ at the top of the slope. If water is allowed to get under the layer of compost, and if the slope is steep, you can expect erosion and the compost or composted mulch will float away. However, if you have a filter berm at the

top of the slope and keep the compost layer continuous over the ‘shoulder’ of the slope, the water will hit the slope and ride all the way to the bottom on top of the blanket of organic materials.

Organic materials are more flexible, lighter, and absorb more water than soils in general, so they also aid in helping water infiltrate into the soil underneath. For vegetation establishment, this is crucial to new seedling germination.

ECONOMICS

All the experts reviewing Bill Stewart's research have had the same comments. What about the cost? Until a mechanism of delivery was possible and predictably available via blower trucks, the use of compost and composted mulch for filter berms has been limited. Depending on the charge for installation and the cost of local compost or composted mulch products, filter berms can be significantly less expensive than silt fence. In other words, cost is not a real barrier to the use of filter berms.

In a study conducted in South Carolina with one of the very largest builders, we determined that silt fence would cost about \$1.50 per linear foot of installed silt fence. This cost did not include the cost to remove the silt fence and disposal costs. However, it appears that many people in the field ignore these costs or simply consider the costs of retrieving silt fence as zero. When comparing the installation of a 1 foot high by 2 foot wide filter berm of compost, we found we could be very cost competitive (see cost spreadsheet at the end of this paper).

It is important to note that the costs we experienced in the project in South Carolina were perhaps the lowest we have found in the country. In general, the larger the contractor, the better price they have for silt fence installation. In other meetings with smaller contractors, we discovered that they were paying up to \$4.50 per linear foot of silt fence, with an earmarked \$2.00 per linear foot included for the removal and disposal of used silt fence.

In many markets, the cost of application matches the cost of the product. For instance, a \$16 per cubic yard compost would cost \$16 per yard for application. Many blower truck operators simply double costs of materials to arrive at an installed cost for organic materials. This is a good rule of thumb to use and when calculating the amount of compost or composted mulch required, we determined that one cubic yard will provide 20 linear feet of filter berm 1 foot high and 2 feet wide. This sized berm is adequate for the majority of silt fence replacements, which are actually demarcations of the work zone itself. Much of the silt fence installation, when performed on flat ground, is simply to show the perimeter of the active work zone.

Remember that on state jobs, where silt fences are used, that the monies to pay for installation and removal has to come from some tax base or government fund. It stands to reason for all of these agencies to band together and support compost use for filter berms because it can save the state money and it will most likely be a locally produced product. In every single case study we have done, the officials at the state level agreed that silt fence did not work to achieve the runoff and erosion reduction goals. Also, they pointed out that silt fence is not actually specified in many projects. Rather, the contractor

has to submit an erosion control plan or water discharge plan that calls for some recognized method to reduce erosion.

Silt fence, because it is so common, is the leading tool used to respond. In other words, if local contractors put compost filter berms into their plan, the local officials would have to determine if this tool would be acceptable. Several agents confessed they could not shut a project down if we submitted filter berms as the chosen method, but if it failed, we would be forced to utilize another method.

Real world benefits of using filter berms are during projects that are very dynamic. A day in the life of field construction is unpredictable and often times weather plays a spoiling role in the best laid plans of good contractors. When berms are disturbed at the top of slopes, as is shown in the photo below, we violate the cardinal rule not to let water under the berm or compost blanket. Without repair, erosion will set in and gullies will form. However, the new option with compost filter berms and blower trucks is to provide a 'Band-Aid' to these real world un-preventable construction scars. Trucks can quickly and efficiently return to sites and cover initial erosion that starts as a result of late completion of guard rail installation or other surface disturbances. This makes local officials very comfortable with the use of compost because it allows a faster remedy than waiting until the slope is eroded, getting a dozer to level it back out and reseeded. Remember, those are your tax dollars on state projects!

FIELD REPORTS

Two field projects have been completed recently which focus on the principle objectives outlined earlier: reducing erosion on slopes using compost blankets and replacement of filter berms using filter berms.

Richmond, Virginia

A project was coordinated in Richmond with the Virginia Department of Transportation to determine the effectiveness of compost for mulch and as filter berms. Due to the nature of the slopes, we did not gather much data on filter berms. The berms installed at the top of the slope were eliminated during the final phase of the project, which allowed us to examine the use of compost for repair in these types of situations. The 'construction scar' shown below is indicative of real life projects that have soil disturbances during their final phase and this can cause significant disturbance to the berm or allow water to get under the compost blanket. The photo on the right shows the 'Band-Aid' we used to fix the problem. This is clearly a low cost method compared to other options.



Construction Scar



Band-Aid for construction scar

Four other compost materials were used in two different applications (2" and 4" application depths). The slope was covered with these composts and eight treatment areas resulted. All of the composts were applied with a blower truck which allowed even, efficient application. One of the benefits we discovered by using a blower truck was that there is ample hose (500 ft) to reach most areas needing application. The materials used were a 2" minus compost, a 1/2" minus product, leaf compost 1/2" minus and recycled 'overs', a product common after screening 1/2" minus products. The overs

were rather punky and a little on the larger side, but seemed to work adequately in the blower trucks.

The treatment areas ran the entire length of the slope for all eight treatments. We used the other side of the road, which had matching slope and soil type, as the control. The photos below show the erosion associated with the control area. This area had been a problem in the past for VDOT, so the project served a good purpose in showing how compost can impact even the worst erosion situations.



Treated slopes with compost



Untreated controls

The results of the project were similar for all four treatment areas – there was minimal erosion on all of the slopes except where the berms had been disturbed late into the process, allowing water to get under the mulch layer. Besides these areas, there was no noticeable erosion of soil from anywhere on any of the applications. Since we repaired the damaged areas with our ‘Band-Aid’ application, erosion has been minimal or non-existent.

The VDOT offices were tremendously cooperative in this effort and it is important for readers to understand that these projects take a lot of time and energy and a commitment from both parties to see it through to the final phase. VDOT has since hydroseeded the areas in an effort to understand how the treatment areas would respond. VDOT has concluded that there may be combinations of compost, filter berms and hydroseeding for the toughest erosion projects.

The final determination for the four materials used on the slopes was that the 2” application rates provided enough protection for the slopes to reduce erosion to acceptable levels. Obviously, a 4” application offers for protection, but there is concern that the costs for these materials and their application would be too high. The 2” application rates, however, are cost competitive with the repair costs experienced on these severe slopes and problem areas.

Sun City, South Carolina

DelWebb, a large developer in Sun City, South Carolina, ran several tests using compost for erosion control and filter berm replacement. This project provided much of the data and field results that we missed in the VDOT trial - mainly information about filter berms and the replacement of silt fences.

As a large developer, DelWebb is faced with constant environmental concerns. In the current project, they build up to 500 houses per year, with a total of 6,000 houses targeted in the local area. This requires a large disturbance on local soils, like any construction project. The state requires silt fence be properly installed around each new construction phase. DelWebb became interested in compost because of their environmental concern and their desire to use recycled products, where possible. DelWebb also has a strong commitment to local environmental issues, as well as being good stewards of the land as they develop large areas.

The photos below show the application of filter berms to replace silt fence on DelWebb property. We used the one foot high by two foot wide berm and they seemed to hold up well in most areas. In a few cases, where the berm became damaged from traffic or equipment, we simply asked DelWebb to fix the berm by adding a small amount of compost with a bobcat. This allows minimal maintenance to be performed with equipment normally already on most construction sites.



The final analysis of the filter berms at DelWebb is that they work well enough to consider using in all future construction. The company is currently analyzing costs and has asked to move to the next stage, which will be to use filter berms for an entire new development phase, or neighborhood. As these filter berms are placed, it will be an excellent test to determine how the berms hold up through an entire project rather than just for a couple of months. It is obvious that if the filter berms are more cost effective and perform better than silt fence that they will eventually be adopted as the norm for all construction projects with large developers like DelWebb.

ISSUES FOR THE FUTURE

We need to be conscious of the possible damage to the environment that our accepted practices are now causing. Is the use of silt fence causing more harm than good? Since we never have calculated the amount of materials which escape silt fence, there is a good chance that the amount of environmental damages are larger than we originally thought. We should be conscious of this as we support the new uses of compost and composted mulch in the applications outlined above.

Training and education is certainly a huge need in every state. Even though many states have reportedly worked with some type of compost, all of the state agents we worked with were hungry for information and eager to learn. All of them agreed to field trials during the first meeting, mostly out of frustrations with silt fence failures. As an industry, we need to develop easy to access data, project reviews, specifications, and architect drawings of filter berms and compost applications which satisfy our environmental goals.

In states which have annual printing of spec books for DOT or other agencies, compost use needs to be automatically included with the appropriate drawings. The US

Composting Council already has a good set of specifications to use for erosion control and due to the amount of requests, our offices recently developed CAD drawings to accompany a modified set of specs we make available to all interested parties. This information needs to be at every state office which can use these products.

Finally, nothing substitutes for field projects demonstrating the value of what has been discussed above. The three projects we coordinated helped us learn first hand about the issues, roadblocks and politics that are present in every single project you encounter. We would like to thank those involved for accepting our challenges to use compost and allowing us to demonstrate what others have found to be true. Compost is a versatile, useful product which reduces erosion when used as a filter berm or erosion control blanket.

There are several case studies that have been conducted including Texas, California, Ohio, and other states which have shown that compost has outperformed hydromulch and has reduced erosion by other standard methods used. It is clear we are just at the tip of the iceberg for market development in this area.

Tyler, King and Stinson are founders of Matrixx Organics Company, based in Richmond, VA. Specifications and drawings for filter berms can be obtained via email at rodndon@gte.net.

EPI - Grind-All SE			Del Webb Project			4/5/2000	
Cost comparisons of various soil and mulch applications in the Landscape							
Application	Product cost/ft	Product cost/A	Installation cost/ft	Installation cost/A	Total cost/ft	Total cost/A	Comments
Sodding (per square foot)	\$ 0.16	\$ 6,970	\$ 0.10	\$ 4,356	\$ 0.26	\$ 11,326	Sod may not take first time
Compost & Seed Application		\$ 3,200		\$ 4,000		\$ 7,600	\$400 per acre for good seed
<i>Features</i>	One inch application with seed will smooth over rough spots, reduce final grading required.						
<i>Benefits</i>	Less prep costs, more control over window of time needed to complete job, lower costs						
(1.5 inches compost applied is \$16.00/c.y. for material and \$20.00/c.y. for installation = \$36/c.y. total seed cost figured at \$400/acre)							
				Total Savings per Acre:	\$ 3,726		
Installation of Silt Fence (per linear foot of installation)	\$ 0.60	n/a	\$ 0.90	n/a	\$ 1.50	n/a	Does not work - ineffective
Filter Berm Application (flats) (\$16/yd product + \$20/yd install at 20 linear ft. per cubic yard)	\$ 0.80		\$ 1.00		\$ 1.80		
Filter Berm Application (slopes) (\$16/yd product + \$20/yd install at 6.75 linear ft. per cubic yard)	\$ 2.37		\$ 2.96		\$ 5.33		
<i>Features</i>	Aquatic animals able to effectively navigate over berms, no cleanup needed, recycled product, living filter						
<i>Benefits</i>	Preservation of local environment, less cost, more aesthetically appealing, more effective at removing sediment						
				Total Savings per Year:			(need total ft. of silt fence)
Slope Stabilization/Naturalization (\$16 per yard for product and \$20 for installation)							
Mulch applications - seed extra (2" application)	\$ 0.10	\$ 4,320	\$ 0.12	\$ 5,400	\$ 0.22	\$ 9,720	
<i>Features</i>	Not necessary to seed slopes, soil stays in place, less repair required, aesthetically appealing						
<i>Benefits</i>	Lower overall land mgt. Cost, more environmentally appealing, less erosion of valuable soil						
Installation of Landscape mulch (per cubic yard - manual application)	\$ 15.00		\$ 25.00		\$ 40.00	(all mulch costs per cubic yard)	
Custom Mulch Application	\$ 15.00		\$ 20.00		\$ 35.00		
<i>Features</i>	More even application, use 25% less materials, utilize less labor during peak times						
<i>Benefits</i>	More aesthetically appealing, employees do other tasks, less expensive overall						