Reclamation of Phosphate Mine lands with Compost

The phosphate mining industry annually reclaims an average of 4,000 to 5,000 acres of mine lands in Florida, making it a viable market for compost products.

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The phosphate industry in Florida produces more than 75 percent of the United States' supply of phosphate. The industry is concentrated in five southwest Florida counties that include Hillsborough, Polk, Hardee, Manatee and Desoto, where over 90 percent of Florida's phosphate is mined. In 1996, the mining industry began reclamation at a 100 percent equivalency that requires one acre to be reclaimed for every acre mined. The phosphate mining industry on average reclaims between 4,000 and 5,000 acres a year of mine lands in Florida.

Statutory and Economic Considerations

The cost to reclaim phosphate land is between $3,000 and $8,000 per acre. Earth-moving contributes the largest single expense. Mining reclamation costs for "old-lands" — those mined before July 1, 1975 — are subsidized by the State Comptroller from the Minerals Trust Fund, which is funded by a phosphate severance tax. After that date, state statutes required mandatory reclamation of mine lands by the phosphate industry itself.

The Comptroller reimburses the industry for reclamation of the old lands at a rate of $4,000 an acre for mined-out areas and $2,500 an acre for clay settling areas and other land forms. Of the 87,000 acres of old lands mined before 1975, almost half remain to be reclaimed.

Traditional Use of Organic Material by the Mining Industry

In Florida, the level of organic matter required by the Department of Transportation for establishment of vegetation is 1 percent. Soil found on mined phosphate lands usually has less than one half of one percent organic matter. The mining industry manages its soil to recover its organic content. Topsoil found in overburden is set aside for future use. Peat is seldom available. Muck is the primary material used, but its availability varies. Muck is found in wetland areas with depths ranging from a few centimeters to several meters. As part of a permit to mine wetlands, mining companies typically are required to remove and stockpile muck prior to mining and to use it later to reclaim wetlands.

At the present time, the primary reclamation activity where organic material may be required is in the re-creation of wetlands. The main reasons to save muck found on phosphate lands are its ability to provide a low cost source of wetland seeds for plant establishment and its ability to retain moisture during the dry season.

Some of the problems experienced by the industry with the mining of muck are: 1) it is not uniform in particle size, 2) it may contain nuisance plant seeds, 3) while stockpiled, its moisture level should be maintained to preserve seed and to avoid wind disbursement, and 4) muck may be found with a relatively low organic content level (around 20 percent.)

Wetland creation involves the additional expense of soil recontouring of elevation to create hydrological conditions needed to form wetlands. Another associated cost to the mine company is the processing of muck that includes excavation, transfer, stockpiling and application.

Blending of recycled urban plant debris with muck in order to obtain biological diversity of seed is one option for future field trials. To use recycled urban plant debris organic material in wetlands mitigation projects, it should have the following parameters: 1) be free of weed seed, 2) have a preferred pH range between 5.0 to 6.3) contain a particle size that will not float,

4) have a level of maturity that releases nitrogen, 5) have an organic content range between 35 and 65 percent.

Mining Industry% Past and Present Use of Recycled Organic Material

The industry has had limited exposure to the use of urban plant debris organic material. Historically, there have been a few small scale field experiments where urban plant debris organic material was used in demonstration projects. It has been used in turf establishment on quartz sand slopes and on phosphogypsum stacks.

The industry now requires that organic material be particle size-reduced, managed for weed seed and delivered by motor carrier to the reclamation site. Mining activity in Florida is located on the northern edge of the southern climate zone, which is subject to invasive, nuisance plants. For this reason, a weed seed-free material is required. Another concern by the industry is the availability of a sufficient quantity of acceptable material to meet its reclamation needs.

The Industry's Conversion to the Use of Recycled Organic Material

The most important indicator of successful reclamation is plant performance. State regulations allow one year for revegetation and one year for vegetative establishment. Soil that has been mined needs improvement to support vegetation. Addition of organic material results in increased soil fertility and the ability of vegetation to become established and self-sustaining. The use of recycled urban plant debris organic material by the phosphate industry will increase following successful demonstration projects. The industry is now exploring the development of a low cost means of land application of organic material that does not exceed its present reclamation costs per acre.

Future Uses and Benefits of Recycled Yard Waste Organic Material

The lands with the greatest potential for use of urban plant debris organic material as a soil amendment are the more sterile upland areas that receive sand tailings and the clay settling areas, where the organic content is less than one half of one percent. The successful establishment of turf in upland areas acts as a buffer to filter storm water runoff that reduces water turbidity in wetlands. Organic material also can be substituted for the application of clay that is placed in sand, where it is used to improve the cation-exchange capacity and moisture retention.

The establishment of vegetation aided by the use of organic material will improve the properties of soil structure and reduce soil erosion. The addition of organic material aids the soil's physical and chemical properties by improving cation-exchange capacity, increasing water-holding capacity, reducing the acidity in soils, and providing plant nutrients. Soil biological properties are improved by reintroduction of a microbial population in the soil.

Sheet cornposting. State regulations regarding the duration of time allowed for completion of reclamation is determined by the size of the land and the character of the soil. On a 400-acre tract of land, the state normally allows a total of six years, including four years for earth-moving, one year for revegetation and one year for plant establishment. A longer reclamation period is allowed for upland soils that contain sand tailings and clay settling.

Sheet cornposting offers a large-scale processing potential but requires, as a precondition, the availability of a large tract of land and ample time. The sheet cornposting process involves the formation of windrows with specially designed delivery trailers containing live bottoms. The windrows are strategically positioned for the future even distribution of material when spread to a depth of one or two feet over large land areas. At two feet of depth, the sheet cornposting process accelerates decomposition by creating a lower temperature than found in windrows. This provides a broader range of microbial activity while improving the availability of oxygen and retaining rain water that accumulates on the bottom six inches. At a future date, the remainder of the decomposed material is cut into the soil prior to plant revegetation.

The significance of the scale of operation is illustrated by the fact that, at two feet of depth, an acre will hold 1,000 tons and a 100-acre tract will hold 100,000 tons.

Sand dam. The phosphate industry has reduced its dependence on deep well water and now relies heavily on recycling the water used to transport the slurry mix of mined ore. It also uses water as a medium to separate non-phosphate material. Quartz sand is removed from the matrix of ore material and is used to construct dams found in an elaborate network of retention lakes and canals used to remove clay and reuse the water.

Quartz sand is low in nutrients and organic matter and has poor water retention qualities. To comply with the requirements of turf establishment on dams constructed of sand, the industry applies a mixture of bahia and

bermuda seed to the dam face wall. The industry reports that, within three years, sympathetic weed growth inundates the seeded areas. Contributing to this condition is the four-to-one slope of the dam and the mid-range size of the quartz sand particle that allows water to percolate, creating arid conditions for turf establishment.

The industry is interested in experimenting in a field trial over a two-acre area of a sand dam face. Urban plant debris organic material will be blended with the sand at 0, 30 and 50 percent ratios and applied to one foot depth. The year-long demonstration project will attempt to show that, as the material decomposes, it will provide moisture and nutrient retention needed to assure extended turf establishment, helping to further stabilize the slope.

Phosphogypsum stacks. This is another area where the mining industry may be able to use large amounts of urban plant debris organic material. Very little research is available using urban plant debris as a medium amended on slopes. Here the objective is to create soil conditions that improve the establishment and survival of turf grass on phosphogypsum stacks and that help remediate the effluence impact of surface water runoff that may include soluble salts, fluoride and radon.

The establishment of turf on gypsum stacks has proven difficult as a result of a very acidic pH range between 3.0 and 5.0. Composted urban plant debris organic material with a higher pH range of around 8.0 is expected to raise the soil pH while also improving moisture and nutrient retention qualities to the soil.

Roadway stabilization. Phosphate mines use long pipeline routes to transport the mined ore slurry to benefaction plants where the phosphate rock is separated. The pipelines require service roads and the routes cross areas high in sand content. Yard waste organic material provides a temporary stabilization material for the road surface while providing texture to the sand and reducing dust.

Erosion control. There are watershed areas from rainfall that erode upland areas. Recycled urban plant debris mulch has been effective in reducing erosion when placed in a row or small berm across the top of the area subject to erosion in upland areas. **O**