

**ATHLETIC FIELD TOPDRESSING AS A COMMERCIAL  
MARKET FOR COMPOST FROM DAIRY MANURE  
(Field of Dreams Project)**

**FINAL REPORT**



**June 2008**

**Funding provided through a Clean Water Act Section 319(h) Nonpoint Source  
Grant from the Texas State Soil and Water Conservation Board and the U.S.  
Environmental Protection Agency**

**TSSWCB Project 04-03**

**Leon-Bosque RC&D Council**

**July 1, 2004 to March 31, 2008**

## Executive Summary

The overall project goal was to gain commercial acceptance of a blend of composted dairy manure and sand for renovation and topdressing of athletic fields. The blend of sand and compost is superior to either sand alone or compost alone as a topdressing. Compost has several advantages over sand as a topdressing due to the nutrient and micronutrient content and a high cation exchange capacity. The high capacity enables the blend to bind certain fertilizers, herbicides, and pesticides; this helps the blend stay in place. A secondary project goal was to remove compost from the Upper North Bosque River watershed, which contributes to the Total Maximum Daily Load (TMDL) Implementation Plan.

The athletic field topdressing project began with compost –sand topdressing. The project had three tasks: apply compost-sand top dressing to athletic fields managed by cities, school districts, colleges, universities, and sports associations, evaluate the performance of the compost-sand topdressing blend, and through participation in the project, inform the relatively small athletic field supply and maintenance industry of the performance and affordable cost of the premium topdressing blend.

The entities that participated in the project, the type of athletic fields, the total yards of compost applied, and the reimbursement costs are shown in the first attachment. Several of the entities participated more than once in the project, either for several different fields or for repeated applications. These entities were Keller ISD, Ponder ISD, Glen Rose ISD, Cedar Hill ISD, Gatesville ISD, Goldthwaite ISD, Comanche ISD, Parker County Appraisal District, Hardin-Simmons University, Dallas Baptist University, the City of Plano, and Cisco Junior College. In many cases, several fields were topdressed. As an example, Keller ISD has three high school campuses. All three football fields were topdressed. Most of the entities were in the Dallas-Fort Worth metroplex, but ranged from Borden County in the west to East Texas Baptist in the east.

Funds from the Clean Water Act Section 319(h) nonpoint source grant allowed the Texas State Soil and Water Conservation Board and the Leon-Bosque Resource and Development Council to:

- Demonstrate that a 50:50 blend of sand and compost from the dairy industry in the Upper North Bosque River watershed is a premium blend for renovating and topdressing athletic fields of non-profit entities that include school districts, colleges, and universities, cities, and sports associations.
- Promote acceptance of the compost-sand blend as a commercially feasible market for dairy compost from impaired watersheds.
- Export over 6000 cubic yards of compost from the dairy industry in the headwaters of the Upper North Bosque River, which aids in meeting the TMDL Implementation Plan for the impaired segments of the Bosque River.

- Provide cost-share assistance to over 30 ISDs, colleges, universities, and sports organizations to improve the appearance and safety of their athletic fields. Additional benefits include reduced water requirements and reduced chemical applications.
- Continue the project in FY08 and FY09 with funding provided by the State of Texas in the last legislative session (Rider 32 to the Texas Commission on Environmental Quality budget).
- Administer the project in a cost-effective manner, as evidenced by the fact that 97.5% of the total federal funds were expended on application of the compost-sand blend to athletic fields.

## **Project Summary**

### **Introduction**

The North Bosque River (segment 1226) and the Upper North Bosque River (segment 1255) have been on the Clean Water Act Section 303(d) List of Impaired Waters for a number of years. Bacteria are a source of the impairment of the main stems and the tributaries. The 2002 Texas Water Quality Inventories (WQI) for Lake Waco (segment 1225) shows algal growth concern and nutrient enrichment concern. The 2002 WQI for the Upper North Bosque River and 2004 WQI for the North Bosque River showed concern for algal growth concern and nutrient enrichment concerns and stated that excessive algal growth impaired the general use based on the general narrative criteria for nutrients in the Texas Surface Water Quality Standards. In December 2001, the US Environmental Protection Agency (EPA) approved two TMDLs for phosphorus in the North Bosque River to control the excessive algal growth in the Bosque River watershed. One year later, the Texas Commission on Environmental Quality approved the Implementation Plan.

The dairy industry in Erath County has been identified as a source of the nutrients, primarily in the form of phosphorus, and bacteria in the watershed, although the relative contributions have been debatable. In an ideal dairy setting, the nutrients in the manure are applied to crop and pasture land and utilized by the forages that are consumed by the dairy animals. There would be no export of nutrients other than in milk and meat. The import of nutrients in the feed stocks would balance the export of nutrients. However, the real dairy world is not ideal in this sense. The nitrogen and phosphorus are in a general ratio of about ten to one in forages. The ratio decreases to less than three to one in the manure that is applied to crop and pasture land; this is due to nitrogen losses to the atmosphere in the form of ammonia and gaseous nitrogen oxides in the manure handling system for both dry and wet components. For dairy planning in Erath County in general, crop and forage production from one lactating dairy cow will require one acre of crop or forage land if nitrogen is used as the limiting nutrient. For phosphorus, the requirement increases to four acres per lactating animal, with commercial nitrogen requirements for the forage production. Dairies in Erath County were sited based on the nitrogen land

requirements prior to 1996, when phosphorus was first brought to the attention of the dairy industry. Consequently, the excess phosphorus accumulates in the soil and saturates the capacity of the soil to bind the phosphorus in insoluble forms. Forms of phosphorus (known as soluble reactive phosphorus) are in fact soluble and will move with runoff. (The conventional wisdom for row crop fertilization was that the polyphosphates were insoluble and would not move with runoff from irrigation or rainfall.) The net result is that forms of soluble phosphorus (the orthophosphates) are carried from manure application fields to the tributaries of the impaired stream segments. Export of manure from the watershed is required to bring the nutrients into balance.

The dairy manure export of the compost out of the watershed is a partial solution to the water quality impairment in the North Bosque River watershed. Several composting facilities operate to process dairy manure. The manure typically comes into the composting facility at about 75% moisture. The composting process reduces the volume by about half, which includes moisture reduction. The finished product has a percent organic matter content ranging from the high 20s to high 40s. The nitrogen content in the typically finished product is about 1% and the phosphorus and potassium contents are about 0.4%. The raw manure that goes to the composting yard is quite variable in composition, depending on the amount of soil in the dry lots and sand in the free stall barns. Raw manure that has too much soil or sand is rejected at the composting yard. In the composting process, the solid manure is digested anaerobically in windrows that are turned periodically to increase the effectiveness of the digestion. The digestion process produces heat that destroys weed seeds, bacteria, and pathogens that may be present in the raw manure. The finished product does not have an offensive odor and has the texture of a fine loamy soil. For the compost used in this project, the finished product at 50% moisture weighs about 800 to 900 pounds per cubic yard. The loaded cost at the composting yard is \$10 for general use and \$14 to \$16 for topdressing compost, which has been screened with a finer screen. The costs are comparable to the cost of sand.

The costs of the compost essentially preclude agronomic uses of the compost. At the Texas AgriLife Research and Extension Station in Stephenville, compost was used agronomically for a field with a peanut-forage rotation. The application rate was 7.5 tons per acre and the delivered cost was \$20 per ton (application was in-kind) for a total of \$150 per acre. At the application rate of 7.5 tons per acre, the field surface was not completely covered. The benefits do not warrant the costs.

For export of the compost from the watershed, a high-volume commercial market is needed that can afford the production and transportation costs of the compost. Existing markets, such as for horticultural uses, have been developed but the compost supply exceeds the demand.

### **Compost for topdressing athletic fields**

Renovation and topdressing of athletic fields could be a major commercial market for dairy compost. There are more than 1000 Texas communities, independent school

districts, colleges and universities, and sports associations with athletic fields. Typical areas of athletic fields are 30,000 ft<sup>2</sup> for softball, 60,000 ft<sup>2</sup> for football and 80,000 ft<sup>2</sup> for baseball. The City of Granbury provides an example of the potential of athletic fields to utilize compost. The school district, city, and two sports associations have a total of 23 athletic fields.

Athletic fields have high maintenance requirements for inputs of fertilizer, weed and pest control chemicals, irrigation, and mowing. In addition, well-maintained athletic fields must be renovated and topdressed periodically to alleviate compaction, level the surface, improve infiltration of water, and provide optimal conditions for turf growth. The topdressing is normally done with sand only or with an organic material such as peat. If a compost source is nearby, compost may be used.

A blend of sand and compost is superior to either component as a topdressing material. Compost adds structure to the sand, so the blend will stay in place better than sand. Sand has no beneficial agronomic qualities and “undigested” organic materials tend to oxidize fairly rapidly in Texas summer conditions. Although the dairy compost has organic matter content usually in the 30% range, the easily oxidizable cellulose has been digested leaving the hemicellulose and lignins. Compost will last much longer than other organic materials in Texas summer conditions. The organic matter of the compost also adds some cushion to the surface, especially after repeated topdressing, which decreases the compaction from heavy use. The compost-sand blend will promote infiltration and percolation, which should reduce irrigation requirements. The nutrient content of the compost is low, but at high application rates, is quite significant. At the application rate of 100 tons per acre, the nitrogen content is 500 pounds and the phosphorus and potassium contents are 150 pounds each. Micronutrients in the compost are extremely important to the vigor and appearance of the turf. One turf manager reported that the slow release of the micronutrients in the compost, as opposed to the quick release of micronutrients in commercial fertilizers, resulted in the greenest, most vigorous turf observed on that particular field. The high cation exchange capacity (CEC) of the compost should bind some fertilizer, herbicides and insecticides in place.

Negative aspects of the use of compost are limited. The compost will have a high sodium adsorption ratio (SAR), which causes clay particles to bind together. This may increase compaction and decrease infiltration and percolation. Two respondents to surveys mentioned weeds and rye grass. In all likelihood, the weed seeds and the rye grass seeds were present in the soil and germinated with the pre-application treatment.

Normal rates for topdressing, as described by the regional athletic field maintenance industry, are from 50 to 100 tons per acre. At a rate of 100 tons per acre, the depth of the topdressing will be slightly less than one inch. The 100 ton per acre rate was used for much of this project. As one industry contact stated, at 100 tons per acre, everyone will know that the field has been topdressed and everyone will notice the response as the turf grows through the topdressing.

## **Materials, methods, and operation**

The Leon Bosque RC&D Council executed a memorandum of agreement (MOA) with Tomlinson Ball Field Materials to conduct this project. Tomlinson Ball Field Materials has supplied infield clay for baseball fields for a number of years. The clients have included the San Diego Padres to the Toronto Blue Jays fields, a majority of high school fields in North Texas, and the major Texas universities. In 2000, we initiated discussions with Ronnie Tomlinson to explore possibilities for compost as topdressing for baseball and other athletic fields.

After we developed a plan and experimented with various combinations of sand and compost, we approached the Texas State Soil and Water Conservation Board to seek funding. The Board, with EPA approval, provided \$50,000 for a demonstration project (CWA Section 319(h), project 02-18). The Council submitted a proposal for additional Section 319(h) funding to expand the scope of the project in the FY04 cycle. We received \$300,000 in federal funds to conduct this demonstration project to develop a commercial market for dairy compost from the North Bosque River watershed. The project was titled "Field of Dreams."

Non-profit entities that manage athletic fields were the target clientele for the project. These entities included independent school districts, colleges and universities, cities, and sports associations. Tomlinson Ball Field Materials and the regional turf maintenance industry representatives (listed in an Attachment 2) contacted these entities to participate in the project. Presentations were also made by the Tomlinson Ball Field Materials at state turf grass meetings. When interested they executed a MOA with Leon Bosque RC&D Council to provide information about their athletic field(s), specify the cost-share agreement, and agree to the procedures. The entity contracted either with Tomlinson Ball Field Materials or the regional contractors to furnish the compost and sand. Depending upon the situation, the compost and sand was blended at the Tomlinson's in Hood County or the compost and sand were delivered separately and blended on site. The contract included the necessary pre-application treatment of the athletic field prior to the topdressing. This normally included some form of aeration, such as knifing, coring, and plugging. For some athletic fields, such as the Glen Rose ISD high school baseball field, the entire field was renovated. Compost was incorporated into the top six inches of the turf areas. Upon completion of the job, the entity paid the contractors and submitted an invoice to the Council for reimbursement on a 50-50 cost share basis. The invoice included all necessary documentation. The Council submitted a request for reimbursement to the Texas State Soil and Water Conservation Board. Upon approval and electronic deposit of the requested amount, a check was prepared and sent to the entity.

A listing of the participating entities, the type of athletic fields, the amount of compost, and the amount of the cost share is attached.

## **Results and evaluations**

There were no instances of “did not meet expectations.” The performance of the compost-sand blend was very positive. In the first survey, 61 of the 72 possible responses were satisfied or very satisfied. Two responses were dissatisfied with either improved drainage or soil mulching effect. Of the 17 responses in the final survey, all 17 were satisfied or very satisfied with the improved grass vigor and appearance. Only one respondent gave a dissatisfied response related to improved drainage. While a majority of comments were positive, there were only five negative comments in both surveys. One of the comments referred to the use of the field immediately after application of an inch of topdressing. Two referred to weeds or to ryegrass, both of which were likely present in the field when the topdressing was applied. Two comments referred to the quality of the compost as either too wet or not properly composted. The number of entities that repeated applications or applied the topdressing to a number of athletic fields was very encouraging. Several evaluations are included in Attachment 3.

## **Budget Analysis**

The reimbursement costs for the project are as listed in the attachment. No funds were expended by the Council on personnel, fringe benefits, capital equipment, supplies, transportation, overhead, or other direct costs. A 2.5% administrative fee covered the costs of the monthly bank charges, communications, bookkeeping, and an audit at the end of the project.

## **Conclusions**

Simply stated, the compost-sand blend, were ideal materials for renovation and topdressing of athletic fields. Everyone was satisfied with the performance. The football field at East Texas Baptist University (Marshall, Texas) was selected by the Texas Turfgrass Association as the field of the year for 2006. For one municipality, the field with the compost-sand topdressing was the only playable field during the dry summer of 2006. Other anecdotal comments frequently stated that the field appearance was the best ever. The additional cost of the compost over that of sand only without a subsidy or cost-share arrangement is a concern. Leon RC&D will address this issue by demonstrating the value of the compost over the course of several years. We will also develop an economic analysis of the compost-sand blend for use by the industry in marketing the product. The topdressing costs will then be incorporated into the budget cycle of the entity. Lastly, the project contributed to North Bosque River Total Maximum Daily Load Implementation Plan objectives by removing nearly 7000 cubic yards of compost from the North Bosque River watershed. As the product gains commercial acceptance, water quality will improve in the watershed and water use will decrease in the high water-use athletic fields across North Texas.

**ATTACHMENT 1**

**PARTICIPATING ENTITIES IN THE FIELD OF DREAMS PROJECT**

<b>Entity</b>	<b>Type of Athletic Fields</b>	<b>Compost</b>	<b>Cost</b>
University of Dallas	baseball, soccer, softball	105	\$ 4319.70
Keller ISD	all athletic fields	212.5	\$ 1300.00
Abilene Christian University	football	70	\$ 3870.00
Early ISD	track field	50	\$ 3203.50
Southwest Christian Acad	athletic fields	100	\$ 5661.00
Grapecreek ISD	football	50	\$ 4495.00
Akins ISD	football	12.5	\$ 600.00
Keller ISD	all athletic fields	120	\$ 4812.00
City of Plano	soccer	35	\$ 1435.00
City of Plano	soccer	100	\$ 6486.00
City of Carrollton	soccer complex	200	\$ 8038.00
City of Rowlette	soccer complex and park	100	\$ 4435.00
Keller ISD	athletic fields	12	\$ 425.00
Texas Soccer Foundation	entire complex	200	\$ 12150.00
Cisco Junior College	football	20	\$ 5360.00
Comanche ISD	baseball, softball, football, practice	150	\$ 3044.25
Brownwood ISD	football practice	80	\$ 5805.00
Gatesville ISD	baseball, softball, football, practice	50	\$ 2310.60
Hardin Simmons University	football and soccer practice	180	\$ 13964.75
Goldthwaite ISD	football	40	\$ 2897.00
Cisco Junior College	football	100	\$ 4447.50
Parker County Appraisal Dist	grounds	75	\$ 2864.50
Keller ISD	athletic fields	25	\$ 1061.25
Comanche ISD	athletic fields	137.5	\$ 5901.36
San Saba ISD	football	40	\$ 3020.70
Keller ISD	athletic fields	25	\$ 1064.25
Dallas Baptist University	athletic fields	140	\$ 5988.00
Parker County Appraisal Dist	grounds		\$ 2150.00
Glen Rose ISD	baseball	300	\$ 9148.50
Hardin Simmons University	football, soccer, practice	420	\$ 16022.30
Ponder ISD	football	100	\$ 2350.00
City of DeSoto	football	150	\$ 4711.25
Ponder ISD	football	100	\$ 825.00
Hawley ISD	football, softball	80	\$ 5492.50
Early ISD	football, softball	105	\$ 6160.25
Cedar Hill ISD	football, soccer, baseball complex	100	\$ 4500.00
Ponder ISD	football	50	\$ 1750.00
Eastland ISD	football	62.5	\$ 3715.00
Gatesville ISD	football	50	\$ 2372.40
San Saba ISD	baseball	60	\$ 3872.00
East Texas Baptist University	all athletic fields	350	\$ 18687.50

Cisco Junior College	football and baseball	135	\$ 6315.00
Boyd ISD	football	75	\$ 5080.00
Argyle ISD	football	100	\$ 7500.00
Borden County ISD	football	40	\$ 3340.00
Waxahachie ISD	baseball	75	\$ 4924.95
Ponder ISD	baseball, softball	100	\$ 2800.00
Ponder ISD	baseball, softball	100	\$ 4700.00
Goldthwaite ISD	football	80	\$ 2877.50
Dallas Baptist University	all athletic fields	292.5	\$ 18427.50
Joaquin ISD	football, practice	100	\$ 7640.00
Argyle ISD	baseball	100	\$ 4700.00
Ponder ISD	football	50	\$ 1500.00
Cedar Hill ISD	football, soccer, baseball, softball	150	\$ 2800.00
Glen Rose ISD	softball	430	\$ 6000.00
Tolar ISD	football	275	\$ 5000.00
Cedar Hill ISD	football	225	\$ 4586.86
Fort Worth Country Day	baseball, softball	125	\$ 3000.00
TOTALS		6627.5	\$291,911.87

The compost is cubic yards and the cost is the amount of the cost-share reimbursed to the participating entity.

## **ATTACHMENT 2**

### **PARTICIPATING CONTRACTORS IN ATHLETIC FIELD MAINTENANCE**

Tomlinson Ball Field Materials  
5305 Weatherford Highway  
Granbury TX 76049

Tex-Sand Sport Turf Specialty, Inc  
PO Box 1442  
Hawkins TX 75765

Texas Multi-Chem, Inc  
PO Box 291306  
Kerrville TX 78029

Sports Field Solutions  
8191 S. W. Loop 820  
Benbrook TX 76126

Dyna-Mist Construction Co., Inc  
1105 E. Plano Parkway, Suite 3  
Plano TX 75074

**ATTACHMENT 3**

**END OF PROJECT EVALUATION  
COMPOST-SAND PREMIUM ATHLETIC FIELD TOPDRESSING BLEND**

**US ENVIRONMENTAL PROTECTION AGENCY, TEXAS STATE SOIL AND  
WATER CONSERVATION BOARD, AND LEON-BOSQUE RESOURCE  
CONSERVATION AND DEVELOPMENT COUNCIL**

**Organization:** \_\_\_\_\_

**Name of Person Completing This Evaluation:** \_\_\_\_\_

**Contact Information:** Phone \_\_\_\_\_ Email \_\_\_\_\_

**Assessment of Participation in the Project**

	Did Not Meet Expectations	Met Expectations	Exceeded Expectations
Overall Satisfaction	_____	_____7_____	_____10_____
Cost-Share Incentive	_____	_____10_____	_____7_____
Participation in Project	_____	_____12_____	_____5_____
Involvement with Turf Maintenance Industry	_____	_____12_____	_____4_____

**Performance of the Compost-Sand Blend on Your Field(s)**

1 – very dissatisfied 2 – dissatisfied 3 – no difference 4 – satisfied 5 – very satisfied

	1	2	3	4	5
Improved grass vigor/appearance	_____	_____	_____	_____9_____	_____8_____
Improved playing surface	_____	_____	_____1_____	_____7_____	_____9_____
Improved drainage	_____	_____1_____	_____5_____	_____8_____	_____3_____
Reduced compaction	_____	_____	_____1_____	_____10_____	_____6_____
Reduced water requirements	_____	_____	_____8_____	_____5_____	_____4_____
Reduced chemical inputs (fertilizer, herbicide, insecticide)	_____	_____	_____8_____	_____5_____	_____4_____

Were there any negative aspects of the use of the compost-sand blend on your field(s)?  
Yes 3 No 13 If no, please comment: “Waiting on compost to dry.” “did not cook long enough. Reeked! Drew flies for weeks.” “weeds” “We were pleased with this project and hope to do it again.”

**Future Use of the Compost-Sand Blend on Your Athletic Fields**

	Not likely to use	Undecided	Likely to use
With cost-share	_____	_____1_____	_____15_____

Without cost-share      \_\_\_\_\_6\_\_\_\_\_      \_\_\_\_\_8\_\_\_\_\_      \_\_\_\_\_1\_\_\_\_\_

**EVALUATION OF THE PREMIUM COMPOST-SAND BLEND  
FOR ATHLETIC FIELD TOPDRESSING**

The following are extracts from an evaluation in the fall of 2005.

4. Assessment of participation in the compost-sand athletic field topdressing project:

	Did not meet Expectations	Met Expectations	Exceeded Expectations
Overall satisfaction	_____	___7___	___5___
Cost-share incentive	_____	___6___	___6___
Participation in project	_____	___6___	___6___
Involvement with industry	_____	___6___	___6___

5. Performance of the compost-sand blend on your athletic field:

- 1 – very dissatisfied
- 2 – dissatisfied
- 3 – no difference from previous
- 4 – satisfied
- 5 – very satisfied

	1	2	3	4	5
Improved leveling of field	_____	_____	__1__	__8__	__3__
Improved playing surface	_____	_____	_____	__7__	__5__
Improved drainage	_____	__1__	__4__	__2__	__5__
Improved grass vigor	_____	_____	_____	__7__	__5__
Reduced compaction	_____	_____	__2__	__4__	__6__
Soil mulching effect	_____	__1__	__2__	__5__	__4__

6. Were there any negative aspects of the compost-sand blend as a topdressing for your athletic field?

Yes      2      “Rye grass came up in different parts of the field.” “Complaints in early spring by some players having to play on “sand lots.” Later as the turf came up the surface was great.”

No      10

7. Future use of compost-sand blend on your athletic fields

not likely to use      undecided      very likely to use

routine maintenance	1	2	9
renovation		3	10

**APPLICATION SURVEY FOR THE COMPOST-SAND BLEND ATHLETIC FIELD  
TOPDRESSING**

The following information is extracted from the survey conducted at or soon after the time of the application of the compost-sand blend to the athletic fields.

5. Importance of factors to participate in the project:

	Not important	Important	Very important
Type of material		4	21
Cost-share incentive		7	18
Participation in project	1	17	7
Involvement with industry	5	11	9

6. Perception of benefits of compost-sand blend

	Not important	Important	Very important
Low organic matter	4	12	9
Nutrient content	2	15	9
Micronutrient content	1	11	13
High CEC	1	10	10
Soil mulching effect	3	12	10
Improved leveling of field	2	12	11
Improved playing surface	1	6	18
Improved drainage	2	10	12
Improved grass vigor		6	19
Slow release of nutrients	1	10	12
Reduced compaction		8	16

Comments: “Fields still show heavy compaction problems in front of goals and center field but 75% of turf (Bermuda) stand.” “Level and grass is holding up good.” “Good rain, new mower and the topdressing has been an excellent combination. Best ever.” “The turf condition is excellent.”

“Very heavy use since application. Condition is better than in past years.” “This application really helped level and soften field.” “This application has already improved drainage, allowed the turf to thicken & relieved the compaction problem.” “Thick healthy grass” “Grass deep green & thick, growing well.”

