

## **Appendix K**

### **Case Studies**

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### **Breckenridge ISD demonstrates Dairy Manure Compost on Football Field**

The Buckaroos of Breckenridge High School, 500 West Lindsey, Breckenridge, had been practicing football on a field with compacted soil and poor grass cover and density on many sections.

Phillip Bales, Stephens County Extension Agent - Agriculture, Texas Cooperative Extension, offered to work with the school district to address these problems. With inputs from Dr. Jim McAfee, Extension Turfgrass Specialist in Dallas, Bales formulated plans for a turf management demonstration that included mechanical aeration of the field, fertilization with dairy manure compost supplemented with inorganic nitrogen, and other practices such as timely irrigation.

The demonstration was initiated in May 2004, and turf response ratings were taken through September 2004. This trial compared dairy manure compost applied alone, dairy manure compost amended with inorganic fertilizer, and inorganic nitrogen fertilizer alone. The treatments were (a) 40 tons/acre dairy manure compost, (b) 40 tons/acre dairy manure compost followed by 20 pounds/acre inorganic nitrogen and (c) 60 pounds/acre inorganic nitrogen.

Through a program funded by the Texas Commission on Environmental Quality and designed to assist public entities with utilization of composted dairy manure, Bales was able to provide the dairy manure compost utilized in the demonstration.

Visual assessments were made of turf stand, density, color, and weed presence. Overall health of the practice field vegetation improved across all treatments. Specifically, turf density improved providing coverage on many previously bare areas. Bales reported that the improvement was sustained even after athletic activity resumed in 2005.

Tommy Wolfe, Director of Maintenance and Transportation, Breckenridge Independent School District, said that \$200 was spent annually to purchase and apply inorganic fertilizer to the football field before the demonstration. Because dairy manure compost provides plant essential nutrients in organic form, the school purchased less inorganic fertilizer following the compost demonstration. The benefit of utilizing less inorganic fertilizer has the potential to last 2 to 3 years as the phosphorus and potash provided by dairy manure compost can persist beyond one year. Wolfe indicated that irrigation costs (estimated at \$150/year) were not affected by treatments.

Unfortunately the dairy compost used in the trial was not of top-dress quality, which resulted in some unintended consequences. This "general use" grade material contained small rock (limestone or caliche) fragments, which had to be removed by hand. Also, the appearance of some weeds in the turf suggested that the product was not fully composted, e.g. proper temperatures were not maintained. When composted correctly, dairy manure compost should not contain any viable weed seeds. While use of this product could be effective in other situations, such as cases where it would be incorporated into the soil, its use as a top-dress would not be recommended.

Dairy manure is transformed into compost by several commercial businesses located in the North Bosque and Leon River watersheds. Different grades of compost are available for a variety of applications, including top dressing, soil amendment and erosion control. Top-dress quality products are available and typically are made from selected feed stocks that are rock free and screened to insure product uniformity.

PREPARED IN COOPERATION WITH THE TEXAS COMMISSION ON ENVIRONMENTAL QUALITY AND U.S. ENVIRONMENTAL PROTECTION AGENCY

The preparation of this report was financed through grants from the U.S. Environmental Protection Agency through the Texas Commission on Environmental Quality.

### **City of Waco sells Dairy Manure Compost to Citizens**

The City of Waco initiated a project in spring 2002 to provide dairy manure compost to local homeowners for use on their lawns, landscapes and gardens. The material was purchased from commercial compost facilities located in the North Bosque and Leon River watersheds. The City's cost of the material was reduced by \$5 per cubic yard, thanks to the Texas Commission on Environmental Quality (TCEQ) Dairy Compost Rebate Program funded through an EPA grant.

Dairy manure compost contains many of the essential nutrients needed by "yard" plants, including lawn grasses, ornamentals, trees, shrubs and garden crops, and organic matter that improves soil tilth and water holding capacity. Additionally, because most of the nutrients contained in the compost are gradually released over time, need for re-treatment is minimized as well as potential for off-site movement of the more mobile nutrients (such as nitrate nitrogen).

Research and demonstration trials conducted by the Texas Agricultural Experiment Station and Texas Cooperative Extension have shown that dairy manure compost is a good substitute for inorganic fertilizers. It can be used by homeowners in combination with inorganic fertilizers to balance nutrients, optimize plant growth, prepare areas for new plants or renovate problem areas in lawns, flower beds and gardens.

This city project is now in its fourth year. Christian Heger, Solid Waste Services, City of Waco, said that with the aid of the TCEQ Compost Rebate Program, the city purchased dairy manure compost for resale to its citizens during two weekends in February 2005. Its citizens bought about 1,200 cubic yards of dairy manure compost in bags and truckload lots ranging from 1-cubic foot to about 9-cubic yards.

Heger said a city that has interest in initiating a similar project with dairy manure compost should consider several factors. First, take advantage of the TCEQ Dairy Compost Rebate Program as long as it's available. Next, buy the dairy compost from a reliable and reputable composter that is recommended by TCEQ and which meets homeowners' quality needs. Heger's city bought dairy manure compost that contained small "rocks" in 2002. That material might have been suitable for constructing a new flower bed where it would be incorporated into the soil but it was not acceptable for use in top dressing lawns.

Heger also noted that the distribution site needs to be located in an area that is well suited for storing and dispensing the compost. The site needs to be somewhat isolated from city activities but readily and easily accessible to the citizens who will purchase dairy manure compost.

When possible, involve volunteers in the project. They can help with numerous activities including collecting money from citizens who purchase the material, directing traffic, and helping load the material. Heger said his city had volunteers who were college students, Master Composters and others.

Timing of the sale is also important. In 2005, the city of Waco scheduled the dairy compost sale for two weekends in February. Due to the cool, wet conditions, Heger said the sale would have been even more successful had it been scheduled for two weekends in March when citizens were more likely to start working on their lawns and gardens.

Heger said his city neither gained nor lost money when it sold dairy manure compost bought through the TCEQ Compost Rebate Program. The city made the dairy manure compost available to its citizens at cost so they might have greater access to a valuable local resource that provides an alternative to  
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inorganic fertilizers. In addition, by utilizing this local resource, the city and its citizens are helping protect local water quality and maintain the viability of a vital part of the economy.

The dairy compost not purchased by citizens was donated to public works such as landfills and parks. However, the 2005 sale was the only sale where leftover dairy compost existed and had to be donated to the public works. In previous sales, Heger said no compost was available to be donated as all of the material was bought by the citizens.

In a small but important way, this project provided an avenue for removing composted dairy manure from the impaired regions of the North Bosque and Leon River watersheds while providing citizens of Waco, who depend on water from these watersheds, with quality organic fertilizer and soil amendments. Additionally, it demonstrates to other local communities how to actively involve its citizens in using a natural resource on their own land while simultaneously supporting the Central Texas dairy industry.

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### **Lovell Lawn and Landscape raises Live Oaks in Dairy Compost**

Joe Pope, Erath County Extension Agent - Agriculture (retired), Texas Cooperative Extension, worked with Lovell Lawn and Landscape, a small landscaping business located at 6744 South U.S. Highway 281, Stephenville, to evaluate the use of dairy manure compost as a potting media for small Live Oak trees.

Jason Lovell, president of the landscape company, primarily had been using bark mulch for potting his plants. As part of the Dairy Manure Compost Utilization Program funded through a Clean Water Act Section 319(h) Grant by US EPA through the Texas Commission on Environmental Quality, Mr. Lovell agreed to work with Pope in conducting a demonstration.

The demonstration compared the use of bark mulch, dairy compost and Bovinite™ as growth media for several hundred Live Oak trees being grown by Lovell. Bovinite™ is a commercial dairy compost product specially processed to reduce overall salt content and to increase the nitrogen to phosphorus ratio. Further, the material is much less dense than typical dairy manure compost and contains high organic matter content.

Each treatment was introduced as the growth media when the Live Oaks were repotted from 30-gallon to 45-gallon containers between February 2004 and September 2004.

Initially, Pope and Lovell planned to take measurements on changes in tree diameter and other indicators of plant response. Opportunity to sell the trees, however, precluded collection of measured growth data but the following observations were made.

Lovell noted that Live Oaks grown in the Bovinite™ exhibited the best overall performance followed by those grown in dairy compost. Trees grown in those media outperformed those potted in the bark mulch in rate of growth, root proliferation and overall appearance.

Specifically, Live Oak trees grown in the dairy manure compost and Bovinite™ required less frequent irrigation and were less likely to stress for moisture due to delayed watering than those potted in the bark mulch. In addition to improved performance, the use of dairy compost and Bovinite™ also resulted in some time and labor savings.

The dairy manure compost utilized in the demonstration had a lower organic matter and higher inorganic (sand) content than the Bovinite™ or bark mulch. Consequently, containers with Live Oaks potted in dairy manure compost were heavier than those with the trees potted in the bark mulch and the Bovinite™.

However, Lovell reported that his customers were pleased with the condition of the Live Oaks potted in the dairy manure compost and unaware or unconcerned about the weight differences.

Lovell Lawn and Landscape continues to buy about six truckloads of dairy manure compost a year from the commercial composting operations located in the North Bosque River watershed. The majority of the compost is used in the maintenance and renovation of landscapes (lawns, flower beds, etc.) for customers that include private home owners and businesses in Stephenville and surrounding communities.

Currently, the company produces only a limited number of container grown trees. For this, Lovell utilizes a commercial potting media that contains dairy compost and is specifically formulated and marketed for that purpose by a local composter.

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### **Santo ISD Utilizes Dairy Manure Compost in Sports Field Management**

The Fighting Wildcats of Santo High School, Farm-to-Market Road 2201, Santo, TX played football on a field that was considered to be in "fair-to-poor" condition largely due to compacted soil and substandard turfgrass cover.

Scott Mauney, Palo Pinto County Extension Agent - Agriculture, Texas Cooperative Extension, offered his assistance to the school board in renovating the field. He contacted Dr. Jim McAfee, Extension Turfgrass Specialist in Dallas, and together they formulated a sports field management plan that included mechanical aeration of the football field, a top-dress application of dairy manure compost and commercial (nitrogen) fertilizer, timely applications of irrigation and efficient weed control practices.

As part of the Dairy Manure Compost Utilization Program, a project funded through a Clean Water Act Section 319(h) Grant by the US EPA through the Texas Commission on Environmental Quality, Santo ISD and Texas Cooperative Extension cooperatively demonstrated the use of dairy manure compost on the field. Further, Santo ISD was able to receive a \$5 rebate for each cubic yard of compost purchased.

The demonstration was implemented in May, 2004, when top-dress quality dairy manure compost was uniformly applied to the surface of the field at a rate of 80 tons per acre. Subsequently, the field was mechanically aerated to partially incorporate the compost, enhance nutrient and water uptake and to reduce compaction. As the season progressed, the field received two additional applications of 20 pounds per acre of inorganic nitrogen fertilizer and was mechanically aerated a second time.

The treatments and timely maintenance resulted in better turfgrass coverage and uniformity. Improvements were noted in grass density, health, color, and overall appearance. Ray Hollis, Maintenance Supervisor with the Santo ISD, even noted that the football players liked the added cushion of the healthy turf stand, which aided in fewer injuries when falling during play.

Unfortunately, the condition of the field has again declined primarily due to overuse this last season. Athletes from a newly constructed school were temporarily reassigned to the Santo ISD field and it was also utilized by community soccer programs. The expectation is that with the addition of new sports facilities in the community, use of this field will again be largely limited to varsity sporting events and field health can once again improve.

It is at this point that the board expects their investment in the dairy manure compost application to pay dividends. The one-time heavy applications of compost are expected to improve chemical and physical properties of the soil, which will potentially hasten the recovery of the field from damage caused by overuse or other stresses such as climate. In addition, large compost applications can improve turfgrass health and optimize turfgrass response to fertilization, irrigation, aeration, and other management practices. Thus, standard fertilizer treatments and management practices (e.g. irrigation, aeration, etc.) can maintain the field for several years before re-treatment with compost is necessary.

Due to the positive results on the football field, the Santo ISD School Board considered a similar compost-fertilizer-management program for the baseball infield in 2005. However, plans to construct a new field were also under consideration. Thus, the board decided to delay the substantial investment of a dairy compost application until baseball field construction plans were finalized.

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The costs of purchasing and hauling dairy compost can be substantial, especially for smaller school districts with limited budgets. Figure 1 is an example of the itemized costs associated with compost purchase and transport.

| <b>Compost Budget Sheet</b>                     |                    |
|---|--------------------|
| Compost (200 CY @ \$16.00/CY).....              | \$ 3,200.00        |
| Freight (50 Mi @ \$3.00/loaded Mi X 3 loads) .. | \$ 450.00          |
| Sub-total (before rebate).....                  | \$ 3,650.00        |
| Composted Manure Incentive Payment              |                    |
| (Rebate of \$5.00/CY).....                      | -\$ 1,000.00       |
| <b>TOTAL COSTS.....</b>                         | <b>\$ 2,650.00</b> |

**Figure 1.** Estimated costs for the purchase and transportation of dairy manure compost. Costs are related based on a top-dress application on a football field at a rate of 80 tons per acre.

This example does not include the equipment and labor costs associated with compost application, which can also pose difficulty when utilizing compost. For example, compost spreaders were not readily available to Santo ISD but as part of the demonstration, TCE provided a small compost spreader. Mauney reports though that applying the 80 tons per acre compost treatment with the small research-type spreader required two people and nearly two days to accomplish.

The final question is will the school board realize the long term responses to the dairy compost applications they are anticipating? Research studies conducted at the Texas A&M Research and Extension Center at Dallas confirm that incorporation of dairy compost 6-inches deep into the soil does indeed provide such long term benefits. This and other demonstrations have shown that dairy compost is a good source of nutrients that are released for plant use over time. When supplemented with periodic commercial fertilizer applications, specifically nitrogen, turfgrass responses (growth, color, density) are typically better than those obtained following only commercial fertilizer use. Long term improvements in soil physical and chemical properties, however, are less likely to result from surface applications than from incorporation of dairy compost into the soil.

### **Citizens and Compost Beautify Tarrant County Courthouse**

The landscape maintenance staff for the Tarrant County Northeast Sub-Courthouse, 645 Grapevine Highway, Hurst, Texas encountered problems in maintaining good growth and healthy appearance of turfgrasses and perennial flowers at that facility. When increasing the irrigation schedule from once to twice per week failed to improve plant performance and appearance, Dotty Woodson, Tarrant County Extension Agent - Horticulture, Texas Cooperative Extension, suspected problems related to fertility and soil conditions.

To address these landscape issues, Woodson established test plots to demonstrate the use of dairy manure compost combined with recommended rates of commercial fertilizer on turfgrass and perennial flowerbeds. Research and demonstration trials conducted at the Dallas Research and Extension Center showed dairy manure compost used in combination with inorganic fertilizer optimized plant growth, prepared soil for new plantings, and renovated problem areas in turfgrass and flower beds. These trials and Woodson's demonstration were components of the Dairy Manure Compost Utilization Project, which was funded through a Clean Water Act Section 319(h) Grant provided by the US EPA through the Texas Commission on Environmental Quality.

The treatments Woodson chose for the turfgrass demonstration were a) inorganic fertilizer only at the recommended rate of 8 pounds of nitrogen per 1,000 square feet applied two times during the growing season, b) dairy manure compost applied once at a rate equivalent to 20 tons per acre plus 20 pounds of inorganic nitrogen (N) applied twice during the growing season, and c) dairy manure compost applied twice at a rate equivalent to 20 tons per acre plus 20 pounds of inorganic nitrogen applied twice during the growing season. A 20 ton per acre rate of dairy manure compost is equivalent to about 1/2 inch of compost spread evenly over the grass surface.

The flowerbeds' treatments were a) inorganic fertilizer only at a rate of 8 pounds of nitrogen per 1,000 square feet, b) dairy manure compost at a rate of 100 tons per acre incorporated to a depth of 6 inches, and c) 100 tons dairy manure compost per acre plus 20 pounds of inorganic nitrogen incorporated to a depth of 6 inches. To convert the application rate to a smaller scale for the flowerbeds, Woodson determined the 100 ton per acre rate is equivalent to approximately a 6 inch layer of the material evenly applied on the soil surface.

By incorporating the compost into the top 6 inches of soil, Woodson created a much improved environment for plant growth and development. The dairy manure compost provided essential nutrients required by plants, added organic matter that improved soil physical properties, and increased water infiltration and retention within the soil.

The dairy manure compost was purchased from a commercial composter located in the North Bosque River Watershed. State agencies and local governments that purchase dairy manure compost from qualified vendors are eligible for the \$5 per cubic yard rebate available through the Dairy Compost Incentive Program managed by the Texas Commission on Environmental Quality.

A highly regarded and effective Extension educator, Woodson has conducted numerous turf and ornamental plant management workshops for various groups, including the Tarrant County grounds maintenance staffs, Sheriff's department staff, individuals required to perform community service and Tarrant County jail inmates participating in a "from-jail-to-work" program.

She initiated the dairy manure compost demonstration project at the sub-courthouse with assistance from county community service participants who

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attended her workshops. With Woodson's guidance, the participants established the test plots by applying the dairy manure compost and fertilizer treatments. The grounds maintenance staff at that facility were also actively involved and able to apply their knowledge acquired from their training in the day-to-day care of the demonstration plots.

Turfgrass growth improved in vigor and color in the demonstration plots where compost and fertilizer were added. The differences were clearly visible and prompted many clients visiting the sub-courthouse to comment about the improved appearance of the turfgrass.

The growth and vigor of the ornamental plants were also greatly improved in the plots where compost and compost plus fertilizer were added.

In one problem area, grass seed was sown in an attempt to establish turf where it had not grown before. However, a large rain storm washed away some of the grass seed and the area is still bare. Woodson plans to apply more compost and grass seed to this area to help control erosion and establish turf.

Woodson said the county staff decreased water costs by an estimated 30-50 percent after the demonstration plots were established on the sub-courthouse turfgrass and flowerbeds. In the past, the staff watered twice a week, and now the staff only waters once a week. The compost increased the infiltration rate and water holding capacity of the soil. Woodson was unsure of the water savings in dollars for the county as a result of the education programs and demonstrations. However, she was sure her time with the staff throughout the project helped decrease the volume of irrigation water and saved the county money, as well as contributed to the beauty of their landscapes.