

## **Utilization of Dairy Compost to Establish Urban Landscapes**

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**Index Words:** Compost, dairy manure, landscape application, organic matter, water quality

**Significance to Industry:** Composting dairy manure for landscape use provides numerous benefits for the nursery industry as well as for the environment in general. One major benefit in using dairy compost is the removal of this material from agricultural watersheds which may help alleviate water quality concerns of excess phosphorus (P) for associated rivers and lakes. A second benefit is the improvement of the soil physical properties by the addition of organic matter to the soil. Decomposing organic matter releases organic acids that interact with soil particles, especially clays, and binds them together thus increasing soil aggregation. As a result, clay-textured soils benefit by increased movement of water and gases through the soil. Accordingly, these effects improve the root zone environment improving plant growth. A third benefit is that compost can also serve as a slow release source of essential plant macro- and micro-nutrients.

**Nature of the Work:** Government regulations and increasing concerns over excessive phosphorus migrating into water bodies has spurred interest in methods to manage high volumes of dairy manure outside of traditional agricultural land application while reducing the environmental impact (Garling and Boehm, 2001; Roe, 2000; Sikora, 1999; Zhang et al. 1996). One option for reducing soil P loading in agricultural watersheds is to increase the value of dairy manure through composting and to export the composted manure to urban areas where it can be used to establish new landscapes following construction activities.

Construction of new homes and businesses is a continuous process in rapidly growing urban areas such as the Dallas Ft. Worth Metroplex. In this type of rampant urban expansion, large tracks of land are quickly converted to residential homes, business offices or strip malls.

The primary objective of these development projects is to complete the construction quickly so that the property can be sold. Post-construction landscaping is usually approached from only the plant-selection viewpoint in order to sell the property. Very little thought or effort is devoted to soil preparation prior to planting the landscape. This is unfortunate because the soil has usually been severely disturbed and compacted by vehicles and soil-moving construction equipment which negatively impacts plant growth (Randrup and Lichter, 2001). Subsoil and construction debris are often mixed with or completely replace the original top soil. Although ornamental plants and turfgrass planted in this disturbed soil may initially perform well due to abundant watering and fertilization, they frequently decline over time when heat and drought stress become prevalent. High rates of compost mixed with the soil prior to establishing the landscape may have positive short and especially long-term effects on the survival and aesthetics of the urban landscape. These short and long term effects were evaluated in this study. The overall objective of this study was to evaluate the effect of compost on establishment and subsequent growth of typical urban landscape plants, including shrubs, flowering annuals and flowering perennials in simulated new urban landscapes.

**Methods:** In this study, the soil surface was conditioned to represent newly constructed landscapes using surface cultivation and leveling. Compost dairy manure was applied and incorporated at 0 (control), 9, 18, and 27 kg/m<sup>2</sup> and incorporated to a depth of 15 cm. Treatments were replicated 4 times in a completely randomized block design. The composted dairy manure had total N, P, and K contents of 9.0 g kg<sup>-1</sup>, 1.04 g kg<sup>-1</sup>, and 4.90 mg kg<sup>-1</sup>, respectively. Compost application supplied 81, 162, and 243 g m<sup>-2</sup> of N, 9.4, 18.8, and 28.2 g m<sup>-2</sup> of P, and 44, 88, 132 g m<sup>-2</sup> of K. The soil was sampled prior to the addition of compost and subsequently at the end of the second growing season to determine the effects of compost addition on residual nutrient levels in the soil. Soil samples were collected from each plot at depth increments of 0 to 7.5 and 7.5 to 15 cm for laboratory analysis. The analyses included pH, EC, NO<sub>3</sub>-N, P, K, Ca, Mg, Na, Fe, Mn, Cu, Zn, and organic matter. Plant growth data was collected monthly throughout the

growing seasons to calculate the plant growth index. In addition, chlorophyll content, as an indicator of photosynthesis, was determined using a spad meter to measure reflectance.

**Results and Discussion:** There was no significant difference in the plant growth index, chlorophyll reflectance, overall appearance or per cent flowering between the control and the compost application levels. This may be due in part to the highly variable nature of the dairy compost utilized in this study. Plants typically respond most favorably to nitrogen applications. The high standard of deviation for the compost N content (Table 1) suggests that there was probably a high degree of variability in the amount of N supplied by the dairy manure compost.

Compost applications significantly increased the concentration of various soil macro- and micro-nutrients (Table 1). Phosphorus was of special interest due to the potential harmful effects of excess P on surface water bodies. Prior to application of composted dairy manure, plant available soil P in the upper 15 cm was below the Texas Cooperative Extension soil P test critical level of  $50 \text{ mg kg}^{-1}$ . At the end of the second growing season, a single application of 9, 18 and  $27 \text{ kg m}^{-2}$  of composted dairy manure increased Mehlich 3 extractable soil P in the 0 to 7.5 and 7.5 to 15 cm depths of the soil profile Table 1. The critical soil P level was exceeded by all rates of composted dairy manure in the upper 7.5 cm, but only by the 18 and  $27 \text{ kg m}^{-2}$  rates at the 7.5 to 15 cm depth. Other nutrients that were significantly increased to a depth of 15 cm by the addition of composted dairy manure included K, Fe, Zn, and Cu. Soil  $\text{NO}_3\text{-N}$  was not increased in the upper 7.5 cm, but an increase was detected in the 7.5 to 15 cm depth. It is likely that by the end of the second growing season, excess  $\text{NO}_3\text{-N}$  had leached from the soil surface to slightly deeper depths. Other nutrients that were increased with application of composted dairy manure included Ca, Mg and S. Compost application rate had no significant effect on soil pH or electrolytic conductivity at the 0 to 7.5 cm depth, but decreased soil pH and increased EC at the 7.5 to 15 cm depth (data not shown). Compost application had no significant effect on soil Na and Mn levels at any depth (data not shown).

**Literature Cited:**

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Table 1. Effect of dairy manure compost on plant available nutrients at the end of the second growing season.

Compost Rate (kg m <sup>-2</sup> )	OM (%)	NO3-N	P	K	S	Fe	Zn	Cu
----- mg/kg -----								
0-7.5cm								
0	3.9	4.8	40	392	39.0	16.6	0.6	0.7
9	5.0	4.0	89	414	47.5	18.4	1.6	0.8
18	5.0	4.0	128	567	48.5	23.1	3.5	1.3
27	5.2	5.0	177	583	52.5	23.5	4.5	1.5
	†	ns	***	***	**	**	***	***
7.5-15cm								
0	3.9	3.0	18	353	34.5	16.5	0.3	0.7
9	3.8	3.0	34	410	37.5	17.7	0.7	0.8
18	4.1	3.8	58	532	40.3	19.1	1.5	0.9
27	4.1	3.8	64	577	40.3	18.6	1.8	1.0
	ns	**	***	***	**	*	***	***

ns, †, \*, \*\*, \*\*\* Not significant and significant at the 0.10, 0.05, 0.01, and 0.001 level of probability, respectively.