Producing compost from wood waste and other organic by-products in Wisconsin

Narrative

Assessment of compost maturity or "quality" is important for successful use of composts in agricultural and horticultural production. We evaluated compost process variables and assessed "maturity" of four different sawdust-based composts through the use of a perennial ryegrass growth bioassay. We composted sawdust with either cannery waste, duck manure, dairy (heifer) manure or potato culls in 30 m-long windrows for approximately one year. Windrows were turned with biweekly for the first 60 days of composting, covered for the winter and then turned weekly until 370 days of composting. Process variables measured included CO_2 respiration, total volatile solids, total C and N, C:N ratio, water soluble nitrate and ammonium N and ortho-P, dissolved organic carbon (DOC), pH and electrical conductivity. Ryegrass biomass production was evaluated in a greenhouse study using compost samples from each sampling date mixed with peat (1:3 v:v). Ryegrass biomass production and N uptake were measured every 7 days for a total of three cuttings. We then related process variables to ryegrass growth and nitrogen uptake using regression analysis.

Respiration rate declined with time as the composts decomposed, and high rates of respiration were maintained throughout the first 145 days of composting across all compost types. The potato cull compost exhibited significantly greater CO_2 respiration and concurrent loss in total C compared to the other three composts through 150 days of composting. Among all composts, the C:N declined from 25-40:1 to 25-12:1 after one year of composting. Dissolved organic carbon declined 2-3 fold only after 280 days of composting and was not correlated with ryegrass growth. The two animal manure composts contained the highest ammonium N and P concentrations over the first 50 days of composting (~ 500-1800 mg/kg compost C). Compost NO_3-N concentrations remained close to zero for the first 90 days of composting; nitrate mineralization did not occur until after 200 days of composting.

Over all dates evaluated, cannery waste compost produced significantly less ryegrass biomass compared to other three composts (0.59 g/pot vs. 0.69-0.71g/pot). Cannery waste compost appeared to inhibit ryegrass growth in the first few days of composting (day 16), whereas heifer manure compost stimulated ryegrass growth at days 43 and 145. After 250+ days of composting duck manure and potato cull composts produced significantly more ryegrass biomass than either cannery waste or heifer manure composts. Duck manure and potato cull composts had the greatest number of significant correlations between total ryegrass biomass and compost process variables including CO_2-C respiration, water soluble NO_3-N, C:N ratio, pH, EC and total C. These findings demonstrate that relationships between plant growth, nutrient uptake and indicators of compost maturity differ according to feedstock blends. Furthermore, they indicate that we don't have a "universal" set of compost variables that can be used reliably to assess compost maturity as it relates to plant growth.

Impact: This project demonstrated that wood wastes from saw mills can be successfully combined with other organic waste streams to produce high quality compost. The conversion of organic waste streams to soil amendments should have significant economic and environmental benefit.

Publications:

L. R. Cooperband, A. G. Stone, M. R. Fryda and J. L. Ravet. 2003. Relating compost measures of stability and maturity to plant growth.; Compost Sci. Utiliz. 11: 113-124.