DAIRY COMPOST EFFECTS ON SOIL TEST LEVELS

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ABSTRACT

Composted dairy manure was applied to plots in a production alfalfa (*Medicago sativa* L.) field to determine the impact on alfalfa yield, soil nitrogen (N), phosphorus (P), and soluble salts. Unfertilized plots were maintained as controls. Application of 2.5 to 5 tons dairy compost per acre, or phosphate fertilizer can increase soil test P particularly in the top 3 inches of soil, therefore much of the P, potassium (K), and magnesium (Mg) exported from fields in hay can be replaced with compost.

INTRODUCTION

Compost is an environmentally-friendly byproduct of the dairy industry. It is logical to return unused nutrients from a dairy to the alfalfa fields that they were exported from, rather than to use only commercial fertilizer to maintain the nutrient balance. Alfalfa yield may be better maintained by applying compost to replace nutrients (N, P, K, Mg, and calcium (Ca)) exported from fields by forage harvesting.

Composting manure can reduce field application costs associated with fresh manure application by reducing volume and moisture composition. Composting can also increase application uniformity due to a reduction in particle size and a decrease in the amount of viable weed seeds and phytotoxic substances contained in manure. However, with composting, there are potentially greater production and environmental costs associated with extra handling and possible losses of nutrients.

The objectives of the study were to: 1) determine effects of applied compost on Portneuf soil cropped with alfalfa in southern Idaho, and 2) develop or refine alfalfa fertility guides to plan for more sustainable agronomic practices of alfalfa production and to solve nutrient cycling problems from dairy manure.

METHODS

Site Description

The 'Ultra' variety of alfalfa (Medicago sativa L.) was planted 1 May 2001, after a previous crop of dry edible beans (Phaseolus vulgaris L.) on a producer's field near Kimberly, Idaho. The soil was a surface-irrigated Portneuf silt loam (coarse-silty, mixed, mesic, Durinodic Xeric Haplocalcid) near Kimberly, ID USA (42o32' N and 114o20' W, elevation 1200 m). The experimental design was a randomized complete block with 4 replications.

Treatments

Targeted treatments were: an untreated check (O), application of 2.5 tons per acre (5.6 Mg ha^{-1}) dairy compost prior to establishment and annually (C1X), application of 5 tons per acre (11.2 Mg ha^{-1}) compost prior to establishment and annually (C2X), post establishment annual application of 2.5 tons per acre (5.6 Mg ha^{-1}) dairy compost (A), commercial fertilizer (F) applied to provide nutrients equivalent to the N-P-K levels in compost treatments prior to establishment and annually, and post establishment annual application of 300 lbs/ac (336 kg ha^{-1})

monoammonium phosphate (11-52-0). Annual treatments were repeated every year in the same plot so that cumulative treatment effects on soil test nutrients and yield over 3 years could be determined.

Composted dairy manure was applied to the soil prior to planting at a standard rate of compost (C1X) and twice the standard rate (C2X), and incorporated to a 6 inch (15-cm) depth prior to seeding alfalfa. Different batches of compost were applied in subsequent years to the same plots (4 x 2 m) at 0 (control), 4 for C1X, and 8 tons per acre for C2X treatments (8.93 and 17.9 Mg DM ha^{-1} yr^{-1}, respectively) on 10 April 2001. In 2002 the actual rates were 2.22 (C1X) and 4.44 tons per acre (C2X) (5.0 and 10.0 Mg ha^{-1}) on an as-delivered basis.

A 30 by 20-foot (9.1 by 6.1-m) tarp was used to collect and weigh compost spread by the truck to determine actual application rates for each batch. A commercial compost spreader truck applied the compost in randomized 30-foot (9.1-m) wide strips, and plots were established within the strips as 30 by 100-foot (9.1 by 30.4-m) plots.

Soil and Compost Sampling and Analyses

Soil samples were taken from the field using a Giddings Probe and a 1.25 inch (3-cm) hollow core sampler. Samples were taken in October 2000, before treatment initiation; March of 2001, 2002, and 2003; and October 2002 and 2003 at the conclusion of the study. Each time, 7 soil cores were composited for each plot from 0 to 3, 3 to 12, and 12 to 24 inches (0 to 7.6, 7.6 to 30.5, and 30.5 to 61 cm). Samples were analyzed for Olsen P.

Compost samples were collected as grab samples from the tarp and composited for each batch, and stored frozen until analyzed.

RESULTS

Compost Characteristics

The composition of the compost was similar in both 2001 and 2002. The average nutrient analysis and application of nutrients for the dairy compost is shown in Table 1.