IMPLICATIONS FOR USING COMPOST IN VEGETABLE PRODUCTION

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INTRODUCTION

Compost is a valuable soil amendment that contains organic matter, nitrogen, phosphorous, potassium, and most of the critical minor plant nutrients (e.g. Ca, S, Mg, Cu, and Zn). Adding compost to soil is one of the fastest ways to increase soil organic matter and improve soil quality.

The concentration of plant nutrients in a compost product will depend on the nutrient content of the source materials, and the management of the composting process. Many of the plant nutrients such as P and Zn will be conserved during the composting process.

Most application recommendations are based on the addition of a specified volume or mass of compost. A common recommendation for landscape or horticultural use is to spread 1.3 to 7.6 cm layer of compost, and then incorporate to a depth of 15 cm (e.g. Cooperband, 2002). Another recommendation is to surface apply compost at rates of 6 to 160 t/ha (Ozores-Hampton and Obreza, 1998).

Several extension publications recommend application of compost at agronomic rates for horticultural use (e.g. Cooperband, 2002; and Rynk, et al., 1992). However, compost products are rarely spread at agronomic rates based on crop needs. As a result, it may be possible to apply major plant nutrients in extreme excess of the agronomic rate, and to apply elements such as Cu and Zn at amounts in excess of agronomic and regulatory limits.

The objective of this study was to evaluate the use of compost in vegetable production with respect to agronomic need using tomatoes.

Tomatoes were selected because they require a small amount of pre-plant N (45 kg/ha), and large amounts of P_2O_5 (190 kg/ha) and K_2O (224 kg/ha). In addition, spreading compost prior to field preparation would most likely fit easily with current cultural practices.

The complete report is given in *Composition of Animal Manure Compost and Utilization Implications* (Chastain et al., 2006).

ESTIMATES OF PLANT AVAILABLE NITROGEN AND PHOSPHOROUS

Plant Available Nitrogen = PAN = 0.5 TAN + 0.12 Organic-N + NO_3-N

Total Ammonical Nitrogen = TAN = NH_4^+-N + NH_3-N

Plant Available P_2O_5 = AP_2O_5 = 0.40 P_2O_5.

RESULTS

Table 1. Plant Nutrients and Sodium in Compost (kg / t, wet basis)

Compost Type	Total-N	PAN	P_2O_5	AP_2O_5	K_2O	Ca	Mg	S	Zn	Cu	Na
Cow Manure A	3.51	0.42	2.59	1.03	2.06	3.11	1.17	0.81	0.05	0.03	0.35
Cow Manure B	3.54	0.42	2.54	1.02	2.04	11.21	0.90	1.00	0.04	0.02	0.36
Mushroom	3.86	0.46	3.10	1.24	3.26	14.85	1.63	2.45	0.06	0.06	0.74
Yard Waste	5.43	0.65	1.08	0.43	1.38	7.33	1.25	0.69	0.06	0.02	0.05
25% Swine Solids	8.89	1.48	8.19	3.27	4.00	5.39	1.98	1.51	0.27	0.25	0.31
33% Swine Solids	17.12	3.07	27.14	10.86	10.51	12.13	7.34	4.50	0.84	0.95	0.33

Table 2. Resultant Material, PAN, K_2O, and Sodium Application Rates if Compost is Applied to Provide 190 kg AP_2O_5 / ha for Tomatoes

(Mylavarapu and Franklin, 1997)

Compost Type	Compost Mass (wet t/ha)	Compost Depth (cm)	PAN (kg/ha)	Fraction of PAN Need Applied	K_2O (kg/ha)	Fraction of K_2O Need Applied	Na (kg/ha)
Cow Manure A	184	2.63	77	1.72	379	1.69	65
Cow Manure B	187	4.00	79	1.76	382	1.70	67
Mushroom	153	2.82	71	1.58	500	2.23	113
Yard Waste	441	9.40	287	6.38	608	2.71	21
25% Swine Solids	58	1.31	86	1.91	232	1.04	18
33% Swine Solids	18	0.30	54	1.19	184	0.82	5.8

Table 3. Resultant Material, PAN, P_2O_5, and Sodium Application Rates if Compost is Applied to Provide 224 kg K_2O / ha for Tomatoes

(Mylavarapu and Franklin, 1997)

Compost Type	Compost Mass (wet t/ha)	Compost Depth (cm)	PAN (kg/ha)	Fraction of PAN Need Applied	AP_2O_5 (kg/ha)	Fraction of AP_2O_5 Need Applied	Na (kg/ha)
Cow Manure A	109	1.56	46	1.02	112	0.59	38
Cow Manure B	110	2.35	47	1.04	111	0.59	39
Mushroom	69	1.26	32	0.71	85	0.45	51
Yard Waste	162	3.46	106	2.36	70	0.37	7.7
25% Swine Solids	56	1.27	83	1.84	184	0.97	17
33% Swine Solids	21	0.37	65	1.44	231	1.22	7.1

SUMMARY & CONCLUSIONS

Six compost products were obtained for the purpose of evaluating the plant nutrient, carbon, and organic matter contents. The composts included in the study were a yard waste compost (containing no animal manure), two cow manure based products, mushroom compost (containing manure and straw), and two compost products that contained 25% and 33% separated swine solids. The carbon sources used ranged from wood waste to cotton gin trash.

The benefits and potential issues associated with using compost to fertilize vegetables was studied using tomatoes. The constituent application rates (e.g. N,P_2O_5, K_2O, Na) resulting from spreading compost at the agronomic rates for P_2O_5 and K_2O were calculated and evaluated.

It was determined that the only compost products that were unacceptable for use on tomatoes fields were yard waste compost and mushroom compost. Application of the yard waste compost at the agronomic rate for P_2O_5 provided 6.4 times more pre-plant N than required. Fertilization with mushroom compost provided excess N along with excessive amounts of sodium (113 kg Na/ha).

The data and nutrient balancing calculations point out that application recommendations based on a prescribed volume (application depth) or mass per unit area (t/ha) are not useful. Instead, compost application rates need to be determined based on analysis of the plant nutrients in a compost product, soil-test results, and the nutrient requirements of the crop to be grown.

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