Utilization of Compost made from Agricultural and Forestry Wastes for Improving the Economic and Ecological Sustainability of Agronomic Crop Production on Low Organic Matter Soils in the San Luis Valley of Colorado.

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Project Description: The main objective of this study is to improve water conservation and sustainability of crop production on the low organic matter soils of the San Luis Valley, Colorado. This will be accomplished through on-farm demonstrations that will examine the impact of field incorporated compost made from agricultural and forestry wastes has on: 1.) reducing the use of synthetic fertilizers and fungicides, by improving nutrient retention in the root zone and the health and diversity of the soil's biomass, 2.) improving water utilization, thereby reducing water and power use in center-pivot irrigation systems, 3.) crop yields and costs of production for potatoes, barley and alfalfa.

Two agricultural waste streams, sawdust and cull potatoes, being generated in the San Luis Valley have become problematic for their local industries. Logs harvested from the National Forests surrounding the San Luis Valley are milled locally, generating sawdust for which there are very few feasible uses. In a 1997 Colorado State University (CSU) survey of western Colorado mill operators, the second most mentioned problem was that of mill residues (sawdust). Most of this sawdust has been stockpiled at locations near the mills. Potatoes are the area's most economically important crop, and the foundation of the local economy. On average, about 9.6% of each year's potato crop is not marketable, due to size, appearance or presence of disease. This study looks at using cull potatoes in combination with sawdust to create a dry compost that can be used on agronomic crops in the San Luis Valley, Colorado.

This was a three-year study that looked at applying compost to potato, alfalfa, and barley crops. Rates of 0, 4, 8, and 12 tons of compost/acre have been applied to six different sites around the San Luis Valley in the falls of 2000, 2001, and 2002. Four of the sites were planted to potato rotated with barley and the two remaining sites were planted to alfalfa. Crop disease, crop yield, and soil readings were taken at each of the six sites during the 2001, 2002, and 2003 growing season to determine the effect compost had on the soil and crops.

Table 1. Effects of different rates of compost on potato plant development and incidence of disease, San Luis Valley, Colorado, 2003

Field	Treatment[a]	Vigor[b]	Stems[c]	% Rhizoctonia[d]	Stolons[e]	% Rhizoctonia[f]	Black scurf severity index[g]
3A	0	4.9	4.5	33.2	27.5	0.9	0.9
	4	4.9	3.7	35.3	24.6	2.4	1.5
	8	4.8	3.7	28.9	25.7	1.8	0.0
	12	4.4	3.8	35.8	25.9	7.5	0.1
3B	0	4.8	3.4	24.3	19.4	0.7	0.0
	4	4.9	4.2	37.5	22.2	2.4	0.0
	8	4.8	3.6	33.8	25.0	6.6	0.1
	12	4.6	4.1	27.6	28.4	4.6	0.2
Overall Mean	0	4.8 a	4.0	28.7	23.4	0.8 b	0.5
	4	4.9 a	4.0	36.4	23.4	2.4 ab	0.8
	8	4.8 a	3.6	31.3	25.3	4.2 ab	0.1
	12	4.5 b	3.9	31.7	27.1	6.1 a	0.1
LSD(P=0.05)		0.26	NS	NS	NS	3.70	NS

[a]Rate of compost applied in tons/acre.

[b]Mean plant growth rated 1 – 5, where 1 = poor and 5 = good; five plants/treatment/replication.

[c]Mean number of stems per plant; five plants/treatment/replication.

[d]Mean percent stems with Rhizoctonia canker; five plants/treatment/replication.

[e]Mean number of stolons per plant; five plants/treatment/replication.

[f] Mean percent stolons with Rhizoctonia canker; five plants/treatment/replication.

[g]Black scurf severity index = mean percent of the affected tuber surface area, 10 8-10oz. tubers per treatment per replication multiplied by the severity of the sclerotia, where 1 = small sclerotia and 3 = large sclerotia.

Table 2. Effects of different rates of compost on the incidence of potato early blight, San Luis Valley, Colorado, 2003

		Percent Leaves Infected	
Field	Treatment	August 12	August 28
3A	0	2.8	62.5
	4	3.3	57.5
	8	3.2	48.3
	12	5.3	46.3
3B	0	3.1	62.9
	4	2.2	58.8
	8	2.6	59.2
	12	1.6	62.5
Overall Mean	0	3.0	62.7
	4	2.7	58.1
	8	2.9	53.7
	12	3.5	54.4
LSD(P=0.05)		NS	NS

Table 3. Effects of different rates of compost on potato tuber number, size, and quality, San Luis Valley, Colorado, 2003

		Percent[b]										
Field	Treatment[a]	< 4 oz.	No.	4-10 oz.	No.	> 10 oz.	No.	MS[c]	No.	Total lbs.	Total no.	Cwt/A[d]
3A	0	10.4	27.1	56.7	54.1	29.3	14.2	3.6	4.6	44.2	107.8	452.7
	4	8.6	25.8	55.7	54.5	30.7	14.3	5.0	5.4	42.0	99.5	430.3
	8	13.8	33.5	49.8	45.7	32.5	15.6	4.6	5.2	42.0	112.3	430.3
	12	13.6	35.0	45.0	42.0	36.8	18.4	4.7	4.6	44.8	110.5	459.8
3B	0	10.5	31.2	52.7	48.8	33.1	16.5	3.6	3.5	39.3	105.8	403.4
	4	10.4	31.1	56.7	52.7	27.9	13.4	5.0	2.9	43.3	112.0	444.4
	8	11.5	32.5	52.8	48.8	32.9	16.3	2.8	2.5	42.0	110.0	430.9
	12	10.8	32.0	47.1	46.9	39.5	18.7	2.7	2.5	42.9	111.0	440.0
Overall mean	0	10.5	29.2	54.7	51.4	31.2	15.3	3.6	4.1	41.8	106.8	428.1
	4	9.5	28.4	56.2	53.6	29.3	13.8	5.0	4.1	42.7	105.8	437.4
	8	12.3	33.0	51.3	47.2	32.7	16.0	3.7	3.8	42.0	111.1	430.6
	12	12.2	33.5	46.0	44.5	38.1	18.5	3.7	3.5	43.9	110.8	449.9
LSD(P=0.05)		NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

[a] Rate of compost applied in tons/acre.

[b] Based on tuber weight in pounds and tuber number, mean of four replications.

[c] Misshaped tubers.

[d] Total yield expressed as hundred weight per acre, 1-15 foot row per treatment per replication, mean of four replications.

Means followed by the same letter are not significantly different at P=0.05.