IMPACT OF COMPOST AND TILLAGE ON SWEET CORN YIELD, SOIL PROPERTIES, AND NEMATODES

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Abstract. In 1996, an estimated 840,000 tons of municipal solid waste compost was produced in Florida. The objectives of this study were to assess the impact of previous applications of yard waste compost (YWC), new applications of YWC, and three fertilizer rates on sweet corn (*Zea mays*) yield, soil properties, and plant-parasitic nematodes. Three old residual YWC treatments (YWC incorporated, YWC mulch, control) were split with two new YWC treatments (0 versus 120 ton/acre). These split plots were further split and received three fertilizer treatments (full extension recommendation, one-half extension recommendation, and control that received no fertilizer). Therefore, this site in 1998 was a split-split plot with the old YWC main treatments in a randomized complete block design with four replications. On 2 April, 'Silver Queen' sweet corn was planted approximately one month after the application of new YWC. Yield data were collected as well as nematode data from soil samples at planting and near harvest time. Yield was equal among all the old YWC treatments at the full extension fertilizer rate, but was greater for the YWC residual treatments when extension fertilizer recommendations was reduced. New YWC treatments did not significantly impact yield. Extension fertilizer recommendations can possibly be reduced by one-half under the old YWC additions, whereas the control required the full recommendation. Bulk density significantly decreased from both old YWC and new YWC treatments. At field capacity, percent soil water was the highest in the treatments containing old and new applications of YWC.

INTRODUCTION

Recent studies have shown that yard waste compost (YWC) applied to corn (*Zea mays* L.) cropping systems caused improvement in soil properties and some reductions in plant-parasitic nematodes, all highly correlated with increased corn yield (Gallaher and McSorley, 1994a; 1994b; 1994c; 1994d; 1995a; 1995b; 1996; McSorley and Gallaher, 1995; 1996a; 1996b). Corn yield increases are traced to improvement in soil properties from application of YWC (Gallaher and McSorley, 1994c; 1994d; 1996). For example, soil water storage at planting time was increased when YWC was incorporated into the soil and increased even more when YWC was used as mulch (Gallaher and McSorley, 1994c). The objectives of this study were to assess the impact of previous applications of YWC, new applications of YWC, and three fertilizer rates on sweet corn yield, soil properties, and plant-parasitic nematodes.

MATERIALS AND METHODS

The YWC experiment was superimposed on an existing experiment located on the Green Acres Agronomy Field Research Laboratory in Alachua County. The original experimental design was a randomized complete block with four replications. The YWC used in this study was < 1 in sieve size. The Green Acres study was begun in 1993 and the soil type was an Arredondo loamy sand (loamy, siliceous, hyperthermic, Grossarenic Paleudult) (Soil Survey Staff, 1994). The incorporated and mulch treatments received 120 ton YWC/acre each year from 1993 to 1996 for a total of 480 ton YWC/acre. The control treatment received no YWC any year at this site. Sweet corn was grown in 1997 to observe the residual effect of previous treatments on yield (Gallaher, 1998; Gallaher, et al., 1998).

On 2 April 1998, 'Silver Queen' sweet corn was planted approximately one month after the application of new YWC. The old residual YWC treatments were split in 1998 and either received 120 ton new YWC/acre or no new YWC. These latter new YWC treatments were split again and received either the full extension fertilizer recommendation, one-half the extension recommendation, or no fertility (control). The extension fertility recommendation was 150-0-100, lb N, P_2O_5, K_2O per acre and was based on the old YWC control treatment. Nitrogen (NH_4NO_3) was applied in three equal splits and K (KCl) in two equal splits. Therefore the experimental site was a split-split plot experiment in 1998 with four replications. The experimental area was irrigated as necessary and insecticide was applied as needed.

Soil samples were taken to determine bulk density and

water content at harvest following irrigation to field capacity. Bulk density measurements were obtained using the core method and water content was determined by gravimetry with oven drying (Blake, 1965).

Nematode samples were collected at planting and harvest by removing 6 soil cores per subplot. Soil samples were analyzed for nematodes from 100-cm^3 subsamples (Jenkins, 1964). Fresh sweet corn ears were harvested by hand from the two middle rows of each plot, graded according to USDA standards for green corn and weighed (Anonymous, 1954). Completed data was statistically analyzed, followed by mean separation with Duncan's New Multiple Range Test and/or LSD using MSTAT (1985). Graphs were produced using CA-CRICKET Graphics (1990).

RESULTS AND DISCUSSION

Yield

An interaction occurred between old YWC treatments and extension fertilizer recommendation treatments (table 1). Yield was equal among all the old YWC treatments at the full extension fertilizer rate, but was greater for the YWC residual treatments when extension fertilizer recommendations were reduced. New YWC treatments did not significantly impact yield. A 50% to 70% or more higher yield of fancy grade ears was found for both old YWC treatments when averaged across all new YWC treatments and all fertilizer levels, compared to the control treatment (Fig. 1). When averaged across all old and new YWC treatments, fancy grade ears required the full extension fertilizer recommendation (Fig. 2).

Soil data

Bulk density significantly decreased from both old YWC and new YWC treatments. The addition of new YWC to the old YWC incorporated treatment had a bulk density of 0.90 g/cc soil compared to the old YWC control that received YWC, with a bulk density of 1.40 g/cc soil. The highest bulk density was for the old control treatment that had never received any YWC, which was 1.61 g/cc soil. Soil water was highest in the treatments containing both old and new YWC at field capacity (table 2).

Nematodes

All nematodes increased during the growth period of sweet corn (table 3). Root-knot nematode numbers were greatest in YWC-treated plots compared to the control while the reverse was true for lesion nematodes.

SUMMARY

Recycling of urban plant debris as yard waste compost (YWC) requires extensive research in Florida and the USA. This research investigated the use of YWC as a fertilizer amendment and its effect on soil quality and sweet corn yield. Data show that the effect of YWC is for sweet corn yields of fancy grade ears to increase by as much as 70%. Extension fertilizer recommendations can possibly be cut by one-half under these old YWC additions, whereas the control required the full recommendation. Soil quality is highly improved as evidenced by a large reduction in bulk density and by increase in soil water holding capacity of 70 to 150%, depending upon the old and new YWC treatment combination. The more favorable soil quality from addition of YWC resulted in increased corn yield. Greater numbers of root-knot nematode were associated with a more favorable soil environment. The healthier corn likely provided a good host environment for increased root-knot nematode numbers.

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Table 1. Silver Queen Sweet Corn Fresh Ear Weight from Old Residual and New Treatments of Yard Waste Compost (Ywc) and Three Fertilizer Treatments, Gainesville, Florida, 1998.

Extension Fertilizer Recommendations			
Old YWC	Full	One-Half	None
	Total Fresh Ear Weight, lb/acre		
Incorporated	12230 a x	11460 a x	7140 b x
Mulch	11480 a x	10840 a x	5670 b x
Control	10880 a x	6720 b y	1750 c y

CV = 22.6%; LSD = 2234. Interaction significant at 0.05 p. Duncan's New Multiple Range Test and LSD gave same mean separation. Values among old YWC treatments within a fertilizer treatment not followed by the same letter (x, y) are significantly different at the 0.05 level of probability according to Duncan's New Multiple Range Test. Values among the extension fertilizer means within a old YWC treatment not followed by the same letter (a, b, c) are significantly different at the 0.05 level of probability according to Duncan's New Multiple Range Test.

Table 2. Bulk Density and Percent Soil Water at Water Field Capacity for the Silver Queen Sweet Corn Site from Old Residual And New Treatments of Yard Waste Compost (Ywc), Gainesville, Florida, 1998.

	New YWC		New YWC	
Old YWC	Added	Control	Added	Control
	Bulk Density, g/cc		Soil Water, %	
Incorporated	0.90 c	1.22 b*	31.9 a	22.1 a*
Mulch	1.05 b	1.23 b*	23.9 b	21.5 a NS
Control	1.40 a	1.61 a*	16.7 c	12.8 b*

Values among the three old yard waste compost treatments (YWC) within a new YWC treatment not followed by the same letter are significantly different at the 0.05 level of probability according to Duncan's New Multiple Range Test. Values between added and control of new YWC within a old YWC treatment are significantly different, as designated by a *, at the 0.05 level of probability according to LSD. LSD for bulk density = 0.07; LSD for soil water = 3.58. NS = not significant.

Table 3. Nematode Numbers Associated with Silver Queen Sweet Corn from Old Residual and New Treatments of Yard Waste Compost (Ywc) and Three Fertilizer Treatments, Gainesville, Florida, 1998.

	Nematodes			
Old YWC	Stubby-Root	Root-Knot	Lesion	Ring
	Pi - Nematodes/100 cc soil			
Incorporated	3.8 b	38.1 a	2.5 b	51.0 a
Mulch	3.1 b	29.3 a	4.8 b	21.4 a
Control	8.3 a	16.6 a	13.0 a	77.8 a
Pf - Nematodes/100 cc soil				
Incorporated	14.5 a	184.0 ab	20.8 b	424.3 ab
Mulch	13.0 a	238.0 a	18.4 b	160.0 b
Control	9.3 a	113.0 b	40.1 a	747.8 a

Values among the three old yard waste (YWC) compost treatments within a nematode species not followed by the same letter are significantly different at the 0.10 level of probability according to Duncan's New Multiple Range Test. Pi = initial populations at beginning of experiment; Pf = final populations at the end of the experiment. Stubby-Root = *Paratrichodorus minor*; Root-knot = *Meloidogyne incognita*; Lesion = *Pratylenchus* spp.; Ring = *Criconemiodes* spp.

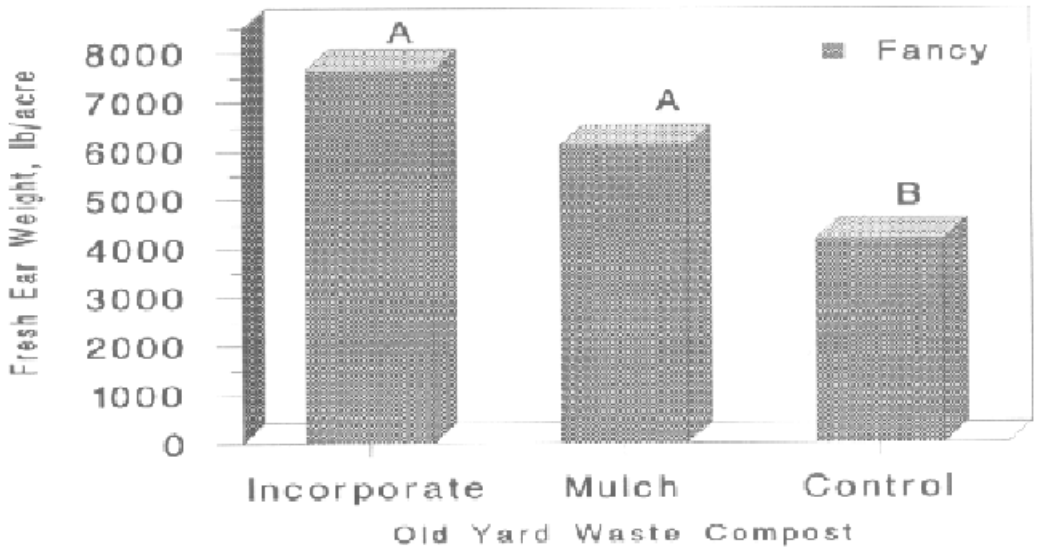
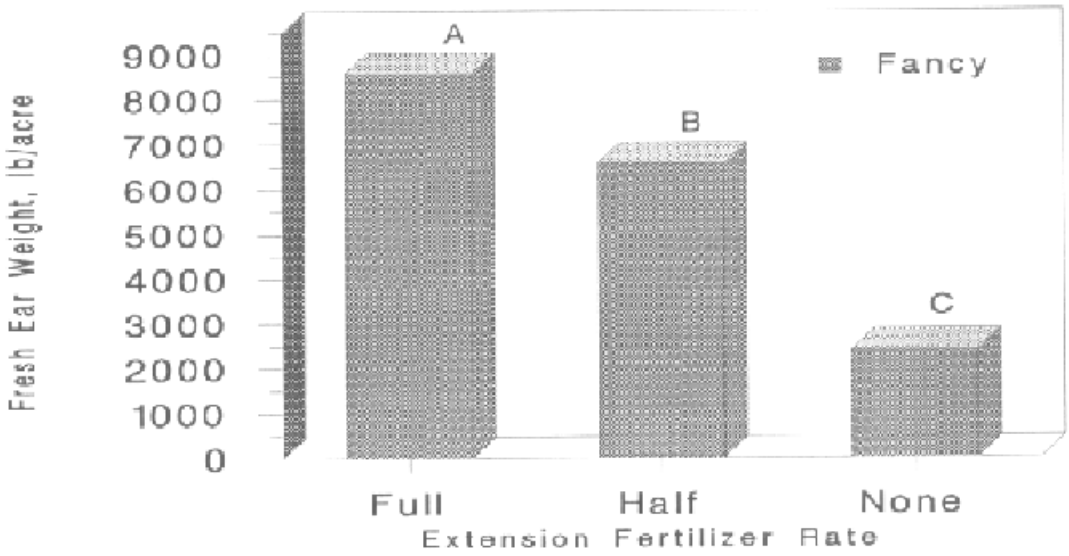


Fig. 1. 'Silver Queen' sweet corn fresh fancy grade ears for old yard waste compost (YWC) treatents averaged over new YWC and fertilizer rates. Values with the same letter are not significantly different at P=0.05.

Fig. 2. 'Silver Queen' sweet corn fresh fancy grade ears for Extension Service fertilizer rates averaged over old yard waste



compost (YWC) and new YWC. Values with the same letter are not significantly different at P=0.05.