

## EFFECT OF ORGANIC AMENDMENTS ON SOIL PROPERTIES AND ORNAMENTAL PLANT GROWTH

R.C. Sloan<sup>1</sup> and S.S. Harkness<sup>1</sup>

<sup>1</sup>Horticulture Research & Education Unit; North Mississippi Research & Extension Center;  
Mississippi State University; Verona, MS 38879

**ABSTRACT:** The second phase of a soil amendment evaluation was initiated in June 2001 to examine the effect of adding supplemental soil amendment to the soil amendment beds constructed in 1999. There was no effect due to the addition of a supplemental amendment on soil bulk density, nor were there were no consistent effects on plant growth due to the supplemental treatments.

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**KEY WORDS:** Soil amendment, pine bark, plant bed, bed preparation, urban soil

**MATERIALS AND METHODS:** Three soil amendment treatments and a non-amended control were evaluated in this trial. 1) Pine bark screened to a 3/8 in maximum was treated with 1% N as anhydrous ammonia and 0.5% iron (PBN). The anhydrous ammonia was applied to the bark by a commercial process. 2) Pine bark screened to a 3/8 in maximum particle size composted with cotton gin waste in a 2:1 ratio (CGW). The cotton gin waste had a fertilizer analysis of 3% nitrogen, 1% phosphorus and 2% potassium. 3) Pine bark which was screened to a 3/8 in maximum size (PB). The two rates of amendment application were 3 and 6 in deep on the plots while the control rate of application was zero. Although no amendment was added to the plot in the control treatment, soil from outside the plots was added to the plots to raise the surface of the plots up to the level of the plots that had amendment added. The seven soil amendment treatments are listed in Table 1. Each of the seven soil amendment treatments was applied across 2 levels of tillage, 4 and 8 in.

The original beds, constructed in 1999 and measuring 15 x 4 ft, were amended with either CGW3, CGW6, PB3, PB6, PBN3, or PBN6. For this phase of the trial each of the original beds were divided into 3 equal subdivisions. The supplemental soil amendments were added at a rate of 100, 50, or 0% (1.0 x, 0.5 x, and 0 x) of the original rate of amendment. Therefore, supplemental rates of amendment added to the beds that received 6 in of amendment in the original construction of the beds were 6, 3, and 0 in (1.0 x, 0.5 x, and 0 x) of amendment. Likewise, the supplemental rates of amendment added to beds that received 3 in of amendment in the original construction were 3, 1.5, and 0 in of amendment.

Two liners of *Ilex cornuta* 'Needlepoint' were planted in each of the subdivisions of the amendment beds in March 2004. The experimental unit for the supplemental amendment treatments was the pair of 'Needlepoint' holly plants. During the growing season fertilizer was

applied monthly at a rate of 7.7 lb 8-8-8 N-P-K (IMC Rainbow Agribusiness Inc, Florence, AL) per 1000 ft<sup>2</sup> of bed. Grassy weeds were controlled with fluzifop at a rate of 4 oz/ac ai post emergence spray while broadleaf weeds were controlled with paraquat at a rate of 12.4 oz/ac ai directed postemergence spray and hand weeding. Water from microsprinklers was applied at a rate of 1 in once per week in absence of rain. The growth index used to measure plant growth was calculated by the following formula:  $\pi \cdot r^2 \cdot h$ . In this formula  $r^2 = (((\text{width1} + \text{width 2})/2)/2)^2$  where width 1 and width 2 were obtained by measuring plant width at right angles to each other to get an average plant diameter and h = plant height.

The experimental design was a split-split plot arrangement of treatments in a randomized complete block design with tillage depth as the main plot factor and the sub plot factor consisting of an augmented factorial arrangement of a control, soil amendment type, and amendment application rate. The sub-sub plot factor was the supplemental rate of soil amendment. The main plots were arranged in a randomized complete block. There were four replications of each treatment plot. The data collected during the trial were analyzed by SAS PROC MIXED (SAS Institute Inc, Cary, NC). Mean separation was conducted with Fisher's Protected LSD at the 0.05 significance level.

## **RESULTS AND DISCUSSION:**

Soil bulk density was measured in the supplemental amendment subplots on November 17, 2004. There was no effect on soil bulk density due to the supplemental application of amendments (data not shown). There were effects on bulk density due to the original soil amendment applications and tillage treatments (Table 2). Since there were no effects due to the supplemental amendment treatments, the data from the subplots that did not receive supplemental amendments was analyzed. These would reflect the effect of the original amendment treatments on soil density. The control plots which received no soil amendment had a greater soil bulk density than the other plots in the trial except for the PBN3 and CGW3 plots. The PB6 plots had the lowest soil bulk density in the trial except for the PBN6 and CGW6 plots.

There was an interaction between the effects of amendment, tillage, and supplemental amendment (amendment \* tillage \* supplemental addition) on the growth of 'Needlepoint' hollies measured on December 9, 2004 (Tables 3 and 4). Because of this interaction, there was no effect on growth of the hollies that could be ascribed to amendment, tillage, or supplemental amendment in a simple manner. There were combinations of amendment plus tillage plus supplemental amendment that did produce larger plants than other combinations of treatments, but these results were inconsistent. The application of supplemental amendment did result in enhanced plant growth in a few amendments in each of the tillage treatments. In the 4 inch tillage, the addition of the 0.5x rate of CGW3 and the addition of the 1.0x rate of PBN6 did result in greater plant growth than the CGW3 and PBN6 plots that received no supplemental amendment. There was no increase in plant growth due to applications of supplemental amendment in the other amendment treatments. In the 8 inch tillage, there were increases in plant growth observed in the 1.0x rate of CGW6 and the 1.0x rate of PB6 compared to the 0x rate for each amendment. Again, there were no effects due to the addition of supplemental amendment in any of the other amendment treatments.

**Table 1.** Soil amendment treatments and rate of supplemental applications to field plots at the North Mississippi Research & Extension Center.

Soil amendment composition	Original rate of application	Supplemental rate of amendment		
		1.0 x	0.5 x	0 x
Pine bark (PB 3)	3 in	3 in	1.5 in	0 in
Pine bark (PB 6)	6 in	6 in	3 in	0 in
Pine bark plus nitrogen (PBN 3)	3 in	3 in	1.5 in	0 in
Pine bark plus nitrogen (PBN 6)	6 in	6 in	3 in	0 in
Pine bark plus cotton gin waste (CGW 3)	3 in	3 in	1.5 in	0 in
Pine bark plus cotton gin waste (CGW 6)	6 in	6 in	3 in	0 in
Control (no amendment)	0 in	0 in	0 in	0 in

**Table 2.** Effect of pine bark based soil amendments on soil bulk density measured November 17, 2004.

Soil Amendment	Bulk density g/cm <sup>3</sup>
Control	1.23 a <sup>z</sup>
PBN3	1.05 ab
CGW3	1.04 ab
PB3	1.02 b
PBN6	0.94 bc
CGW6	0.909bc
PB6	0.79 c
Tillage depth	
4 inch	0.85 b
8 inch	1.02 a

<sup>z</sup> Means with the same letter do not differ at the 5% significance level by Fisher's Protected LSD.

**Table 3.** Effect of pine bark based soil amendments and 4 inch deep tillage on growth of *Ilex cornuta* ‘Needlepoint’ measured December 9, 2004.

Treatment	Addition	Size cm <sup>3</sup> <sup>z</sup>
PBN6	1.0	22407 a <sup>y</sup>
CGW3	0.5	21758 ab
CGW6	0.5	21664 a-c
CGW3	1.0	21147 a-d
CGW6	0	17748 a-e
PBN6	0.5	17557 a-f
CGW6	1.0	17541 a-g
PBN3	0.5	17170 a-h
PBN3	1.0	16022 a-i
PB6	1.0	14741 b-j
CGW3	0	14135 c-j
PB6	0	13671 d-j
PBN6	0	13305 d-j
PBN3	0	13257 e-j
PB6	0.5	13043 e-j
PB3	1.0	9553 ij
PB3	0	8648 ij
PB3	0.5	8159j
LSD = 7550		

<sup>z</sup> Growth Index =  $p \cdot r^2 \cdot h$

<sup>y</sup> Means with the same letter do not differ at the 5% significance level by Fisher’s Protected LSD.

**Table 4.** Effect of pine bark based soil amendments and 8 inch deep tillage on growth of *Ilex cornuta* ‘Needlepoint’ measured December 9, 2004.

Treatment	Addition	Size cm <sup>3</sup> <sup>z</sup>
PB6	0.5	24406 a <sup>y</sup>
CGW6	1.0	22006 ab
PBN6	1.0	21256 a-c
PB6	1.0	21171 a-d
PBN3	1.0	19229 a-f
PB3	1.0	18251 a-f
CGW3	0	18129 a-f
PBN3	0.5	17281 a-f
PBN6	0.5	15548 b-f
PBN6	0	14332 c-f
CGW3	0.5	13851 c-f
PBN3	0	13715 c-f
CGW6	0.5	13510 f
PB3	0.5	13372 f
PB3	0	12929 f
CGW3	1.0	12772 f
CGW6	0	12499 f
PB6	0	10984 f

LSD = 7550

<sup>z</sup> Growth Index =  $\pi \cdot r^2 \cdot h$

<sup>y</sup> Means with the same letter do not differ at the 5% significance level by Fisher’s Protected LSD.