Pine Chips: Peat Substrate Ratios and Fertilizer Rates Affect Plant Growth

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Index Words: container media, nutrition, loblolly pine, wood fiber

Significance to the Industry: This study shows that plants can be grown in 100 percent pine chips if fertilizer rates are increased from 200 ppm N to 300 ppm N or with no additional fertilizer if pine chips contain at least 40 percent peat moss by volume.

Nature of Work: The increased cost and limited availability of pine bark (PB) and peat moss (PM) have prompted many studies related to the development of a new substrate for growing nursery crops. Wright and Browder (2) conducted studies to evaluate the potential of pine chips (PC) as a suitable alternative nursery substrate to PB and PM. They concluded that PC is capable of growing nursery crops, but it was noted that the electrical conductivity (EC) of the PC substrate was lower than a PB substrate, possibly due to nutrient leaching in the more porous substrate. They hypothesized that by adding PM or other composts to the PC substrate, container capacity could be increased and aeration decreased thereby improving plant growth.

The objective of this research was to determine if adding various amounts of sphagnum PM to PC would increase plant growth due to PM's high water holding capacity (WHC) and cation exchange capacity (CEC), and to determine the quantity of fertilizer required as percent PM increased.

On February 2, 2006 coarse loblolly pine (*Pinus taeda* L.) chips were further ground in a hammer mill (Meadows Mills, Inc., North Wilkesboro, NC) fitted with a 4.76 mm (3/16 inch) screen to a particle size suitable for plant growth. The initial chips were produced by grinding a 17 m long by 25 cm basal diameter debarked loblolly pine log with a Morbark Chipper (Winn, MI) operated at Wood Preservers, Inc., Warsaw, VA. Pine chips were amended with PM (Premier Pro-Moss) (Premier Tech, Quebec, Canada) at the following levels as percent of the total volume: 0 to 100% in 10% increments. Marigold (*Tagetes erecta* Big. 'Inca Gold') seeds were sown on February 3, 2006 in a 144 plug tray. The marigolds were transplanted into 1-quart containers containing the various treatments on February 17. All treatments were fertilized at each watering (250 mL of beaker-applied) with either 50, 100, 200, or 300 ppm N using a 20N-4.4P-16.6K fertilizer (20-10-20 Peat-lite, Scotts Company, Marysville, OH). There were two reps per fertilizer rate per treatment. Calcium sulfate ($CaSO_4$) was pre-plant incorporated into each substrate at a rate of 0.6 kg/m^3 (1 lb/yd^3) also dolomitic lime was pre-plant incorporated to the peat at a rate of 3.6 kg/m^3 (6 lb/yd^3). Shoots were severed at the substrate surface on March 16, dried at 65° C, and weighed. This experiment was a completely randomized design with two single container replications per treatment per fertilizer rate and was subjected to regression analysis using SigmaPlot (version 9.01 SPSS Inc., Chicago, IL).

Results and Discussion: Shoot dry weight of marigolds grown in ground pine chips fertilized with 50, 100, and 200 ppm N increased as the percent PM increased (Fig. 1). However, the dry weight of plants fertilized at 300 ppm N did not increase with an increasing PM amendment since the higher fertility rate provided sufficient nutrients without the addition of PM. Results are consistent with Wright and Browder (2) demonstrating the suitability of PC as an alternative substrate; however, additional fertilizer (300 vs 200 ppm N) is required for marigold unless PM is incorporated at rates of at least 40 percent.

Literature Cited:

1. Wright, R.D. 1986. The pour-through nutrient extraction procedure. HortScience 21:227-229.
2. Wright, R.D. and J. F. Browder. 2005. Chipped pine logs: a potential substrate for greenhouse and nursery crops. HortScience 40:1513-1515.

Figure 1. Shoot dry wt of marigold grown in pine chips amended with varying percentages of peat by volume and fertilized at 50, 100, 200, and 300 ppm N. R^2 and equations are: 50 ppm (•), $r^2 = 0.98$; $y = 0.5871 + 0.0264x – 4.0093x^2$; 100 ppm (◊), $r^2 = 0.97$; $y = 1.4392 + 0.0361x – 0.0001x^2$; 200 ppm (x), $r^2 = 0.80$; $y = 2.6471 + 0.0464 – 0.0003$; 300 ppm (▲), $r^2 = 0.69$; $y = 4.1369 + 0.0142x – 0.0001x^2$.