Lime and Micronutrient Use in Clean Chip Residual Substrate Amended with Composted Poultry Litter or Peat for Use in Annual Production

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Significance to Industry: Clean Chip Residual (CCR) has been identified as possible replacement for pine bark (PB) in nursery and greenhouse production. Composted poultry litter (CPL) is a major waste problem in Alabama for which uses need to be explored. Pine bark, CCR, CPL and peat were tested in 7:1 v:v ratios with each other and with or without lime or micronutrients to determine the best substrates for annual production. Results indicate that *Petunia* x *hybrida* 'Dreams Sky Blue' can be grown in PB or CCR, but use of CPL is not recommended for *Petunia*. Lime and micronutrients did not produce substantial differences in plant growth.

Nature of Work: Finding an alternative to PB and peat as nursery and greenhouse substrates is an important area of research due to rising costs for growers and the demand for consumer product prices to stay the same. Reduced domestic forestry harvesting combined with use of PB as a source of fuel and other alternative uses (3) has and is continuing to lower supplies of PB available to the green industry. In addition, the high cost of shipping PB in the U.S. and peat from Canada has driven the need to develop alternative substrates.

Recent studies have identified a potential alternative substrate: CCR. This material is composed of limbs, needles and bark after pine plantations are thinned at about the 10-12 year age to produce pulpwood. Generally this material is left in the field or sold as boiler fuel. While CCR has a high wood content (~50%) it also has high bark content (~40%). The remaining 10% is composed of needles, and other miscellaneous forest materials. CCR has been evaluated in a fresh state to produce both annual (2) and perennial species (1).

Poultry litter is a major agricultural waste problem in Alabama. Developing uses for this material is an important environmental issue. Composted poultry litter has the potential to provide necessary macro- and micronutrients that may enhance plant growth. However, CPL can potentially harm some crops due to high pH and soluble salts (EC). Recommendations are that CPL must be used as an amendment in quantities less than 20% in order to avoid unnecessary substrate shrinkage and crop damage (4).

Lime and micronutrients are standard amendments in many nursery substrate mixes; however, they have not yet been tested in CCR to determine if their use is necessary. The objective of this study was to evaluate two substrates (aged PB and CCR), two amendments (peat and CPL), with and without lime and micronutrients in order to determine production practices for producing annuals in substrates containing CCR and/or CPL.

CCR was processed through a 4-inch screen in the field. A hammer mill was used to further process CCR to pass a 0.19 inch screen. The CPL was composted for three days in an in-vessel composter. Substrates were mixed in a 7:1 ratio with either of the two amendments creating four main substrate mixes. Substrates were mixed per yd^3 with 10 lb. 14-14-14 (14N–6.1P–11.6K) Osmocote 3-4 month fertilizer. Four combinations of lime (L, 5 lb. dolomitic limestone) and micronutrient (M, 1.5 lb. MicroMax) use were prepared per yd^3 for each of the four main substrate mixes: yes L, yes M; no L, yes M; yes L, no M; and no L, no M. Four-inch containers were filled and planted with two plugs (228 cell) of *Petunia* x *hybrida* ‘Dreams Sky Blue’. Containers were placed in a greenhouse, liquid fed initially (300 ppm N) to provide a starter nutrient charge and irrigated as needed thereafter. Four replications were harvested at 21 days after planting (DAP) and the remainder were harvested at 35 DAP.

Results & Discussion: There were few differences between PB and CCR. At 21 DAP, plants grown in PB had slightly more rootball coverage, with no difference 35 DAP. Leaf greenness was slightly higher for plants grown in pine bark at 28 DAP. Leaf greenness at 15 and 28 DAP was higher for plants grown in CPL. However, all other measurements were smaller for plants grown in CPL. At 21 and 35 DAP plant growth index (PGI), rootball coverage (RBC) and shoot dry weight (SDW) were greatest when substrates contained peat. Flower number (FN) at 35 DAP was also greater for plants in substrates containing peat. Composted poultry litter resulted in greater substrate shrinkage than peat (0.17 inch vs. 0.08 inch).

Shoot dry weight at 21 DAP was slightly higher for substrates containing lime, but those differences were not present by 35 DAP. At 35 DAP RBC was higher for substrates containing lime. Lime had no effect on leaf greenness at 15 or 28 DAP, PGI at 21 or 35 DAP or FN at 35 DAP.

Leaf greenness for plants grown in substrates containing micronutrients was lower than leaf greenness for plants grown in substrates without micronutrients at both 15 and 28 DAP. Plant growth index, RBC and SDW at 21 and 35 DAP were similar as were FN at 35 DAP.

Foliar nutrient content analysis (data not shown) indicated that all plants in the test were low in nitrogen, potassium, calcium and magnesium. There were no differences in nitrogen content for plants amended with either peat or CPL. Manganese was significantly high in substrates containing CCR or peat or no lime or micronutrients. Substrates containing CPL had higher pH and EC (6.3-6.5 and 5.00-0.65 vs. 4.8-5.2 and 2.66-034 for peat) (data not shown). Pine bark generally had a lower pH (5.1-5.7) than CCR (6.0-6.2), but EC showed a similar trend (3.8 at 1 DAP down to 0.5 at 28 DAP). Substrates containing lime had higher pH (6.0-6.3) than those not containing lime (5.1-5.5), while substrates with micronutrients had similar pHs throughout the study (5.5-5.9).

In summary, PB and CCR were similar in plant growth response while plants grown in substrates amended with CPL had less growth. Lime and micronutrient use did not make an appreciable difference in plant growth for *Petunia* 'Dreams Sky Blue'. Pine bark, CCR, and peat can therefore be recommended as substrates for *Petunia*. Composted poultry litter is not recommended for use as an amendment in production of *Petunia* x *hybrida* 'Dreams Sky Blue'.

Literature Cited

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Table 1. Main effects of substrate, lime and micronutrient use on the growth of *Petunia* x *hybrida* 'Dreams Sky Blue'.

	15 DAP[z]	21 DAP			28 DAP	35 DAP			
Treatment	**Leaf greeness[y]**	**GI (g)[x]**	**Rootball coverage[w]**	**Shoot dry weight (g)[v]**	**Leaf greeness**	**Flower number**	**GI (g)**	**Rootball coverage**	**Shoot dry weight (g)**
Substrate									
Pine bark	36.8 a[u]	16.2 a	2.9 a	2.7 a	37.2 a	10.5 a	18.9 a	3.3 a	5.6 a
Clean chip resiual	37.4 a	15.7 a	2.6 b	2.7 a	34.7 b	11.1 a	18.1 a	3.0 a	5.2 a
Amendment									
Peat	35.2 b	18.8 a	4.0 a	3.4 a	34.2 b	16.7 a	21.5 a	3.8 a	7.5 a
Composted poultry litter	39.0 a	13.1 b	1.5 b	2.0 b	37.8 a	4.9 b	15.5 b	2.5 b	3.4 b
Lime									
Yes	37.4 a	16.4 a	2.8 a	2.9 a	36.5 a	11.0 a	18.6 a	3.3 a	5.6 a
No	36.9 a	15.6 a	2.8 a	2.5 b	35.5 a	10.6 a	18.4 a	3.0 b	5.3 a
Micronutrients									
Yes	36.2 b	16.1 a	2.9 a	2.7 a	35.0 b	10.7 a	18.5 a	3.1 a	5.4 a
No	38.1 a	15.9 a	2.6 a	2.7 a	37.0 a	11.0 a	18.5 a	3.2 a	5.5 a

[z]Days after potting.
[y]Leaf greeness of 4 recently matured leaves per plant using a SPAD 502 Chlorophyll Meter.
[x]Growth index = (height + width + perpendicular width) ÷ 3 (1 cm = 0.397 in.).
[w]Rootball coverage measured on a scale of 1-5 where 1 = no roots, 2 = 0-25% coverate, 3 = 26-50% coverage, 4 = 51-75% coverage, and 5 = 76-100%
[v]Shoots harvested at container surface and oven dried at 70°C for 48 h (1 g = 0.0035 oz.).
[u]Mean separation within column by Duncan's Multiple Range test (α = 0.05).