Wulpak Used as a Mulch or an Amendment for Nursery Potting Substrates

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Abstract

Wulpak is a pelleted waste by-product derived from wool products manufacturing litter. It contains no manure or compost although it contains significant plant available nutrients. Preliminary reports suggest that mulching the top of container grown nursery crops provides a weed, moss and algae barrier and acts as a starter fertilizer by enhancing green color and stimulating new growth. To evaluate the usefulness of Wulpak, two studies were conducted. The objective of the first study was to compare the effect of supplemental fertilizing and use of Wulpak as a top mulch compared to incorporation into the potting substrate on plant growth, foliar and substrate nutrient concentrations. The objective of the second study was to evaluate Wulpak compared to PennMulch, a pelleted newspaper product, applied at two mulch depths for control of common nursery weeds. After 70 days, petunias were larger when top-dressed with supplemental Controlled Release Fertilizer (CRF) compared to the standard pine bark substrate or the Wulpak mulch or incorporation-only treatments. Tissue N was not significantly different among any treatments. Tissue P was higher in all Wulpak mulch and incorpation treatments compared to the pine bark standard. Leachate pH was consistently lower in the Wulpak top mulch treatments. Common groundsel and horseweed were controlled by all mulch treatments; although, after three months some common groundsel emerged in the 0.6 cm PennMulch pots. Spotted spurge and longstalked phyllanthus were controlled by both depths of Wulpak and by 1.3 cm PennMulch, but not by 0.6 cm PennMulch. Crabgrass was controlled only by the 1.3 cm Wulpak treatment.

INTRODUCTION

Wulpak is a pelleted waste wool by-product derived from wool products manufacturing litter. It contains no manure or compost although manufacture claims indicate that significant plant nutrients are available. The product is available in the US from Wilbro Inc., Norway, S.C. 29113, under an import agreement with APT Marketing, in Lincoln, UK. Preliminary reports suggest that mulching the top of container grown nursery crops provides a weed, moss and algae barrier and acts as a starter fertilizer by enhancing green color and stimulating new growth. In 1999, Wulpak was a new product in the US and was sold to nursery operators with only limited guidelines for its use.

To evaluate the usefulness of Wulpak as a mulch on the surface of containers, two studies were conducted. The objective of the first study was to compare the effect of using Wulpak as a top mulch or as an addition to the potting substrate on plant growth, foliar and substrate nutrient concentrations. The objective of the second study was to evaluate Wulpak and PennMulch applied at two depths for control of common nursery weeds.

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MATERIAL AND METHODS

Mulch and Amendment Experimental Conditions

The study was initiated on May 12, 1999 on a container plant production area located at the Horticulture Field Laboratory, Raleigh, N.C. Individual spray stakes in each 3.8 L container applied approximately 600 ml of water daily using three cyclic applications between 6:00 a.m. and 9:00 a.m. Crops included in the study were ‘Sunglow’ azalea, *Rhododendron sp*. 'Sunglow' and Petunia x hybrida. Five plants of each test species were planted into containers either top mulched with 68.5 grams of Wulpak or an equal amount was incorporated with pine bark. The rate corresponded to the rate on the Wulpak bag label at 22 kg m^{-3}. Test substrates were either supplemented with Wilbro 18 N-2.6P-10.0 K (18-6-12) 8 to 9 month controlled release fertilizer (CRF) or were only fertilized with nutrients available from the Wulpak. Test substrates were as follows: (1) the “Pine bark Standard” substrate: amended with 2.9 kg m^{-3} dolomitic limestone, 580 g m^{-3} Wilbro booster micronutrient supplement incorporated and top-dressed with 16 g Wilbro/Polyon CRF resulting in approximately 2.88 g N (3.8 L pot)$^{-1}$; (2) “Wulpak top-dress”: a rate of 68.5 g (pot)$^{-1}$ of Wulpak was spread evenly over the surface of the container. Although the amount of nitrogen available during the crop growing period is not known, based upon the waste analysis, approximately 3.9 g N was applied to each container; (3) ”Wulpak top-dress + CRF”: Wulpak was applied at 68.5 g and 8.0 g Wilbro/Polyon CRF was top-dressed per container, providing about 5.3 g N (pot)$^{-1}$, 3.9 g N and 1.4 g N from Wulpak and Wilbro/Polyon CRF, respectively; (4) “Wulpak Incorporated”: 68.5 g of Wulpak were incorporated into pine bark providing approximately 3.9 g N (pot)$^{-1}$; (5) “Wulpak Incorporated + CRF Top-dress”: Wulpak was incorporated into pine bark at 68.5 g and top dressed with 8.0 g Wilbro/Polyon CRF providing approximately 5.3 g N (pot)$^{-1}$. Five fallow containers were saved for physical property evaluation for each substrate (data not shown). Petunias were harvested after 70 days (July 21, 1999) and top dry weight and nutrient levels analyzed. Container leachates were collected monthly from azaleas May through September and analyzed for pH, EC, NH_4-N, NO_3-N and P. Azaleas were maintained for one year after potting then a second analysis was conducted from test substrate containers to provide information about mineralization of Wulpak. Data were subjected to ANOVA and means separated using least significant differences at $p \leq 0.05$.

Mulch Weed Control Experimental Conditions

On 13 July, 1999, 3-liter containers were filled with a bark + sand substrate (5:1 v/v) and copiously seeded with seeds of spotted spurge (*Euphorbia maculata* L.), large crabgrass (*Digitaria sanguinalis* (L.) Scop.), horseweed (*Conyza canadensis* (L.) Cronq.), longstalked phyllanthus (*Phyllanthus tennelus* Roxb.), and common groundsel (*Senecio vulgaris* L.). There were three pots of each species per treatment per replicate with four replications for a total of twelve pots per treatment. PennMulch, a pelleted recycled newspaper product, and Wulpak, a pelleted wool product, were each applied at 0.6 cm and 1.3 cm depths. To achieve the 0.6 cm layer of mulch in a 15 cm diameter container 76 g of Wulpak and 66 g of PennMulch were required. Both PennMulch and Wulpak expand when wetted. PennMulch expands to about twice its dry volume. Wulpak expands to about 1.3 times its dry volume. Pots received approximately 2.5 cm of over-head irrigation daily. Weed control was visually evaluated four and twelve weeks after initiation on a percent scale where 0 = no weed control, 100 = complete control, and 50 = 50% reduction in above ground biomass.

RESULTS AND DISCUSSION

Mulch and Amendment Experimental Conditions

An initial nutrient analysis of Wulpak revealed a 5.8% nitrogen content 5.1% of which was inorganic nitrogen (Table 1). Approximately 7024 ppm (0.7%) was NH_4-N

and 49 ppm were NO_3-N which may account for observed "quick start"-fertilizer characteristics. After one year, nitrogen concentration dropped to less than 6% of the initial nitrogen content and was most likely bound in organic compounds in the wool. Other nutrient concentrations from Wulpak mulch taken at the beginning of the study and after one year as a mulch are shown in Table 1. Petunias were larger when top-dressed with supplemental CRF (Fig. 1). Tissue nitrogen concentrations were not significantly different among any treatments. Phosphorous tissue concentration was higher in all Wulpak treatments compared to the pine bark standard (data not shown). Conversely, magnesium tissue concentration was lower in Wulpak treatments and calcium was lower in mulch treatments compared to pine bark supplemented with dolomitic limestone. Leachate pH was consistently lower in the Wulpak top mulch treatments. For example, four weeks after potting, pH of Wulpak top mulch treatments were 5.9 and 5.6; the pine bark standard was 6.3 and Wulpak incorporation treatments were both 6.2. EC levels were higher for the Wulpak top mulch and Wulpak + CRF treatments potting (1.1 $dS(M)^{-1}$ and 1.3 $dS(M)^{-1}$, respectively) in May (10 days after potting) compared to Wulpak incorporation and Wulpak incorporation + CRF (both at 0.7 $dS(M)^{-1}$) and the pine bark standard at 0.3 $dS(M)^{-1}$. The higher EC, was likely due to higher leachate NH_4-N in May which were 34.0 and 40.0 ppm respectively in the top mulch treatments, compared to the Wulpak incorporation treatments which both had 31.0 ppm NH_4-N, while the pine bark standard had only 1.5 ppm NH_4-N. Conversely, phosphate concentrations in May were higher for Wulpak incorporation and Wulpak incorporation + CRF (13.0 ppm and 14.0 ppm, respectively), which were higher than Wulpak top mulch and Wulpak topmulch + CRF (6.4 ppm and 7.6 ppm, respectively. The pine bark standard with 3.6 ppm had lower phosphate concentrations than any Wulpak treatments (data not shown).

Weed Control Study Results

Control ratings were generally similar for the four-week and twelve-week ratings. Common groundsel and horseweed were controlled by all mulch treatments; although, some common groundsel emerged in the 0.6 cm PennMulch pots by 12 weeks (data not shown). Spotted spurge and longstalked phyllanthus were controlled by both depths of Wulpak and 1.3 cm PennMulch, but not by 0.6 cm PennMulch. Crabgrass was controlled only by the 1.3 cm Wulpak treatment. These results are similar to a previous report in which pelleted waste newspaper products controlled hairy bittercress (*Cardamine hirsuta* L.) and spotted spurge as well as industry-standard herbicide treatments (Wooten and Neal, 2000; Smith et al., 1998).

CONCLUSION

Wulpak used as a topdress does not appear to require any changes in nursery standard practices associated with the addition of dolomitic limestone in potting substrates. When Wulpak was incorporated into pine bark, pH was similar to pine bark that had been amended with dolomitic limestone. Magnesium tissue levels were low in petunia for all Wulpak treatments and calcium concentrations in top mulched plants were also low. Therefore, if calcium and magnesium nutrition are adequate for standard crop production at the nursery, it does not appear necessary to alter normal practices with use of Wulpak. The starter fertilizer characteristics may be a result of the higher initial NH_4-N levels from Wulpak ranging from 30 to 40 ppm compared to < 2 ppm from the standard. Increased phosphorus nutrition both in leachates and tissue P levels may be a positive attribute for use of Wulpak. Data for weed control in containers after four weeks suggest that pelleted wool and waste newsprint could be effective alternatives to preemergence herbicides for weed control in container-grown nursery crops.

Literature Cited

Wooten, R.E. and Neal, J.C. 2000. Evaluations of PennMulch, Wulpak and Geodisk for weed control in containers. Proceedings of the Northeastern Weed Science Society 54:96 (abstract).

Smith, D.R., Gilliam, C.H., Edwards, J.H., Olive, J.W., Eakes, D.J. and Williams, J.D. 1998. Recycled waste paper as a non-chemical alternative for weed control in container production. J. of Environmental Hort. 16(2):69-75.

Tables

Table 1. Nutrient concentrations, pH and C:N ratio of Wulpak pelleted waste wool by-product.

Nutrient	Initial concentration	One year in container Concentration
Total Nitrogen (ppm)	58101	3336
NH_4 –N	7024	
$N0_3$ –N	49	
Phosphorus (ppm)	9344	457
Potassium (ppm)	24015	458
Calcium (ppm)	43028	8223
Magnesium (ppm)	3267	887
Sulfur (ppm)	27641	422
Iron (ppm)	3318	1176
Manganese (ppm)	205	46
Zinc (ppm)	187	27
Copper (ppm)	49	7
Boron (ppm)	25	11
Chlorine (ppm)	3730	
Sodium (ppm)	3510	656
PH	5.8	5.0
EC dS m^{-1}	2.3	1.8
C:N	4.9	116.72

Figures

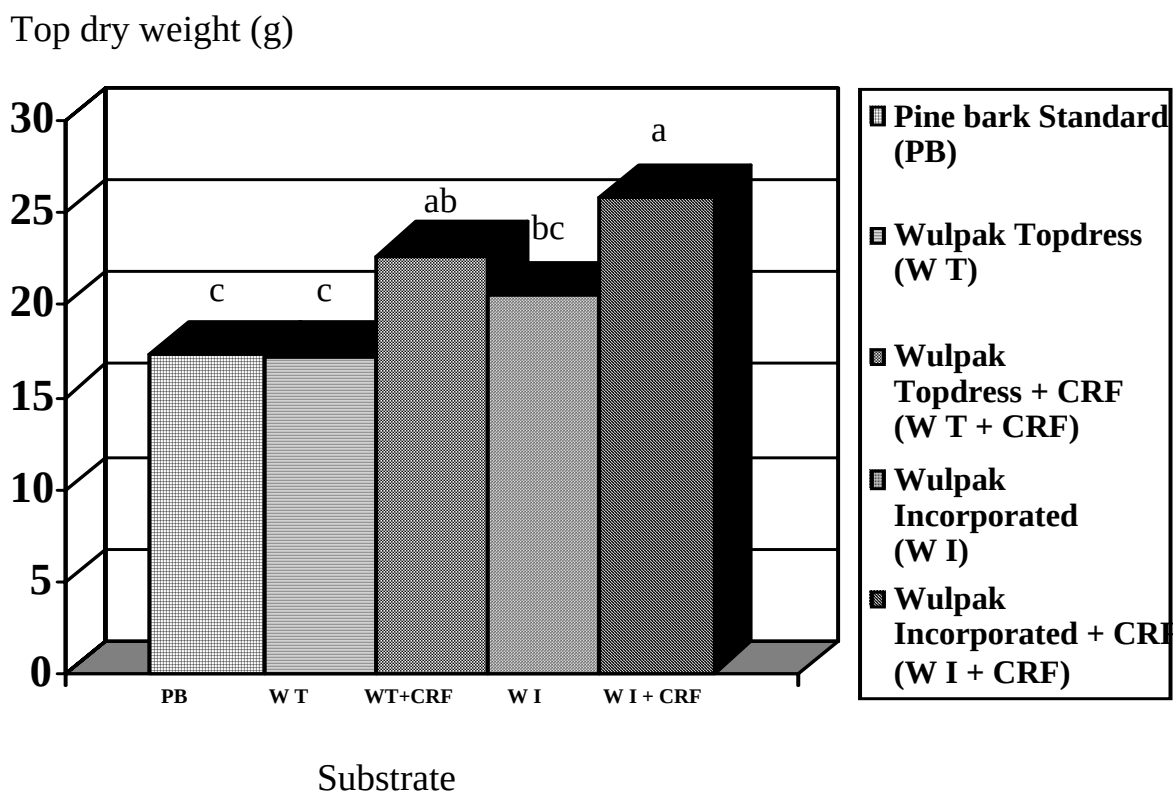

Fig. 1. Effect of supplemental CRF on Petunias (top-dressed application).

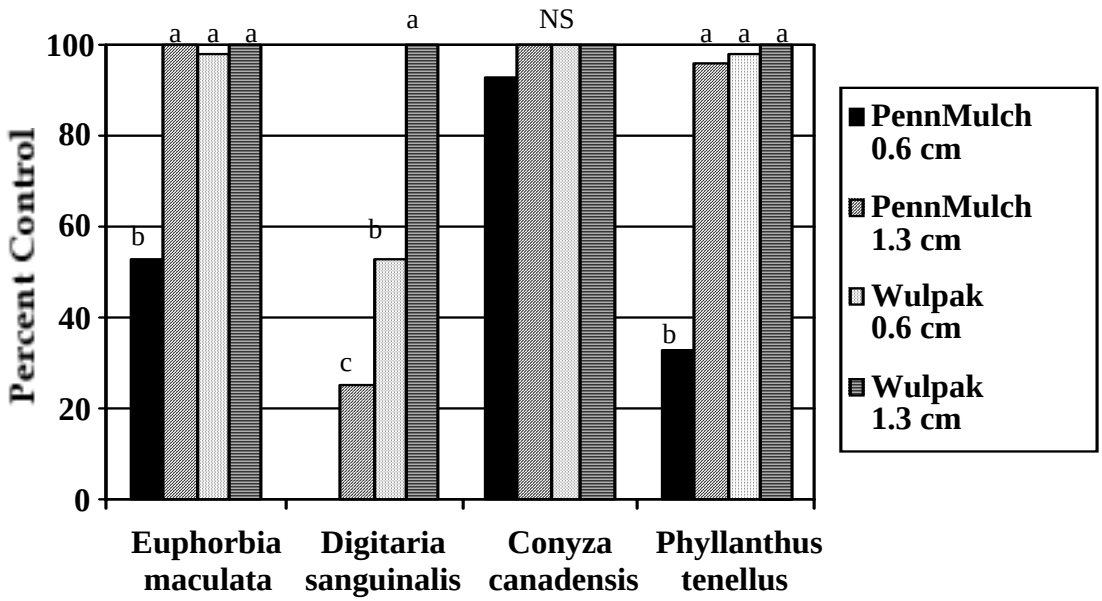

Fig. 2. Weed control in containers with PennMulch and Wulpak four weeks after test initiation.