Evaluating Performance and Stability of Polyethylene Terephthalate (PET) and Cellulose Polymer as Soilless Mix Components

In the U.S., concerns over the long-term sustainability of peat, perlite, and other media components have led to searches for alternative materials. FiberFill, a synthetic fiber made of recyclable polyethylene terephthalate, and Tencel, a cellulose fiber polymer, are new materials with potential as substrate components. FiberFill blocks have already been used for hydroponic vegetable production, but its suitability as well as the suitability of Tencel has not yet been tested as soilless mix components.

The growth of several floriculture crops was tested using substrates containing different proportions of the two polymers. The long-term stability of the materials was tested by measuring respiration rates of the different components by themselves or as blends with peat. A peat- or coir-based mix was amended with the polymers up to 100% of the final volume and fertigated with water-soluble fertilizer as needed. Visual observations of plants, dry weight (DW), leaf area (LA), and consumer preference were measured. Plants grown in 100% FiberFill or Tencel were shorter and had smaller DW and LA than plants grown in partially-amended substrates with the exception of begonia, which were largest in 100% and 75% FiberFill (Figure 1 and 2).

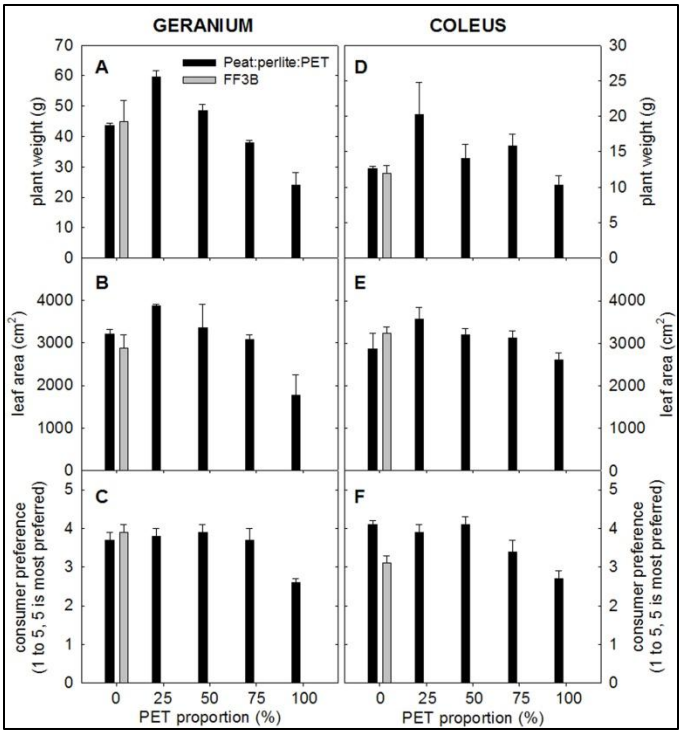

Figure 1. Geranium and coleus weight, leaf area, and consumer preference when grown in peat: perlite substrates containing different amounts of polyethylene terephthalate (PET). A commercial substrate (Fafard 3-B, FF3B) was grown as a negative control for comparison purposes. Error bars indicate standard deviation of the mean.

Substrates containing 50% FiberFill produced plants that were equal to or larger than substrates containing less polymer. Plants grown in Tencel-containing mixes were consistently smaller than plants grown in substrates containing an equal amount of FiberFill. Initial respiration rates of Tencel were lower than those of peat or peat:perlite blends, but after only ten days, respiration rates of Tencel increased after saprophytic organisms colonized the material (Table 1). These results indicate that FiberFill has potential as soilless mix component, but the high respiration rates suggest Tencel would not be suitable for long-term (>6 months) production. However, the movement of the U.S. floriculture industry towards sustainability likely favors the adaptation of the cellulose-based component, Tencel.

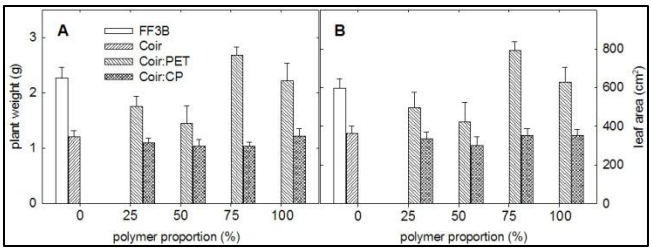

Figure 2. Begonia weight (A) and leaf area (B) grown in a commercial mix (Fafard 3-B, FF3B), coconut coir (Coir), or coir blended with different amounts of polyethylene terephthalate (PET) or cellulose polymer (CP).

Table 1. Respiration rates of polyethylene terephthalate (PET), cellulose polymer (CP), peat:perlite blend, and a 50% peat:perlite/CP blend at four time points after hydrating with a fertilizer solution. After eight weeks of incubation at room temperature (23°C), the materials were dried and weighed to determine the total amount of material lost through respiration.

	Time (weeks)				Weight lost
	0	1.5	6	8	
	μmol CO_2/h/g material				mg (SD)[1]
PET	0.06 f[2]	0.71 ef	0.41 ef	0.97 cdef	3.6 (9.1)
CP	0.12 ef	4.40 b	3.35 bc	3.22 bcd	129.2 (60.2)
Peat:perlite	2.55 bcde	3.31 bcd	0.85 def	0.93 cdef	45.2 (16.2)
Peat:perlite:CP	0.12 ef	10.79 a	2.15 bcdef	1.70 cdef	117.5 (11.3)

[1] weight lost shown with standard deviation.
[2] numbers followed by different letters indicate significant differences ($P < 0.05$) between respiration rates based on Tukey's multiple comparison of means.

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