e-GRO Research Update

January 2015, #2015.04

MICHIGAN STATE UNIVERSITY

Animal Tissue Compost (ATC) as a Substrate Amendment

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Much research has been performed on reducing or replacing peat as a substrate component in horticulture because of scarcity issues as well as harvesting environmental concerns. At the same time, animal farm operations have been seeking a sustainable waste stream with which to manage normal on-farm animal mortality. A potential solution to both problems is to use composted animal tissues as a substrate component for floriculture crops. If the compost is produced cheaply enough and is suitable for greenhouse production, not only could the floriculture industry benefit from a cheaper substrate component but the animal industry could also benefit by having a sustainable and potentially profitable waste stream as well.

The Experiment

We conducted an experiment at Michigan State University (MSU) to determine if animal tissue compost (ATC) could be used in floriculture production. ATC was produced in a composting facility at the MSU South Campus Farms using soiled (with urine, manure, and hay) sawdust bedding mixed in with assorted animal tissues from MSU farms (dairy calves, foals, adult and young sheep, adult and young swine). Compost was aerated and mixed for a minimum of 6 months and then cured for 6 to 10 months more.

Five substrate treatments that consisted of four different ratios of ATC

Summary of Findings

- Geranium and petunia growth was excellent no matter the amount of Animal Tissue Compost (ATC) added.
- Marigold and pansy growth was the same as the control (0% ATC) if only 20% of ATC was used. If more ATC than that was used, marigold and pansy growth suffered.
- ATC has the potential to be a peat extender in floriculture substrates when used in ratios of 20% or less.

Table 1. Substrate treatments used in this study along with their initial properties. *Using saturated media extract method

Treatment			Initial Substrate Properties				
Peat (%)	ATC (%)	Perlite (%)	pH	EC* (mS/cm)	Nitrate (ppm)	Phosphorus (ppm)	Potassium (ppm)
80	0	20	3.9	0.6	22	6	12
60	20	20	4.5	3.5	287	248	504
40	40	20	5.2	5.6	615	236	1037
20	60	20	5.4	6.9	861	178	1381
0	80	20	6.0	7.6	971	134	1596
Recommended Ranges:			5.0-6.8	0.7-3.5	40-200	3-10	60-250

and Canadian sphagnum peat moss were formulated, all containing 20% medium grade horticultural perlite (see Table 1).

Table 1 also shows the initial properties of the substrates. The control substrate (0% ATC) was generally within or close to the published recommended ranges for the properties measured (except for pH, as lime was not added). For the most part, all other treatments containing ATC were high for EC, nitrate, phosphorus and potassium. If you are considering using similar compost in your substrate mix, these properties may be items of concern.

The plant material used was: geranium, marigold, pansy, and petunia. Plugs were planted into the treatments and weekly growth measurements were taken until plants were all in flower (saleable). Measurements consisted of plant height, plant width at the widest portion of the plant and plant width perpendicular to that. Then, a growth index (GI) was calculated as (plant height + plant width 1 + plant width 2)/3 to represent the size of the plant. Plant survival was also recorded on a weekly basis as well as pH and electrical conductivity (EC) of the substrate using the PourThru method.

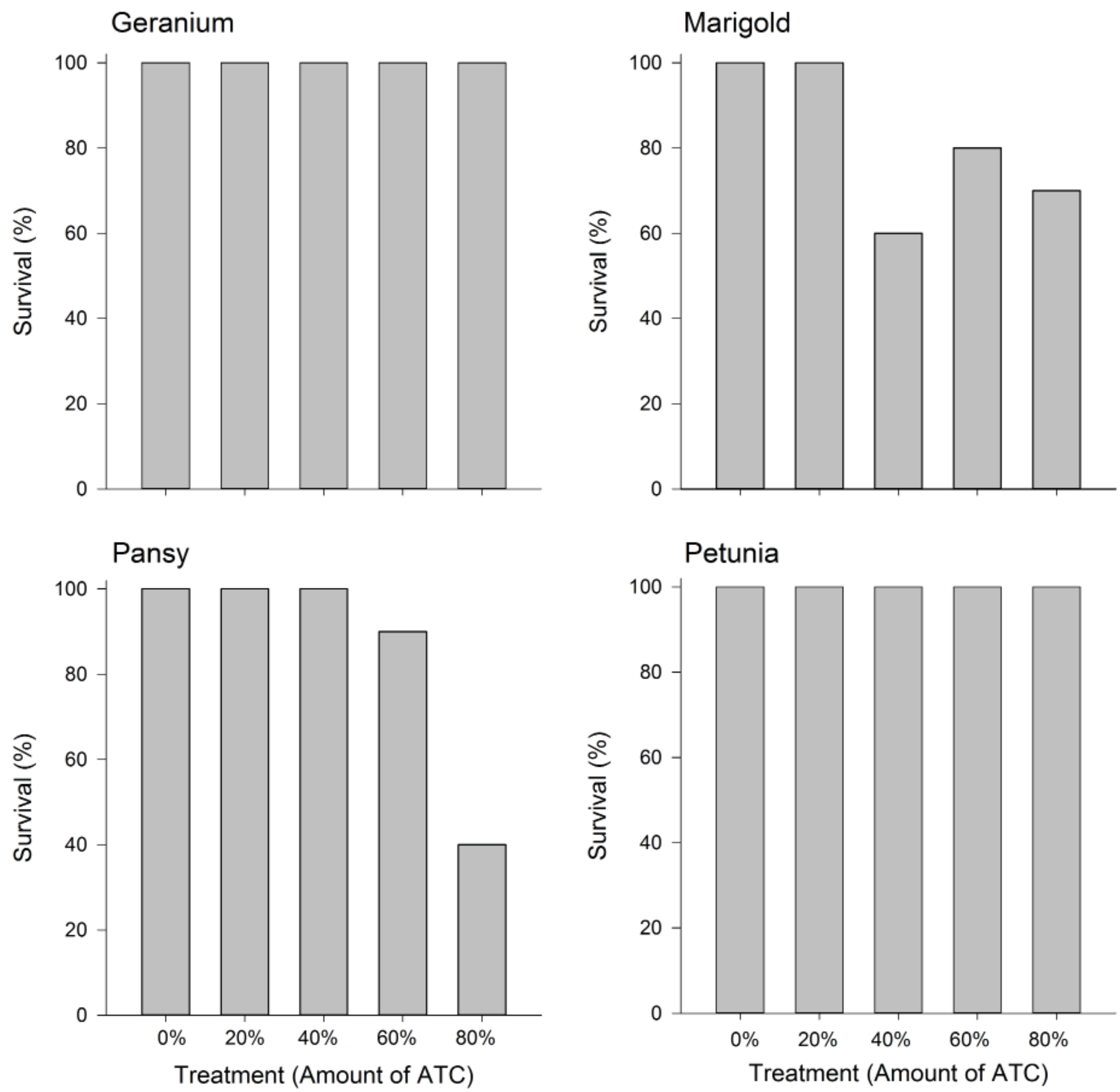

Figure 1. Survival percentages at the end of the study for all four species tested.

The Results

Geranium and petunia had 100% survival at the end of the study for all substrate treatments. However, marigold and pansy did not (Figure 1). The control treatment with no ATC and the treatment with only 20% ATC showed 100% survival for both species. Treatments for pansy and marigold with more than 40% ATC had only 40% to 90% survival. In addition, marigolds planted in substrates with more than 20% ATC had symptoms of a root or crown rot, twisted leaves, and necrotic leaf spots, which may have been due to inappropriate pH or EC.

For geranium and petunia, treatments that contained any amount of ATC had larger plants (growth indexes (GIs)) than the control (0% ATC) at the end of the study (Figure 2 and Figure 3). The opposite was true for marigold and pansy where in most cases the ATC treatments had equal or smaller GIs than the control (Figure 2 and Figure 4). For pansy, the substrate with the smallest amount of ATC (20%) had larger plants than the control, but then as the amount of ATC increased, the plants became smaller and smaller. In 80% ATC, pansy size was smaller than the control (Figure 5).

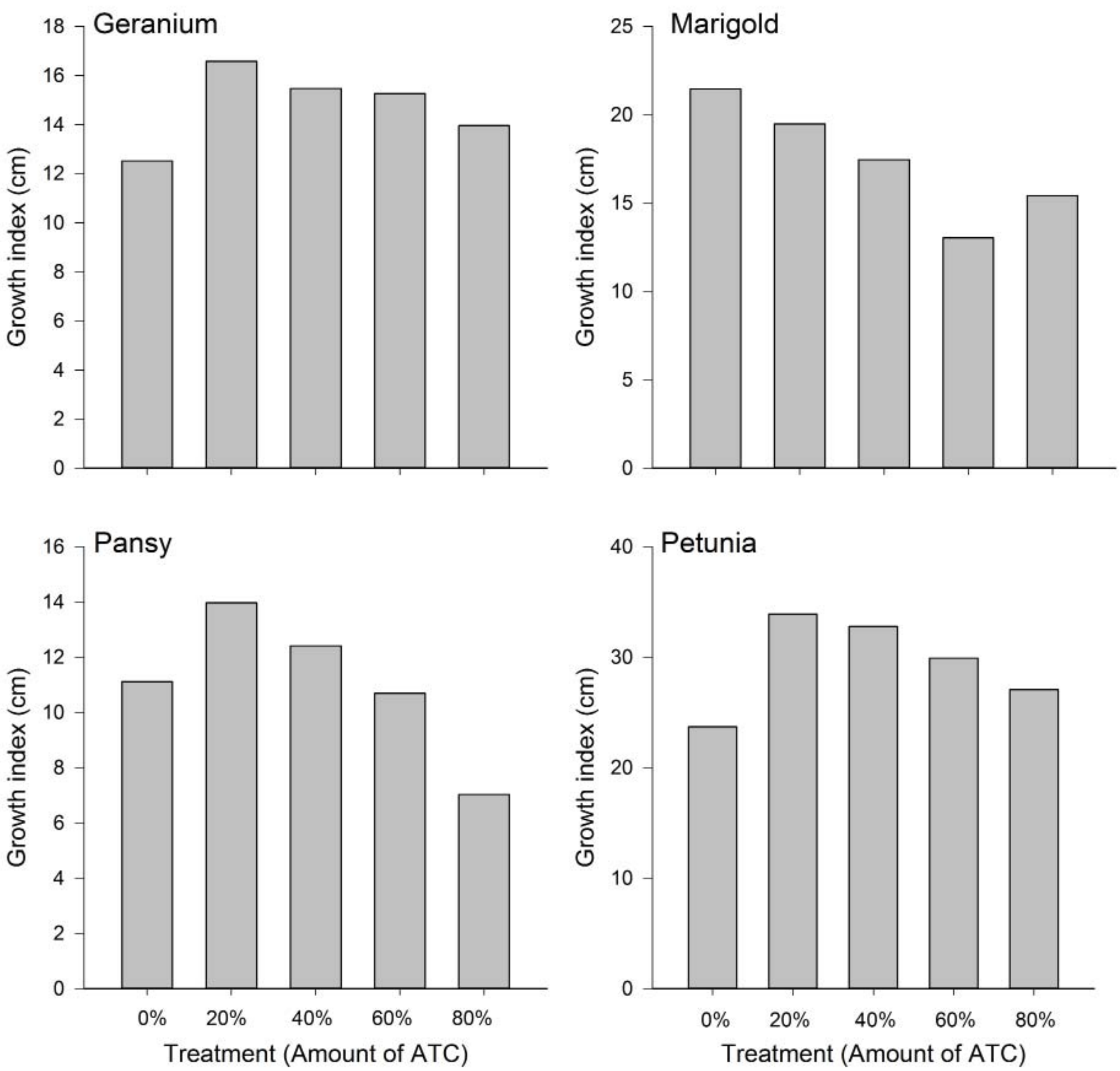

Figure 2. Growth index (GI), excluding dead plants, of all four species tested at the end of the study

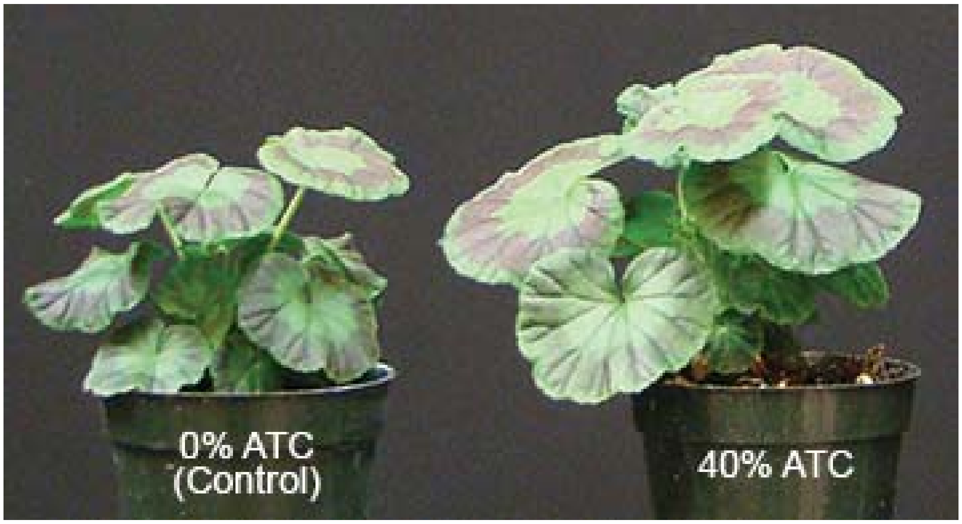

Figure 3. Geranium plant size was larger for all substrate treatments with ATC compared to the control (0% ATC).

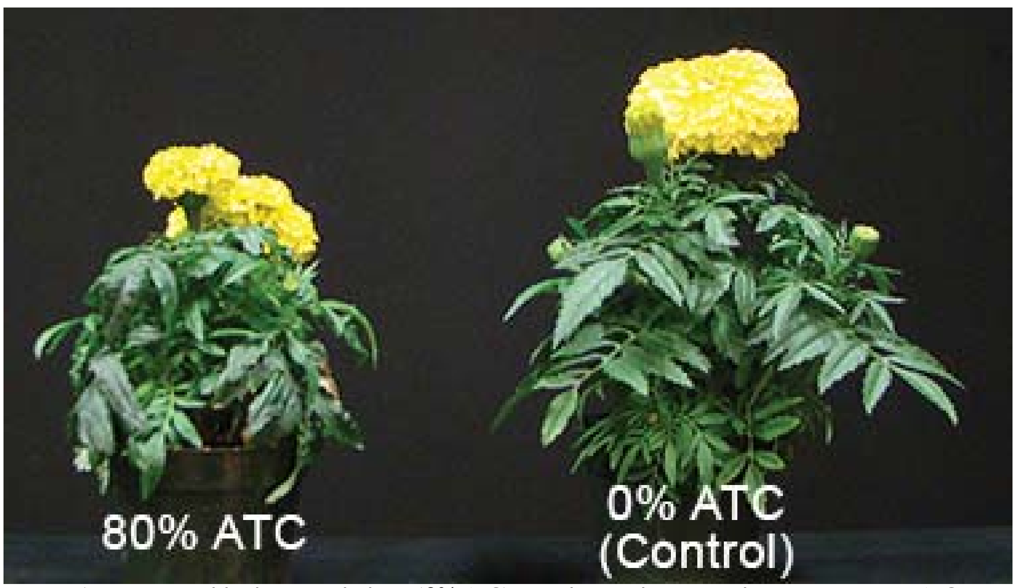

Figure 4. For marigolds, the control plants (0% ATC) were larger than any substrate containing ATC.

Figure 5. For pansy, the substrate treatment containing 20% ATC had larger plants than the control (0% ATC), but all other substrates containing more than 40% ATC had smaller plants than the control.

PourThru pH readings at the end of the study for each treatment containing ATC were generally within the recommended range for each species, or perhaps a little bit high. Nevertheless, there were very few symptoms of high substrate pH seen in plant growth. PourThru EC readings at the end of the study for each treatment varied considerably. Control treatments fell within the recommended ranges between 2 and 6.5 mS/cm. However, increasing the amount of ATC in the substrate caused EC to increase as well. For instance, pansy EC ranged from 5.3 to 9 as ATC increased (Figure 6). This high EC may explain the poor survival for pansy and marigold in substrates with greater than 40% ATC. Symptoms of high EC include wilting (physiological drought), slow growth, necrotic leaf margins, and increased susceptibility to root rots, which were seen here, especially for marigold.

Should I use animal tissue compost as a substrate amendment?

To my knowledge, animal tissue compost is not yet available commercially as a substrate amendment. However, should a source become available, should you use it? Based on the species and the ratios of peat, ATC, and perlite tested here, ATC has the potential to be a peat extender in floriculture substrates when used in ratios of 20% or less. For all the species tested here, the ATC treatment with 20% ATC performed the same as the control (with no ATC). However, as with any change to production, test such a substrate change on a small subset of plants before implementing it in a large scale. Be especially cautious of salt-sensitive species like impatiens, as this ATC had a high salt content (high EC). The addition of ATC in small quantities has the potential to be a nutritional amendment, as well as a potential to replace a liming agent. But future research needs to explore that in more detail.

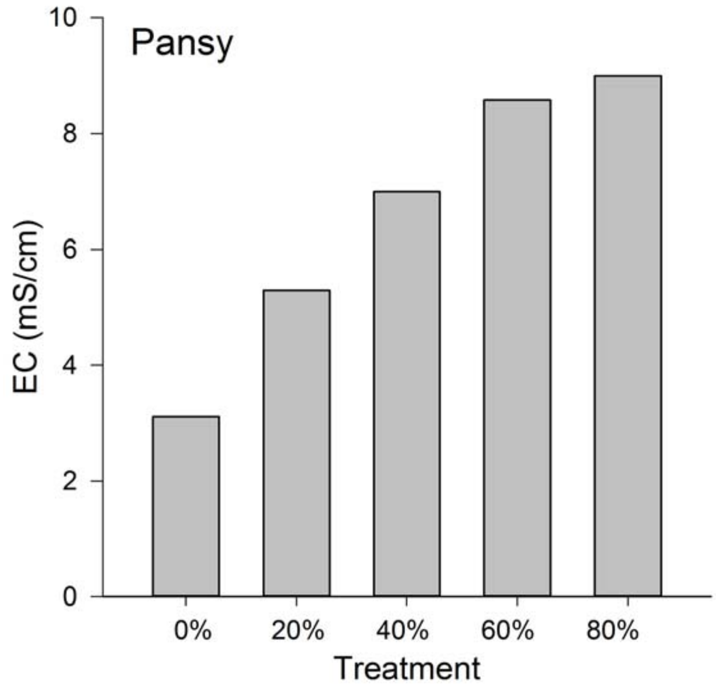

Figure 6. EC readings for pansy at the end of the study using the PourThru method

Participating Universities

Michigan State University
Kansas State University
Virginia Tech Invent the Future
Iowa State University
NC State
University of New Hampshire Cooperative Extension
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