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# Vermicompost Validity

**The second article in our two-parter breaks down the nitty-gritty of ornamental plant production using alternative growing media.**

In recent years, growers have begun seeking alternative and sustainable substrate components for their crops. Many of these alternative substrates, components or additives are agricultural, municipal or industrial waste by-products. With a wide range of alternatives evaluated, animal wastes or manures have been a successful focal point for commercial production of vermicompost. In this last article of a two-part series, we'll present and discuss our research findings trialing two commercially available vermicompost products for potted ornamental and herb production. Trials were conducted at Purdue and Cornell Universities to determine the impact of two different dairy solids-based vermicomposts on plant growth and nutrition.

## Purdue University

### What we did

**Experiment 1** | Our objective was to determine if vermicompost applied as a substrate amendment can reduce fertilizer rates applied to greenhouse-grown ornamentals and herbs. Therefore, we prepared a substrate by amending a commercially available soilless substrate (68% peat, 20% perlite and 12% vermiculite by volume) with or without 25% vermicompost (by volume) supplied by a commercial producer. Calibrachoa, petunia, vinca, basil and rosemary plugs were transplanted into 4-in. round containers filled with each of the two substrates. Plants grown in substrate not amended with vermicompost (control) were irrigated with a water-soluble fertilizer (WSF) at 200 ppm N (Scotts 21-5-20). Plants grown in substrate amended with vermicompost were irrigated with 150, 100, 50 or 0 ppm N derived from the WSF.

On a weekly basis utilizing the pour-through method, substrate pH and electrical conductivity (EC) were analyzed from representative plants of each substrate, species and fertilizer treatment until control plants were deemed marketable. Marketability was determined when plant canopy reached the edge of the container. At this point in the trial, plant height, shoot and root dry mass and foliar tissue analyses were determined.

**Experiment 2** | Our objectives were to quantify substrate and nutritional status of plants grown in a substrate amended with vermicompost. Container substrates were formulated to contain either 0% (control) or 10% vermicompost. Basil and calibrachoa were transplanted into 4-in. round plastic containers filled with each of the two substrates. In the control treatment, plants were irrigated with a WSF at 200 ppm N (21-5-20). Plants grown in the vermicompost-amended substrate were irrigated with 100, 50 or 0 ppm N derived from the WSF.

Substrate solution was again extracted from representative plants each week utilizing the pour-through method and the substrate solution was analyzed for pH and EC. Substrate and foliage (recently



Figure 1. Response of basil (a) and petunia (b) plants grown in (from left to right) substrate not amended with vermicompost (control) and fertilized with a water-soluble fertilizer (WSF) at 200 ppm N, or substrate amended with 25% vermicompost and fertilized with 150, 100, 50 or 0 ppm N derived from a WSF.

matured leaves) samples were collected from each species and were analyzed for nutritional status.

### What we observed

**Experiment 1** | In general, substrate solution pH was highest in treatments receiving 0 ppm N. Inversely, substrate solution EC was highest in treatments receiving 200 ppm N. Within each species, shoot and root dry mass were similar between the 200-ppm N treatment (no vermicompost) and the 100 and 150-ppm N treatments that received vermicompost (Figure 1). Nutritional status of calibrachoa, petunia, vinca and basil plant tissues were within acceptable concentration range when fertilized with 100 to 200 ppm N, and below 100 ppm N, micronutrient deficiencies occurred. Based on these results, it's plausible to produce some herbaceous ornamentals and herbs in a substrate amended with 25% vermicompost and reduce fertilization rates by up to 50% without growth or nutritional differences.

**Experiment 2** | Substrate solution pH increased with decreasing fertilizer rate for both species. This makes sense given that 21-5-20 is a moderately acidic fertilizer and the vermicompost material has a pH

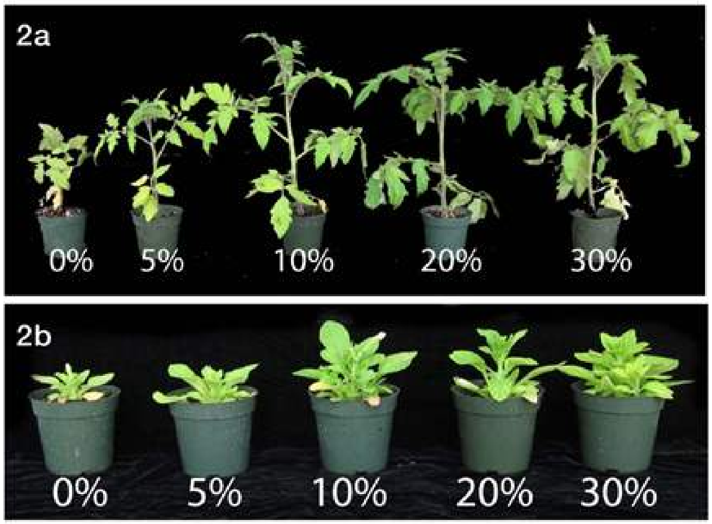


Figure 2. Response of tomato (a) and petunia (b) to vermicompost incorporated at rates of 0% to 30% by volume as the sole fertility source.

Figure 3. Poinsettia Mars Pink fertilized with 200 ppm N (left) or 100 ppm N (right) of 20-10-20 WSF.

Figure 4. Poinsettia Cinnamon Star fertilized with 200 ppm N WSF (left) was a similar size as plants fertilized with 100 ppm N WSF along with 10% vermicompost by volume incorporated into the substrate (right).

slightly above neutral. For basil (4-week crop) and calibrachoa (5-week crop) plants, substrate solution EC increased with decreasing fertilizer rate and after two weeks of growth, the EC decreased. Macro and micronutrient concentration in substrate and tissue samples decreased with decreasing fertilization rate. Based on tissue analysis, results of this study indicate that basil and calibrachoa can be grown in a substrate amended with 10% vermicompost with liquid fertilization maintained between 50 to 200 ppm N to maintain sufficient nutrient levels in foliage.

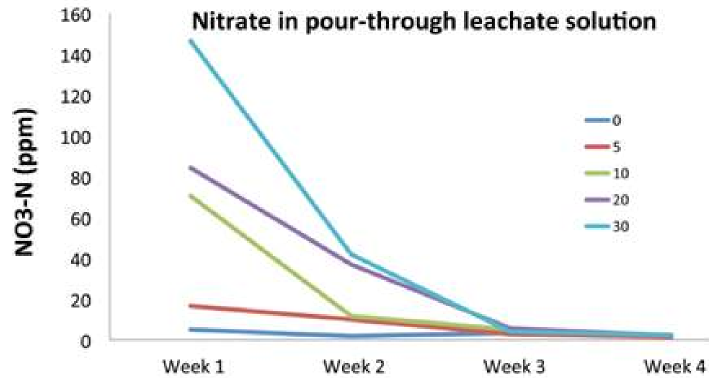


Figure 5. Nitrate-nitrogen in the pour-through solution in response to vermicompost incorporated into the substrate at 0% to 30% by volume.

## Cornell University

### What we did

**Experiment 1** | Our objective was to determine if vermicompost could be used as the sole fertility source for bedding plants. Sun Gro Sunshine Natural and Organic #1 mix was used as the base substrate and vermicompost was incorporated at rates of 0, 5, 10, 15, 20 or 30% (by volume). Pepper, tomato, petunia and snapdragon plugs were transplanted into 4-in. round plastic containers. Containers were irrigated daily or as needed with clear water. After five weeks, the experiment was terminated. Shoot fresh and dry weights, root index, height and width of the plant were measured.

**Experiment 2** | Our objective was to determine if poinsettias could be successfully grown with reduced rates of WSF if the substrate was amended with vermicompost. Poinsettia Mars Pink and Cinnamon Star were transplanted into 6-in. round plastic containers. The base substrate was commercially available peat perlite-based substrate. Plants were irrigated with 20-10-20 WSF on weekdays and clear water on weekends. The treatments included: 1) control, 200 ppm N WSF plus no vermicompost; 2) 100 ppm N WSF plus no vermicompost; 3) 100 ppm N WSF plus 5% vermicompost (by volume); 4) 100 ppm WSF plus 10% vermicompost. After 12 weeks the plants were destructively harvested and shoot fresh and dry weights, root index, height and width of the plant were measured, and pH and EC were measured as previously described.

### What we observed

**Experiment 1** | Due to the moderate alkalinity of Cornell's irrigation water (115 ppm $CaCO_3$) and the slightly basic nature of the vermicompost, pH tended to increase both over time and along with increasing incorporation rates of vermicompost. EC increased with greater incorporation rates of vermicompost. However, EC decreased over time as nutrients from the vermicompost were absorbed by plants or leached from the substrates.

Our EC and nitrate measurements indicate that the fertility of vermicompost had been predominately used or leached by three weeks (Figure 5). The size of tomato plants grew larger as vermicompost incorporation rate increased from 0% to 30% (Figure 2a). For pepper, petunia and snapdragon, plant size increased as vermicompost incorporation rate increased to 10%; no added benefits were found at rates of 20% or 30%. The somewhat high pH with increasing vermicompost rates led to symptoms of iron deficiency in petunia (yellowing between the veins of upper leaves) [Figure 2b]. Commercially acceptable plants could be >>>

grown with 10% vermicompost as the sole fertility source for a short 5-week bedding plant crop. Most of the readily available fertility from our vermicompost source appears to be used up by three to four weeks of transplanting, therefore, top-dressing vermicompost or use of other fertilizers may be necessary for longer term crops. Substrate pH must be monitored and treated if necessary if it becomes too high.

**Experiment 2** | The two poinsettia cultivars performed slightly differently depending on their fertilizer needs. For Mars Pink, plant size was reduced when 100 ppm WSF was used (Figure 3). Vermicompost at either 5% or 10% along with 100 ppm WSF couldn't fully recover plant size as compared to the plants provided with 200 ppm N. Cinnamon Star apparently had lower fertilizer needs; all of the 100 ppm WSF treatments (including with 0%, 5%, or 10% vermicompost) were similar in size to the 200 ppm WSF treatment (Figure 4). The results indicate that vermicompost may be added as a complement to WSF in poinsettia production. However, results were inconclusive whether vermicompost can reduce the amount of WSF required in poinsettia production.

In conclusion, we've found that two different vermicompost materials can be used successfully as both a substrate amendment and as a complementary fertilizer source to reduce liquid fertilizer needs of some short-term bedding plant crops. For longer-term crops (such as poinsettia), more work needs to be done with a greater range of vermicompost application rates or reapplying vermicompost periodically as a top dressing. The physical and chemical properties of vermicompost will vary based on the feedstock and processes used. In our trials, we used two different dairy solids-based vermicomposts, which varied in their nutrient content. When trying vermicompost yourself, work with the supplier to obtain a nutrient analysis and for suggested application rates. Ultimately, the increased adoption of vermicompost as a sustainable substrate and fertilizer input could help to reduce agriculture's environmental footprint. **GT**

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