Cabbage Transplant Production Using Organic Media at Cornell University, 2008

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Introduction

The goal of this project is to create an improved potting medium for organic vegetable transplant production. Healthy vigorous transplants will be less susceptible to insects, diseases and transplant shock leading to better crop performance. Formulating organic potting mixes is especially challenging. Composts are a popular organic source of nitrogen, but can have inconsistent nutrient levels based on their starting materials and poor physical characteristics (large particle size, etc.). Individual batches of compost can change over time with storage and N release can be unpredictable. An alternative to traditional composts is vermicompost. Vermicompost has a finely granulated texture, which is ideal for mixing into peat-based media or applying as a top dressing through existing greenhouse equipment. Past research in the Rangarajan lab has shown improved yield with vermicompost compared to thermophilic compost, even when the same starting material was used for both types of compost.

Many commercially available organic potting mixes are supplemented with nitrogen sources such as alfalfa meal, soybean meal and blood meal. While these amendments do provide nutrients, additional work in the Rangarajan lab showed that mixtures of vermicompost and blood meal out performed either amendment used on its own as well as double the amount of vermicompost. We suspect that the high microbial activity in the vermicompost may be at least partially responsible for converting protein-based N sources in the blood meal to a soluble form, thus making it available to the plant. Here, we tested eight potting media for growth and productivity of cabbage. These mixes were used in a previous on-farm experiment with cabbage transplants (Cabbage Transplant Production Using Organic Media April, 2008) in a cooler greenhouse environment. Our results in that on-farm trial did not show an added benefit of mixing vermicompost with blood meal, as was documented in previous studies. The same transplant media mixes were brought to Cornell for testing at a higher temperature. We hypothesized that since microbial activity is incredibly temperature sensitive, using this particular combination of amendments may require a minimum temperature in order for nutrients to be converted into plant available forms. A controlled trial of these same amendments is currently being conducted at two temperatures at Cornell to develop temperature recommendations for these transplant media amendments.

Transplant production

Cornell University now has an organically-managed greenhouse at the Guterman Research Facility. The facility is being operated to comply with all the NOFA-NY (local certifier) and NOP requirements.

Grower's mix:

Sunshine Organic Blend (SunGro) plus Fertrell 5-5-3 (Fertrell Co, Bainbridge, PA,12 lbs/yd^3). Sunshine Organic Blend ingredients are Canadian sphagnum peat moss, coarse grade perlite, gypsum, dolomitic lime, and a long-lasting wetting agent.

Cornell base mix:
The Cornell base mix consisted of sphagnum peat moss, coarse grade perlite, vermiculite and dolomitic lime (1.1 lbs/yd^3). Sphagnum peat moss was broken up in a soil mixer (Sprout Waldron, Model B-28, Muncy, PA) and placed in covered plastic barrels. A 70% peat, 15% vermiculite and 15% perlite mix was made in large quantities then lime was added as a separate step.

Amendments:
Vermicomposted dairy manure (Worm Power, Avon, NY), Alaska hummus (Fertrell Co, Bainbridge, PA) and blood meal mix were added to the base mixes (Table 1).

Treatment mixes were placed into 200-cell flats. Before planting, sub-samples of all potting mix treatments were sent to the University of Massachusetts Soil and Plant Tissue Testing Laboratory, Amherst, MA, for chemical analysis (Table 2). Cabbage seedling production started on May 22, 2008. Organic cabbage seed cv. 'Kaitlin' (Seedway, Elizabethtown, PA) was planted in the trays. The seed trays were placed on the greenhouse benches to germinate. The plants were grown at approximately 75º F day and 65º F nights. Ten plants from each treatment were cut at soil level, dried and weighed to determine aboveground biomass on June 9, 19, 26. (Figure 1).

Results and Discussion

All treatment media had nutrient levels and chemical characteristics that were appropriate for vegetable transplant production (Table 2). Plant growth was highest in both base mixes amended with 10% vermicompost and blood meal (Figures 1 and 2). When the data were analyzed separately by base mix, the grower's mix supported higher transplant biomass than the Cornell base mix (Table 3.) This is most likely due to the fact that the growers' mix contained a 5-5-3 nutrient amendment, while the background mix contained only peat moss, pearlite, vermiculite and lime. When the data were analyzed separately by amendment, highest plant biomass was supported with the combination of 10% vermicompost and blood meal mix. These potting media performed differently at the Cornell facility with warmer temperatures than at the grower's facility (Cabbage Transplant Production Using Organic Media, April, 2008). We are currently conducting a trial with several temperature regimes for growing cabbage transplants in the media described in the report to determine optimum temperatures for these amendments.

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Table 1. Organic transplant media evaluated for the production of cabbage.

Treatment	Formulation
Grower mix	Sunshine SunGro Organic Blend plus Fertrell 5-5-3 (12 lbs/yd^3)
Grower mix plus blood meal mix	Grower mix with blood meal, green sand and rock phosphate (7 lbs/yd^3)
Grower mix plus dairy vermicompost 10%(v/v)	base mix plus dairy vermicompost
Grower mix plus dairy vermicompost 10% (v/v) plus Blood meal mix	Grower mix plus dairy vermicompost with blood meal, green sand and rock phosphate (7 lbs/yd^3)
Cornell base mix	70% peat, 15% vermiculite and 15% perlite mix plus lime (1.1 lbs/yd^3)
Cornell base mix plus dairy vermicompost 10% (v/v)	Cornell base mix plus dairy vermicompost
Cornell base mix plus dairy vermicompost 10% (v/v) plus blood meal mix	Cornell base mix plus dairy vermicompost and blood meal, green sand and rock phosphate (7 lbs/yd^3)
Cornell base mix plus dairy vermicompost 20% (v/v)	Cornell base mix plus dairy vermicompost

Table 2. Nutrient analysis of organic potting media 2008.

						mg/kg				
media	bulk density (g/cm^3)	coarse frag	pH	EC (ds/M)	% total N	Nitrate-N	Ammonium-N	% OM	% estimated Organic C	Carbon/N ratio
Growers mix	0.17	4.8	6.7	1.42	0.73	285	180	65.5	35.4	48.5
Growers mix plus BM[z]	0.23	3.4	7.0	2.02	1.24	113	441	59.2	32	25.8
Growers mix plus 10% vermicompost	0.26	4.4	6.9	3.99	1.56	1137	121	65.1	35.2	22.5
Growers mix plus 10% vermicompost plus BM	0.29	3.5	7.4	3.57	1.82	372	352	61.4	33.2	18.2
Cornell base mix	0.23	6	5.8	0.25	0.55	43	71	57.7	31.2	56.7
Cornell base plus BM	0.20	5.7	5.2	0.61	1.23	120	73	53	28.6	23.3
Cornell base plus 10% vermicompost	0.21	6.1	5.3	2.2	1.45	724	57	60.5	32.7	22.5
Cornell base plus10% vermicompost plus BM	0.31	5	6.4	2.74	1.85	608	359	57.3	30.9	16.7

[z] BM equals bloodmeal, rock phosphate and green sand (7 lbs/yd^3 of each)

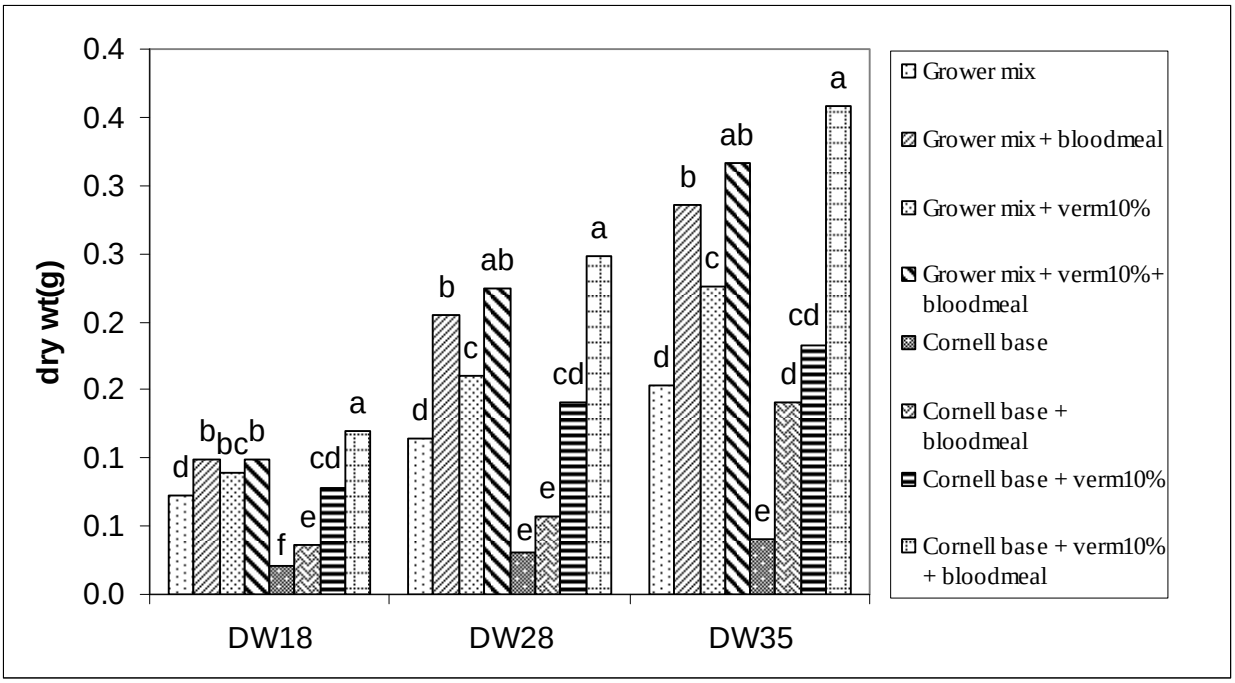

Figure 1. Dry weight of cabbage plants grown in eight organic potting media. Seed was sown on May 22, 2008 in 200-cell trays and were grown at 75º F day and 65º F night temperatures. DAP = days after planting cabbage seed. Columns labeled by a different letter on the same plant date are significantly different at $p<0.05$.

Table 3. Above ground biomass of cabbage plants grown in two different base mixes and four amendments, 2008.

		Dry wt. (g)		
		18 DAP[z]	28 DAP	35 DAP
Base				
	Grower mix	0.09 a	0.18 a	0.25 a
	Cornell base mix	0.06 b	0.12 b	0.18 b
Amendment				
	Bloodmeal mix	0.07 c	0.13 b	0.21 b
	Dairy vermicompost 10%(v/v)	0.08 b	0.15 b	0.20 b
	Dairy vermicompost 10%(v/v) plus bloodmeal mix	0.11 a	0.24 a	0.34 a
	none	0.05 d	0.07 c	0.10 c

[z]Seed was sown on May 22, 2008 in 200-cell trays and were grown at 75º F day and 65º F night temperatures. DAP = days after planting cabbage seed. Columns label by a different letter on the same plant date are significantly different at $p<0.05$.

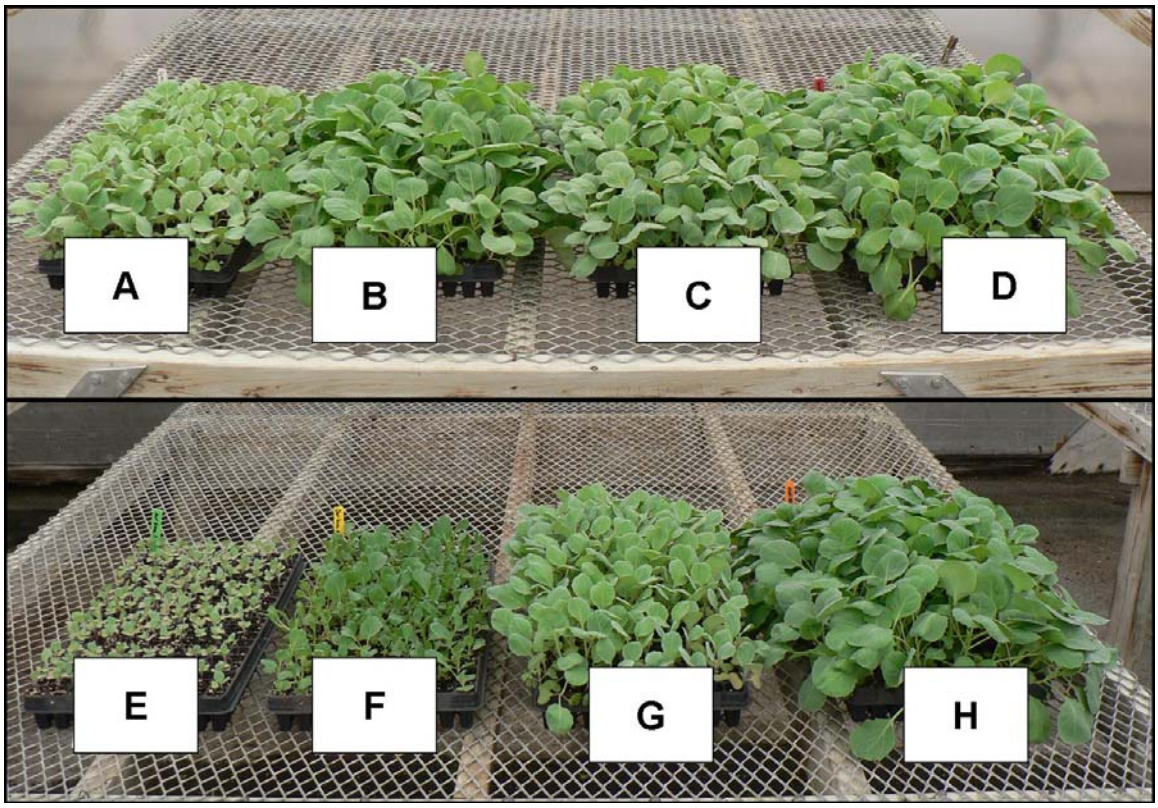

Figure 3. Cabbage transplants 19 DAP, Grower's mix (A.) with bloodmeal (B.), 10% vermicompost (C.), 10% vermicompost & bloodmeal (D.), Cornell base mix (E.) with bloodmeal (F.), 10% vermicompost (G.), 10% vermicompost + bloodmeal (H.). Treatments D and H had the highest transplant biomass of all treatments tested.