Vermicompost amendment to field soil for strawberry and garlic production, 2008-2009

Anu Rangarajan, Cornell University, Department of Horticulture, ar47@cornell.edu
Betsy Leonard, Cornell University, Department of Horticulture, bai1@cornell.edu
Allison Jack, Cornell University, Department of Plant Pathology and Plant-Microbe Biology, alh54@cornell.edu

Background:

International research in horticulture has documented growth and yield benefits of field soil applications of different types of vermicompost in a variety of cropping systems as a supplement to or a replacement for synthetic nutrient amendments. Vermicomposted dairy manure is now produced in large quantities in NY State. Use of this recycled organic matter in agriculture can help provide an economic incentive to move excess nutrients from oversaturated watersheds to areas where they are needed. On a regional scale, closing the loop with livestock manure recycling could reduce the potential soil, water and air pollution associated with high concentrations of livestock manures. Our goal was to find the most efficient and economically viable use of this recycled organic material for crop nutrient management in NY State.[1] Here we present field trials for strawberry (certified organic and conventional) and garlic production.

Methods:

A. Strawberry (certified organic)

Vermicomposted dairy manure (Worm Power™, Avon, NY) was hand applied at 2, 4, and 8 tons per acre based on fresh weight spread over a 3 ft. band (Figure 1) to newly transplanted bare root strawberries in mid-June 2008 (Figure 2) in a certified organic field. After application, the material was raked in to keep it from drying on the soil surface. Each treatment was replicated 5 times in a randomized complete block design. Berries were harvested and weighed on 6 dates in 2009 (6/19, 6/24, 6/29, 7/2).

Figure 1. Hand application of vermicompost to newly transplanted strawberry plants at 2, 4 and 8 tons per acre measured over a 3 ft wide strip around each row.

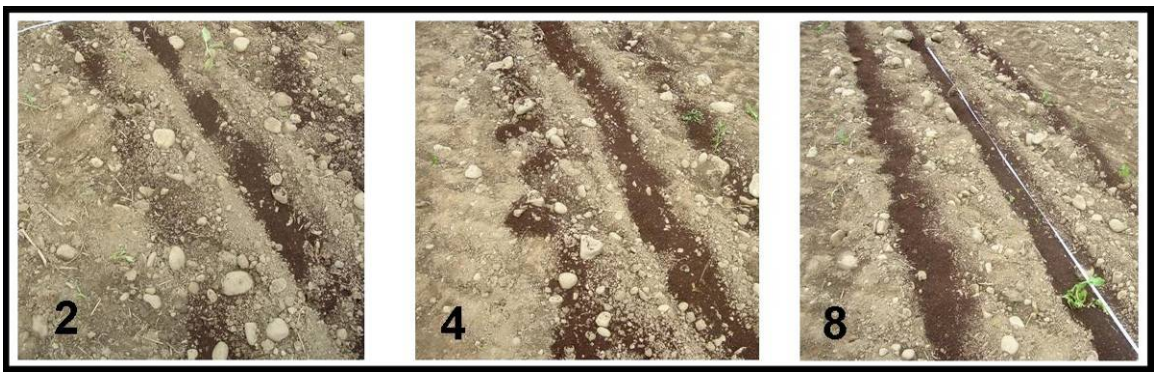


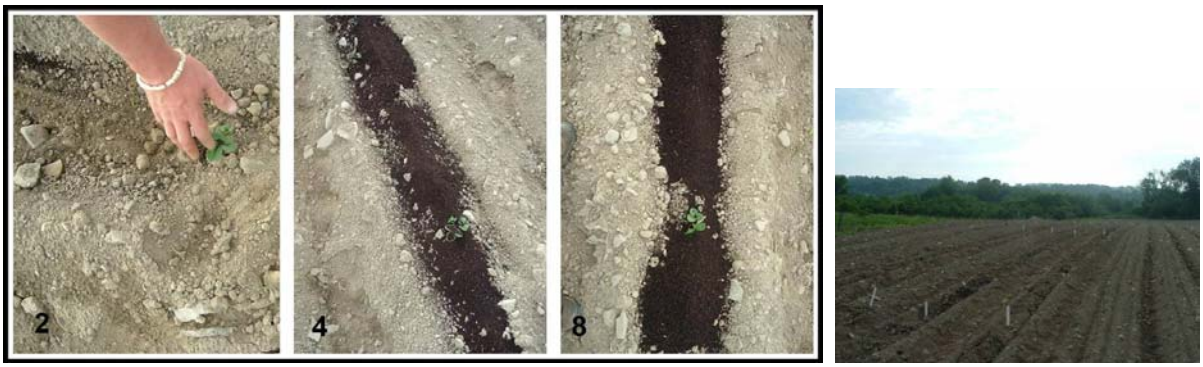
Figure 2. Bare root strawberries (cv. “Jewel”) & staked out field trial

[1] For more information on this project including vermicompost use as a potting media amendment, and suppression of Pythium damping off with vermicompost along with a short educational video, see http://www.css.cornell.edu/cwmi/vermicompost.htm

B. Strawberry (conventional)

Vermicomposted dairy manure (Worm Power™, Avon, NY) was hand applied at 2, 4 and 8 tons per acre based on fresh weight and concentrated into the top of the ridge formed by the transplanter in a conventional strawberry field (cv. "Jewel") in mid-June 2008 (Figure 3). Soil was gently raked over vermicompost to prevent desiccation. Each treatment was replicated 5 times in a randomized complete block design. Berries were harvested and weighed on 6 dates in 2009 (6/19, 6/24, 6/29, 7/2).

Figure 3. Application of vermicompost at 2, 4 & 8 tons per acre concentrated in ridges with strawberry plants (cv. "Jewel"). The 2 tons per acre treatment is being incorporated to prevent desiccation on the soil surface. Overview of the field plot.



C. Garlic (organic)

Garlic (cv. "German White") was planted at 6" spacing in October 2008. Vermicomposted dairy manure (Worm Power™, Avon, NY) was hand applied at 2, 4 and 8 tons per acre based on fresh weight and concentrated into the top of the ridge formed by the planter in a certified organic garlic field (Figure 4). A non-aerated liquid vermicompost extract was applied as an additional treatment. Vermicompost was mixed with water at a 1:30 v:v basis and incubated for 10 days before filtering through 4 layers of cheesecloth. After application, a tractor was used to hill each row, effectively covering applied vermicompost and garlic bulbs with a layer of soil. Garlic was harvested in July 2009, full fresh plants were weighed, garlic head diameter was measured and heads were weighed after drying.

Figure 4. Field applications of 2 t, 4 t and 8 t per acre vermicompost at a certified organic garlic farm.

Figure 5. Hilling planted rows and the full trial plot after hilling.

Results:

A. Strawberry (certified organic)

No visible differences in transplant establishment or growth were observed during the growing season (Figure 6). No significant differences in yield were found (Table 1).

Figure 6. Jewel variety strawberry plants in mid-July 2008 with 0, 2, 4 and 8 tons per acre application of vermicompost at transplant.

Table 1. Strawberry yield “Jewel” variety. Data represent the total yield taken at four separate sampling dates during harvest season.

Treatment	Total yield per plot (kg)
No vermicompost	1.3
2 tons per acre	1.4
4 tons per acre	1.1
8 tons per acre	1.1
	NS

B. Strawberry (conventional)

Although vermicompost application appeared to increase transplant growth during the 2008 season (Figure 7), but no significant differences in yield were found (Table 2.)

Figure 7. Strawberry plants in mid-July during tissue sampling with 0, 2, 4, and 8 tons per acre vermicompost applications

Table 2. Strawberry yield “Jewel” variety. Data represent the total yield taken at four separate sampling dates during harvest season.

Treatment	Total yield per plot (kg)
No vermicompost	7.6

2 tons per acre	8.2
4 tons per acre	7.9
8 tons per acre	8.4
	NS

C. Garlic (organic)

No significant differences were found among treatments for garlic survival, total weight of fresh plants or average bulb diameter. However, after plants had been dried down for 2 weeks, all treated bulbs had a higher average biomass than the untreated control. Other studies have found an increase in garlic head biomass with 50% amendment of vermicompost in greenhouse studies (Arguello et al. 2006).

Table 1. Garlic "German white" variety yield measurements

Treatment	Total # surviving heads (av. of 3 plots)	Av. total weight (kg) 10 ft section (n=3)	Av. total weight (kg) (subsample of 10) (n=3)	Av. bulb d (mm) (n=30)	Av. individual head mass* (g) (n=30)
No VC	1.23	1.23	0.89	55.26	39.6 c[1]
2 tons/ acre	1.66	1.66	1.09	53.45	46.0 ab
4 tons/ acre	1.60	1.60	1.08	53.70	48.9 ab
8 tons/ acre	1.77	1.76	1.19	52.44	50.2 a
VC extract drench	1.72	1.71	1.12	54.49	44.5 bc
	NS	NS	NS	NS	* p = 0.001

*bulb biomass taken after drying down for 2 weeks

[1] means followed by the same letter are not significantly different at $p > 0.05$

Significance:

This evaluation of vermicompost as a field soil amendment did not find any significant crop response to treatment other than an increase in garlic bulb biomass. Given the high cost of the amendment and the current lack of documented benefits for this type of use, field soil applications of vermicompost are not recommended. However, related trials have shown that vermicompost can be an effective and economically viable addition to transplant media for greenhouse production. Please see tomato, cabbage and cauliflower transplant trials on http://www.css.cornell.edu/cwmi/vermicompost.htm.

References:

Arguello, J.A., Ledesma, A., Nunez, S.B., Rodriguez, C.H. and Goldfarb, M.D.D., 2006. Vermicompost effects on bulbing dynamics, nonstructural carbohydrate content, yield, and quality of 'Rosado paraguayo' garlic bulbs. Hortscience 41, 589-592.

This project was funded by New York Farm Viability Institute.