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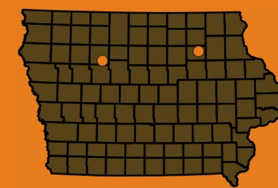

Effect of Compost Extract on Head Lettuce Yield

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http://bit.ly/pfi_horticulture

In a Nutshell

- Compost extract is made by steeping compost in water, then applying the sieved water (with compost extract) as a soil drench with the intention to increase beneficial soil biota, and increased plant health, Brix and yield.
- At two farms, compost extract was applied as a drench treatment to head lettuce.
- Yield and Brix readings of head lettuce was measured to determine impact of compost extract applications.

Key Findings

- Drenching soil with compost extract did not affect lettuce yield at either farm.
- Drenching soil with compost extract did not affect Brix levels in lettuce at Danreis' farm.
- Compost price could be cost prohibitive; at high-intensity application, compost cost was $1.25/row-ft.

Project Timeline:
July 2015 - October 2015

Lettuce in the field at Genuine Faux Farm.

Background

Fruit and vegetable farmers are exploring on-farm compost methods to lower their input costs, increase soil microbial diversity, manage waste and improve yields. These compost methods include different types of compost (manure, vermicompost, food scraps, aerobic vs. anaerobic) and different application methods (potting mixes, soil amendments, sidedress, extract and brewed tea). The concept of functional diversity for soil ecosystem resiliency is well-studied (Chapin et al., 1997; Nannipieri et al., 2003; Hooper et al., 2005), but the interactions and functioning of microbial organisms within the soil are still not fully understood. Ingham includes many citations on her website to support her work with compost teas and extracts (Soil Foodweb Inc., 2014b).

In a 2014 study, two farmers, Siobhan Danreis (Humboldt County) and Jason Jones (Polk County) studied the effect of compost extract applied as a soil drench to carrots. In addition to measuring carrot yield, Siobhan and Jason submitted soil samples for Qualitative Soil Analysis at the Soil Restoration and Research (SRR) Lab in Fairfield at the Maharishi University of Management (MUM), which is the soil foodweb microbial analysis popularized by Elaine Ingham of Soil Foodweb Inc. (Soil Foodweb Inc., 2014a). These analyses showed no significant difference among treatments (Kolbe et al., 2014).

In 2015, Rob Faux (Bremer County) and Siobhan held on-farm trials investigating the effect of compost extract on yield characteristics of head lettuce. Siobhan also continued with limited Qualitative Soil Analysis.

Objective:

To determine the effect of compost extract application on yield of head lettuce.

Methods

Project Design 2015

Farms used a randomized block design with treatment and control plots. Treatments at Siobhan's farm were "high" and "low" application rates with control plots receiving no compost extract. At Rob's, compost extract was applied at a single rate and compared to the control, which received no compost extract.

Compost Extract

Compost was purchased from the SRR Lab at MUM. Farmers received compost on June 22; Siobhan noted the compost had a biomass ratio (BMR fungi:bacteria) of 0.132, which is low for making compost extract (a BMR of 0.75 is considered sufficient). Compost was to be checked daily and sprayed with water to maintain moisture content wet enough to squeeze a single drop of water from a handful.

Compost extract was made by filling a mesh bag with the prescribed amount of compost and submerging in four gallons of water in a 5-gallon bucket. The mesh bag was massaged at a moderate rate for 30 seconds. The mesh bag was removed once the water had the appearance of cocoa, with about 30% opacity. Each 10-ft treatment plot received four gal. of extract (0.4 gal. per row-foot). At Siobhan's farm, the high application rate was created with twice as much compost as the low rate. Siobhan used ½ cup humic acid and 2.5 lb compost in 4 gal. of water for the low rate treatment; for the high rate treatment she used 1 cup humic acid and 5 lb of compost in 4 gal. of water. Rob's treatment plots use the same application rate as Siobhan's low rate plots.

Head Lettuce

At Rob's Farm lettuce plots were grown in succession, providing three replications of the test. Each replication used a different variety of head lettuce: first was 'Pablo' (transplanted May 22, harvested July 14-16), then 'Bunte Forellenshus' (transplanted July 2, harvested Aug. 6), and last was 'Grandpa Admires' (transplanted Sept. 3, harvested Oct. 28). Soil in the treatment plots was drenched with compost extract at transplant and again 8-10 days later. Lettuce was harvested from treatment and control plots and yield data were recorded by plot.

At Siobhan's farm, all three replications were transplanted on June 19 to 'Winter Density', a head lettuce variety. Compost extract was applied as a soil drench on July 7 and July 22. On Aug. 2 and Aug. 9, lettuce was harvested, weighed, measured and Brix readings were taken. In addition to the yield study, Siobhan also took soil samples for qualitative soil health analysis and sent them to SRR Lab on July 21 and Sept. 29.

Lettuce yield data were analyzed at Practical Farmers of Iowa using JMP Pro 11 (SAS Institute Inc., Cary, NC). Statistical significance is determined at the P ≤ 0.10 level and means separations are reported using Tukey's Least Significant Difference (LSD).

Results and Discussion

Treatment Effect on Lettuce

At Rob's farm, individual head lettuce weight in the treatment plots averaged 0.40 lb, while head lettuce in the control plots also averaged 0.40 lb (**Figure 1**). No difference in yield was statistically discernible between the plots receiving compost extract and the control plots.

Due to high variation among plot yields at Siobhan's farm, numerical differences in yield (lettuce length and weight) and Brix among treatment and control plots were not great enough to be statistically discernible. Lettuce head length ranged from 7.8 in./head in control plots to 9.5 in./head in high rate treatment plots (**Figure 2**). Lettuce head weight at Siobhan's farm ranged from 0.24 lb/head in control plots to 0.28 lb/head in the high and low rate treatment plots (**Figure 3**). Brix measurements ranged from 4.6 °Bx (control) to 5.1 °Bx (high rate treatment) (**Figure 4**).

In 2014, farmer-cooperator Jason Jones found an increase in carrot length and Siobhan found an increase in carrot Brix readings due to application of compost extract (Kolbe et al., 2014). Neither farm, however, saw an improvement in carrot yield due to compost extract that year.

Z Bunte lettuce at Genuine Faux Farm.

Figure 1

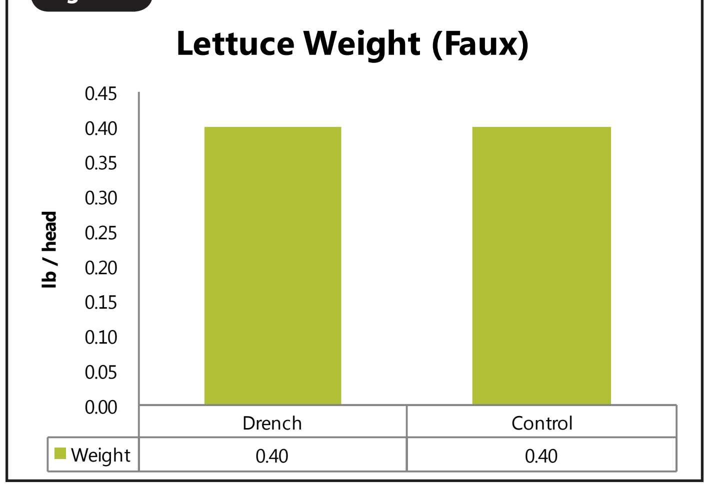

Figure 1. Mean individual head lettuce weight from treatment (Compost extract) and control plots at the Faux farm in 2015. Yields were not significantly different at $P \leq 0.10$.

Figure 2

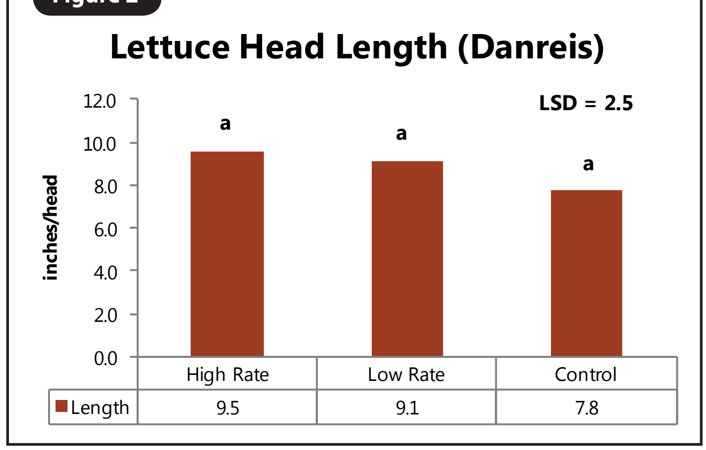

Figure 2. Mean individual head lettuce length from high rate treatment, low rate treatment, and control plots at the Danreis farm in 2015. Yields were not significantly different at $P \leq 0.10$.

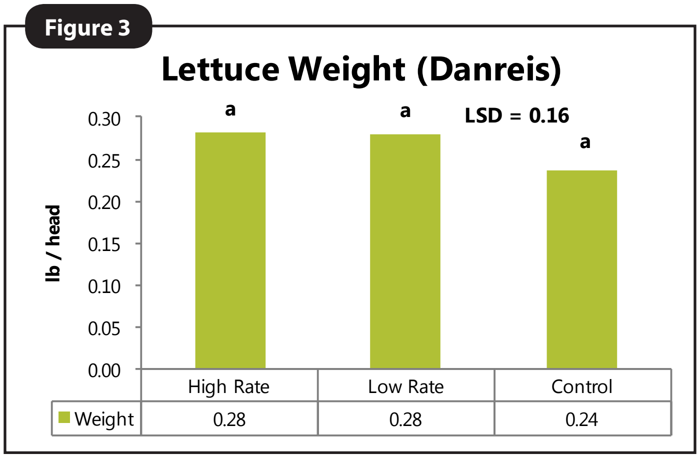

Figure 3. Mean individual head lettuce weight from high rate treatment, low rate treatment, and control plots at the Danreis farm in 2015. Yields were not significantly different at $P \leq 0.10$.

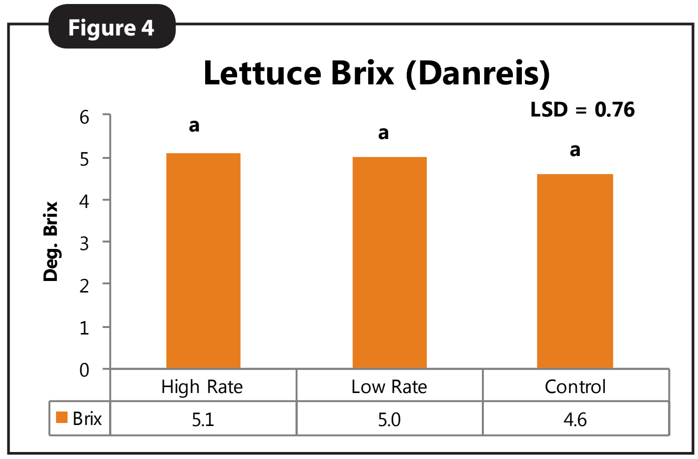

Figure 4. Mean lettuce Deg. Brix from high rate treatment, low rate treatment, and control plots at Danreis in 2015. Yields were not significantly different at $P \leq 0.10$.

Treatment Effect on Qualitative Soil Health Measures

During the 2014 study, effects of compost extract application on soil health were not discernible (Kolbe et al., 2014). For Year 2 of the study (2015) Siobhan again sent soil samples to the SRR lab at MUM for analysis and again, results showed no effect of compost extract applications on fungi to bacteria ratio or presence of beneficial microorganisms.

Conclusions and Next Steps

After two years of field trials on three farms, the measurable impact of compost extract application on annual vegetable crop yield is scant. In 2015, yield and Brix readings were not significantly different among treatment and control plots at either farm. No significant effect of compost extract application was observed.

Furthermore, the application rate of the compost extract was costly. At Siobhan's, low rate plots use 2.5 lb compost per 10 row-ft (0.25 lb/row-ft), high rate plots used 5 lb per 10 ft (0.5 lb/row-ft). At a purchase cost of $2.50/lb for compost (not including shipping), compost only for each 10-row-ft plot cost $6.25 ($0.63/row-ft) for the low-intensity and $12.50 ($1.25/row-ft) for the high-intensity application.

Siobhan sent soil samples, before and after application, to the SRR lab at MUM in Fairfield for Qualitative Soil Health Analysis. For each sample, the biomass ratio between bacteria and fungi was very poor, with bacteria heavily dominating. Siobhan suspected the initial BMR of the compost used for the extract may not have been sufficient to provide a bump; a BMR of 0.75 is desired for lettuce, the compost BMR was 0.132. The conspicuous lack of other microbes (oomycetes, flagellates, amoeba, ciliates) in the samples also made her wonder if moisture at sampling had an impact. She also considered the possibility of other factors contributing to the imbalance, which have not yet been discovered.

Based on Siobhan's sample analysis reports, we suspect the Qualitative Soil Health Analysis is lacking in methodological rigor, and may not be a useful test for understanding, much less amending, soil health. For every sample analyzed, amount of fungi were near zero (0.000 – 0.041; the target is 0.75). No sample was ever significantly different from zero, indicating variability in the samples was so high that estimated averages were unreliable. This may also indicate the methodological variability is so high that the posted averages may be unreliable, too. Additionally, outside experts raised questions about the microscope method used for detecting fungi and larger microbes.

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