



Brewers Spent Grain as a Soil Amendment for Eggplant

In a Nutshell:

- Brewers spent grain (BSG) is a waste product from beer production that can be used as a soil amendment to improve soil organic matter and nutrient availability [1].
- This year, Kate Solko and Kyle Maxwell repeated a trial investigating BSG as a soil amendment. They trialed the impact of fertilization with BSG vs. their new custom-blend fertilizer from Midwestern BioAg on eggplant yields.

Key Findings:

- There was no significant difference in yield of eggplant fertilized with BSG (4 lb/plant) vs. Midwestern BioAg custom fertilizer (5 lb/plant).
- Because raw BSG is quite heavy and difficult to work with, Solko and Maxwell say that they will probably avoid using it in the future.

BACKGROUND

The spent grain left over after brewing beer (brewers spent grain, BSG) contains a lot of nutrients and organic matter that make it a potentially useful agricultural fertilizer [1]. Ames farmers Kate Solko and Kyle Maxwell operate Root to Rise Farm on the same property as a brewery and have previously experimented with using BSG as a fertilizer for eggplant [2]. In 2023, they found that BSG doubled their eggplant yield compared to their then standard Sustane 8-2-4 fertilizer regime.

For their 2024 growing season, Solko and Maxwell switched fertilizers to a custom blend from Midwestern BioAg tailored for their soil's nutrient deficiencies. They were excited to see whether their new, custom fertilizer resulted in higher yields and once again compare a fertilizer to BSG. While BSG is, for them, a free amendment that utilizes a waste product, it is not easy to work with; when raw, it is heavy, very wet and hard to move around the farm, and they have not had success composting it. But, they said, if BSG dramatically increased yields compared to a purchased fertilizer once again, it might be worth the trouble of application!

METHODS

Design

Solko and Maxwell investigated two at-transplant fertilization treatments:

- 1) Midwestern BioAg custom blend fertilizer at 0.044 lb/ft²
- 2) BSG at 1 lb/ft²

Both products were incorporated into the soil with a small walk behind tiller prior to planting. Solko and Maxwell planted four randomized replicates of each treatment (**Figure A1**). Replication and treatment randomization allow for statistical analysis and conclusions about the effect of treatments on yield.

Cooperators

Kate Solko and Kyle Maxwell, Root to Rise Farm – Ames, IA

Funding

Stranahan Foundation



Eggplant and other vegetables at Solko and Maxwell's farmers market display. Photo taken Aug. 3, 2024.

Measurements

During the harvest season, Solko and Maxwell recorded yield as the weight of all marketable fruit per plot and the number of all marketable fruit per plot. They also recorded the number of unmarketable fruits per plot. Finally, they made visual observations of disease pressure and documented plant survival.

Data analysis

To evaluate the effect of the fertility treatments on cumulative season eggplant yield, we used an analysis of variance (ANOVA) followed by Tukey's Honest Significant Difference test (HSD) at 95% confidence. If the difference between the two treatments was greater than the HSD, we considered this to be a statistically significant effect. 95% confidence means that 95 times out of 100, the differences we see between treatments would be due to true differences in the means rather than random chance. On the other hand, if the resulting difference between the two treatments was less than the HSD, we would consider the treatment results to be statistically similar. We could make these statistical calculations because the cooperators' experimental design involved replication of the treatments (**Figure A1**).

RESULTS AND DISCUSSION

Survival rate and pest pressure

During the growing period, none of the eggplant plants looked markedly better than others. All had some potato beetle damage.

Yield

Solko and Maxwell found no significant difference in cumulative marketable eggplant yield or eggplant size between their BSG and Midwestern BioAg fertilizer treatments. The BSG treatment yielded on average 47 lb/plot, or about 4 lb/plant, while the Midwestern BioAg treatment yielded on average 59 lb/plot, or about 5 lb/plant (**Figure 1**). However, there was a lot of variability in yield within treatments across the field, leading to no significant difference between the treatments (HSD = 30 lb/plot). Similarly, the BSG treatment yielded an average of 35 fruits/plot or about 3 fruits/plant, which was not significantly different than the Midwestern BioAg treatment (43 fruits/plot or 3.6 fruits/plant) (HSD = 16 fruits/plot). The average size of each fruit was 1.3 lb in both treatments. Finally, eggplants were harvested on nine different occasions between Aug. 2 and Sept. 27. While total eggplant yield did vary by harvest date, eggplant yield did not vary significantly between fertilizer treatments across harvest dates.

In their 2023 trial with the same design but a different "business-as-usual" fertilizer (Sustane 8-2-4), fertilization with BSG resulted in more than double the total marketable fruit weight and number of marketable fruits compared to fertilization with Sustane. The Sustane plants looked better, with larger and greener leaves. This difference could have been caused by an array of mechanisms including excess nitrogen in the Sustane treatment or inherent differences in the materials applied.

CONCLUSIONS AND NEXT STEPS

While there was no significant difference in yield between BSG and Midwestern BioAg this year, Solko and Maxwell think that Midwestern BioAg is probably the better fertilizer for them. Maxwell concludes that "it's nice to have a free soil amendment [BSG], but it is maybe not as good as a custom blend." The two farmers appreciate that these two trials have helped them determine what fertilizer works best for them both in terms of yield and ease of use.

TABLE 1: Trial management details at Kate Solko and Kyle Maxwell's in 2024.

Eggplant variety	Black Beauty
Reps	4
Plants per plot	12
Number of rows in plot	3
Row-width	12 in. staggered
In-row spacing	18 in.
Bed prep	Rototill
Seeding date	Mar. 25
Transplanting date	June 14
Irrigation	Drip as needed; about weekly
Pest management	Jul. 12, Aug. 3 Sprayed Spinosad for potato beetle control
Harvest dates	Aug. 2 – Sept. 27

Eggplant yield does not differ significantly between BSG and Midwestern BioAg treatments

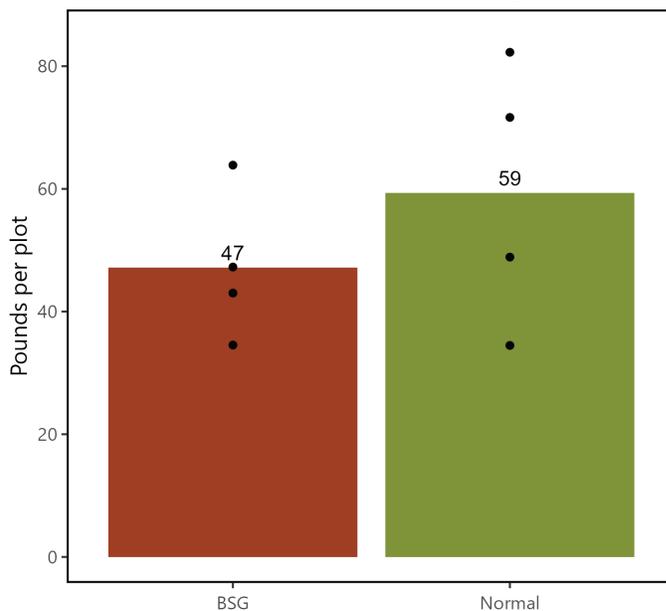


FIGURE 1. Marketable eggplant yield in Kate Solko and Kyle Maxwell's eggplant fertilization 2024 eggplant fertilization trial. Dots on bars indicate the yield of individual replicates within each treatment. We determined statistical significance Tukey's honest significant difference test (HSD = 30 lb/plot). There were no significant differences in yield between the two treatments.



Kate Solko and Kyle Maxwell's 2024 BSG as eggplant fertilizer trial in the field in mid-summer. There were no visible differences between the plants in the two fertilizer treatments this year. Photo taken July 25, 2024.

APPENDIX – TRIAL DESIGN AND WEATHER CONDITIONS

BSG	Midwestern BioAg	Midwestern BioAg	BSG	Midwestern BioAg	BSG	BSG	Midwestern BioAg
Plot 1	Plot 2	Plot 3	Plot 4	Plot 5	Plot 6	Plot 7	Plot 8
REP 1		REP 2		REP 3		REP 4	

FIGURE A1. Example of experimental design used by Solko and Maxwell which included randomized replicated fertilizer treatments. This design allowed for statistical analysis of the results.

Solko

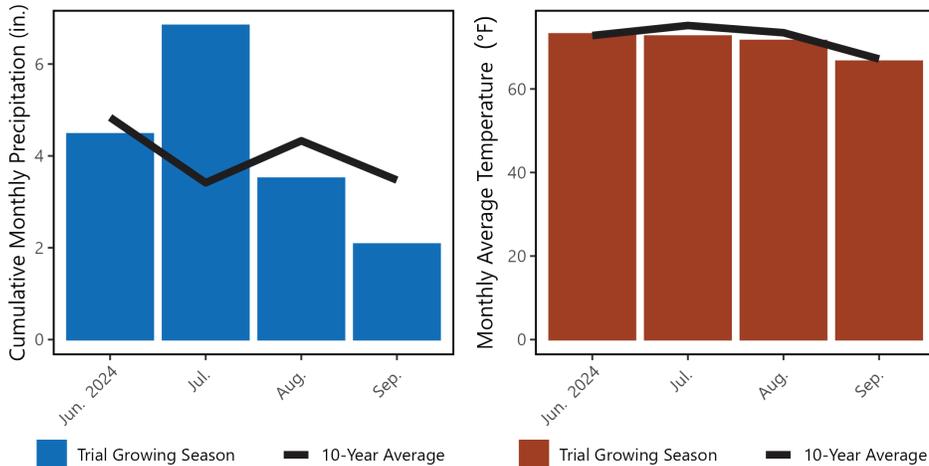


FIGURE A2. Modeled mean monthly temperature and rainfall at each trial site during the study period and the ten-year historic averages. Data is from the NasaPOWER climate dataset [3], [4].

REFERENCES

- [1] C. Cacace *et al.*, “Potential of native and bioprocessed brewers’ spent grains as organic soil amendments,” *Front. Sustain. Food Syst.*, vol. 6, 2022, Accessed: Jun. 01, 2023. [Online]. Available: <https://www.frontiersin.org/articles/10.3389/fsufs.2022.1010890>
- [2] E. Link, K. Solko, and K. Maxwell, “Brewers Spent Grain as a Soil Amendment for Eggplant,” Practical Farmers of Iowa, Research Report, 2023.
- [3] A. Biller, “Building soil fertility with spent brewers grains,” Final report for FNE17-864-SARE Grant Management System, 2018. Accessed: May 25, 2023. [Online]. Available: <https://projects.sare.org/project-reports/fne17-864/>
- [4] A. H. Sparks, “nasapower: A NASA POWER Global Meteorology, Surface Solar Energy and Climatology Data Client for R,” *J. Open Source Softw.*, vol. 3, no. 30, p. 1035, Oct. 2018, doi: 10.21105/joss.01035.
- [5] A. Sparks, “_nasapower: NASA-POWER Data from R_.” 2024. [Online]. Available: <https://CRAN.R-project.org/package=nasapower>



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