



Waste to Garden final report – 2016-2018 summary

The last harvesting for 2018 was been completed a couple weeks earlier than the previous two years due to the exceptionally warm and sunny summer. This is in spite of a later start due to a wet spring. In total we delivered about 178 pounds of green beans, about 251 pounds of onions and 400 pounds of potatoes this year to the Food Bank. The vegetables were of exceptional quality and went very quickly. Attached is a summary of the harvest per plot. Year over year overall production has increased. The general tilth of the soil shows good improvement, even in some of the worst areas (bed 9). This year neither compost nor biochar were added. (See table 2.) Lab testing at two locations showed that the soils were close to optimal with only nitrogen needed. Bloodmeal was tilled in at the rate of ~6 lbs. per bed. Some interesting results are observed. As in previous years for rotational planting the potato section swapped positions with the green bean section. Biochar's influence was not as apparent this year. The west center of the garden showed improvement over the past 2 yrs. There is a possibility that there was clopyralid laced manure pile in this location. If so, its effect is starting to finally wane. Each year there seems to be a less notable difference in the biochar vs the non-biochar amended beds. Some of this may be crop specific.

The season started late due to cold spring rains, but ended up with a very sunny drought summer. Watering was for 45min about every 3d day. We lost about 5 green bean plants over the summer. Like last year results, biochar amended beds did not always show a dramatic improvement for green bean yield. In some plots the non-biochar-amended beds performed better than those with biochar. Similar results showed up with the potatoes. The onion plant beds often showed better results without the biochar. There appears to be greater changes happening to these beds, perhaps on a microbial level. Recently an article was published that said that broccoli can diminish soil microbial and fungal activity in an Australian experimental study (Ryan 2001). It is possible that last year's broccoli crop negatively affected this year's onion plots.

The mixed results could have any number of causes. Some potential confounding factors could be mixing due to tilling and potential disruption of mycorrhizal networks, earthworm activity, increased overall microbial activity., temperature stress, etc.. The starting materials in the test garden were reasonably homogeneous with little variability between test sites. This remained consistent with subsequent annual testing. Recently we found that the brassica family can reduce mycorrhizal colonization. The 2017 broccoli planting may have also had an effect on the amendment beds' mycorrhiza. (<http://www.regional.org.au/au/asa/2001/2/a/ryan.htm>)

The anomalous results indicate that some plants may respond better to biochar and/or soil mycorrhizal activity than others, though there was a general tend toward better performance in some biochar beds. Certainly more detailed testing is required with more limited variables to isolate conditions most favorable to enhancing plant growth with a biochar supplement. Overall the soil showed a steady improvement. As in all outdoor plantings the yields varied to a



certain extent with weather as well as with soil conditions. The potato crops showed a steady gain over the course of 3 yrs., but the green beans were more susceptible to the long drought summer of 2018. Onion yields between the first and last years showed a good general improvement except for row 9 which had a high amount of rock in the fill dirt and weed intrusion from outside of the garden.

| | | Summary | | | | | |
|---|-------------------|-------------------|-----------------|-------------------|-----------------|-------------------|-----------------|
| | | Kg | Kg | Kg | Kg | Kg | Kg |
| Green beans | 3 replicate plots | Total 2018 | Ave 2018 | Total 2017 | Ave 2017 | Total 2016 | Ave 2016 |
| Plot A = Control (soil + compost + bonemeal + lime) | A | 18.7 | 6.2 | 22.0 | 7.3 | 13.6 | 4.5 |
| Plot B = Control + biochar | B | 18.2 | 6.1 | 25.6 | 8.5 | 12.1 | 4.0 |
| Plot C = Control + bloodmeal | C | 17.5 | 5.8 | 26.4 | 8.8 | 16.3 | 5.4 |
| Plot D = Control + bloodmeal + biochar | D | 18.6 | 6.2 | 27.6 | 9.2 | 17.1 | 5.7 |
| Potatoes | 3 replicate plots | | | | | | |
| Plot A = Control (soil + compost + bonemeal + lime) | A | 43.1 | 14.4 | 38.6 | 12.9 | 28.1 | 9.4 |
| Plot B = Control + biochar | B | 52.6 | 17.5 | 40.6 | 13.5 | 38.1 | 12.7 |
| Plot C = Control + bloodmeal | C | 44.0 | 14.7 | 35.3 | 11.8 | 30.4 | 10.1 |
| Plot D = Control + bloodmeal + biochar | D | 41.7 | 13.9 | 38.6 | 12.9 | 40.4 | 13.5 |
| Onions | Individual plots | Total 2018 | Ave 2018 | Total 2017 | Ave 2017 | Total 2016 | Ave 2016 |
| worm castings | 7 | 11.1 | | | | 9.1 | |
| worm castings + biochar | 7 | 11.5 | | | | 8.2 | |
| okara | 7 | 14.1 | | | | 4.1 | |
| okara +biochar | 7 | 11.5 | | | | 5.0 | |
| bokashi tea | 8 | 12.7 | | | | 8.2 | |
| bokashi tea +biochar | 8 | 9.0 | | | | 7.7 | |
| Tagro | 8 | 8.1 | | | | 10.0 | |
| Tagro + biochar | 8 | 13.4 | | | | 11.3 | |
| woodchips | 9 | 8.6 | | | | 5.4 | |
| woodchips +biochar | 9 | 3.7 | | | | 4.1 | |
| D to E fertilizer | 9 | 4.7 | | | | 6.8 | |
| D to E fertilizer + biochar | 9 | 5.5 | | | | 8.6 | |

Year over year, the worm castings plots were a consistent winner in the amendment testing. The okara plots also did well, showing great improvement by the third year. The tagro bed showed consistent good results in the biochar added plot, but declined in productivity without additional tagro being added in the last year.