

2017 Poultry Litter Biochar for Horticulture

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Energy Farmers
AUSTRALIA



**National
Landcare
Program**



1.0 AIM

This project was to examine the effect of applying poultry litter biochar to soil in a horticultural system and its effect on nutrient availability, plant health and yield. The assumption is that by adding biochar to the soil it will assist in fertiliser efficiency by holding nutrients in the soil profile and improve soil and crop health.

2.0 BACKGROUND

This project was initiated by Energy Farmers Australia (EFA) in 2016 after discussions with the owner of a cucumber farm in Geraldton, Western Australia. Their interest was in reducing the amount of nutrients lost on their sandy soils, reducing input costs and improving yield in their main crop, cucumbers.

Energy Farmers had been working with the poultry industry, producing poultry litter biochar from poultry litter waste and thought that poultry litter biochar could be a good fit to alleviate the problems that the farm was having with nutrient runoff as well as potentially supplying nutrition to the crop.

The basis of this assumption was through research EFA had conducted on biochar they had produced, which demonstrated that poultry litter biochar could supply, albeit low levels (compared to traditional fertilisers) N, P and K to the crop (see Appendix 1).

In addition to this, the increasing evidence around the world that biochar can provide many benefits when used in food production. Some of these benefits might include;

- Improved soil fertility and crop yields
- Increased fertilizer efficiency use
- Improved water retention, aeration and soil tilth
- Higher cation exchange capacity and less nutrient runoff
- Increasing soil pH
- Biomass energy production from crop residues and forest debris
- Net sequestration of carbon from the atmosphere to the soil thereby increasing soil organic carbon (SOC)
- Provide habitat for soil microbes and increase microbial activity

(Source: International Biochar Initiative)



Poultry litter biochar on top of the rows



Weight recording stations

3.0 DEMONSTRATION SITE/S DETAILS

The farm is located near Geraldton, Western Australia. The subsoil is dominated by sand to depths of at least 80cm, often highly leached with poor nutrient status and retention

4.0 METHOD

The trial was first established in 2016 with the poultry litter biochar being produced through Energy Farmers pyrolysis kiln from poultry waste supplied by a poultry farmer in the Gingin Shire.

The trial aim was to use a high and low rate of biochar with a high and low rate of the traditional fertiliser used on the farm. We also wanted to use a high and low rate of biochar on its own.

Each greenhouse block has 10 houses and each house has 5 rows where the cucumbers are planted. Each row rate was calculated by measuring the row length (50 meters) x the width (0.5m). therefore, every row was 0.0025 of a Ha.

The farmer applied his base fertilisers by hand and the biochar was applied shortly after with a small fertiliser spreader. Both fertiliser and biochar were then incorporated into the soil by a rotary hoe. To prevent edging effect, we spread the biochar only on the inside 3 rows of each house.

Cucumbers were planted by the farmer and managed as part of their normal farming operation. During the harvest period, cucumbers were picked and weights recorded for each treatment.

In the 2016 season the biochar was laid down on the 10th March with the cucumber seedlings planted on the 6th May

In the 2017 season no extra biochar was applied. However, the farmer did apply 5kg of CPM (starter fertiliser) across the whole farm as a base. In this season the cucumber seedlings were planted on the 28th April.

Table 1: 2016 Treatments and cost of treatments

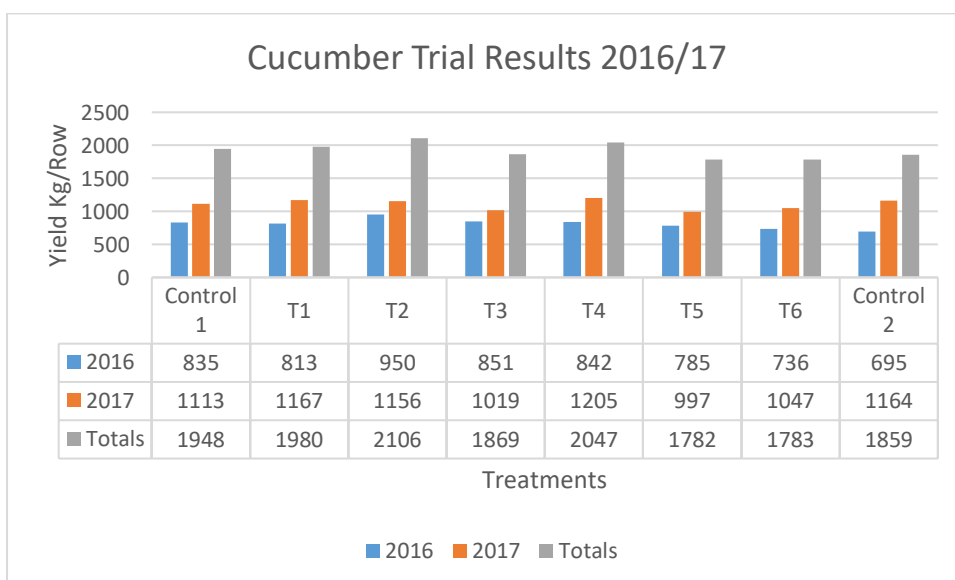
Treatment	CPM		NP		PLB		Total Cost
	kg/row	\$/row	kg/row	\$/row	kg/row	\$/row	\$/row
Control 1	9	7	5	7.8		0	15
T1	9	7	5	7.8	7	5	20
T2	9	7	5	7.8	13	10	25
T3					13	10	10
T4	1	1	2	3.12	7	5	9
T5	1	1	2	3.12	13	10	14
T6					33	25	25
Control 2	9	7	5	7.8		0	15

Key: CPM - Compound Poultry Manure, NP – Nitrophoska, PLB – Poultry Litter Biochar
Costs based on: \$1000/t NP and \$750/t for PLB & CPM

5.0 RESULTS

Trial 1 – Results

Figure 1: Trial 1 yield for 2016 and 2017



Economic Analysis

Table 2: Economic analysis of the treatments over two years

Treatment	Control 1	T1	T2	T3	T4	T5	T6	Control 2	Avg of Control
Total kg 2016	835	813	950	851	842	785	736	695	765
Total kg 2017	1113	1167	1156	1019	1205	997	1047	1164	1138
Total kg	1948	1980	2106	1870	2047	1782	1783	1859	1903
Cucumber Price									
2016 \$2.5/kg	2087	2032	2375	2127	2105	1962	1840	1737	1912
2017 \$2.5/kg	2782	2918	2890	2547	3012	2493	2618	2910	2846
2016 Cost	15	20	25	10	9	14	25	15	15
2017 Cost	0	0	0	0	0	0	0	0	0
Total Cost	15	20	25	10	9	14	25	15	15
Gross margin 2016	2072	2012	2350	2117	2096	1948	1815	1712	1897
Gross Margin 2017	2782	2918	2890	2547	3012	2493	2618	2910	2846
Total gross margin	4855	4930	5240	4665	5108	4441	4430	4632	4742
+/- control		188	498	-77	366	-301	-312		

*Note that total cost does not include the standard fertigation costs during the year applied to all treatments

6.0 DISCUSSION

The analysis points to Treatments 2 and 4 having a significant economic advantage over the normal practice over a two-year period. This supports research carried out by [NSWDPI](#) and [SANTFA](#) showing an increase of fertiliser efficiency with applications of biochar with traditional fertilisers.

Interestingly, in 2016 Treatment 2 was the highest yielding treatment (950kg) and had the best gross margin \$2350 however in 2017, Treatment 4 was the best performing with a yield of 1205kg and a gross margin of \$3013. This might suggest that using a lower rate fertiliser with a moderate rate of biochar is sustainable over the longer term. It would have been beneficial to measure the trial for a number of years to discover if this trend continued.

The results also showed that in cases where biochar is used with minimal or no starter fertiliser, it can have a negative impact on financial returns. This is shown in Treatments 3 and 5. The thinking around this is that the biochar can tax the soil of nutrients when not charged or used with fertilisers

This trial was very basic in nature and the results largely anecdotal but it has confirmed that the implications of applications of biochar in soil is not fully understood but there could be financial and environmental benefits from doing so over the longer term.

7.0 REFERENCES

DAFWA - <https://www.agric.wa.gov.au/mycrop/mysoil-pale-deep-sands-mid-west>
[International Biochar Initiative](#)
Lukas Van Zweiten - [NSW Department of Primary Industries – Biochar SANTFA](#)

Poultry Litter Biochar for Horticulture was delivered by Energy Farmers Australia. It was supported by NACC through funding from the Australian Government's National Landcare Program.

8.0 Appendix

Appendix 1

Poultry Litter Analysis

	pH (H2O)	PH (CaCl2)	EC (mS/cm)	Total C	CN Ratio	Total N	P %	K %
2016 Poultry Litter BC	9.0	8.5	7.7	38.8	10.6	3.7	2.53	2.80