

Application of low rates of poultry litter biochar with traditional fertiliser to assess fertiliser efficiency and yield response



Project ID: 1612-05-11 - Application of low rates of poultry litter biochar with traditional fertiliser to assess fertiliser efficiency and yield response was delivered by Energy Farmers Australia. It was supported by NACC through funding from the Australian Government's National Landcare Programme.

1.0 AIM

This trial aimed to demonstrate that by blending poultry litter biochar with a traditional fertiliser and deep banding it under the seed, fertiliser efficiency, yield and ultimately farm productivity would be improved.

2.0 BACKGROUND

This trial continued the work carried out by Energy Farmers in the NACC funded project titled, "Response and availability of potassium in wheat crops to applications of biochar" Project ID - 1512-05-04 in 2015. The trial examined the potential of using wheat straw biochar as a potential substitute for potash. We also enlarged the scope and trialled poultry litter biochar at various rates with traditional fertilisers to ascertain yield response.

Unfortunately, the original trial did not show any significant response in any of the treatments (biochar or traditional fertilisers) however, we were confident that this was due to seasonal conditions. It seems the nutrient levels in the soil were enough to sustain a crop of this magnitude in a low rainfall season.

Due to a farm worker accidentally ploughing up the original trial in March of 2016 and losing our markers, the trial site was changed. We also decided to change the scope of the trial, this was mainly due to new information gained.

The trial in question was based on research carried out by the [South Australian No Till Farmers Association \(SANTFA\)](#) who carried out a similar trial over 5 years. The evidence shows that blending biochar with traditional fertilisers is showing an increase in fertiliser efficiency and an improved gross margin and we wanted to test the work they did in a local context.

3.0 DEMONSTRATION SITE/S DETAILS

- Jib Jib Farm, Chillominy Rd, Northampton
- The soil is a lower performing loamy sand, moderately acidic with low levels of Nitrogen, Phosphate, Potassium and Organic Carbon
- Demonstration activities
 - Biochar production
 - Soil and tissue testing
 - Seeding of trial
 - Ongoing management of trial i.e spraying
 - Harvesting

4.0 METHOD

Poultry litter biochar was sourced from Chandala Poultry, Gingin, Western Australia, air dried over summer and processed through our pyrolysis kiln in Nanson, Western Australia.

Biochar was blended with fertiliser in paper bags and then banded under the seed using DAFWA's cone seeder on the 9th of May.

Treatments included:

- Treatment 1 - Control
- Treatment 2 - Farmer treatment – 110kg of (Ktill Plus)
- Treatment 3 - Farmer treatment plus 35kg biochar
- Treatment 4 - Farmer treatment plus 70kg biochar
- Treatment 5 - 50% Farmer treatment plus 35kg biochar
- Treatment 6 - 50% Farmer treatment plus 70kg biochar
- Treatment 7 - Farmer treatment plus 35kg biochar inoculated with FlexiN
- Treatment 8 - 50% Farmer treatment plus 70kg biochar inoculated with FlexiN

Final Seeding Protocol

	2016 Treatment Protocol	2016 Treatment Layout		
Treatment 1	Control – No fertiliser	1	6	4
Treatment 2	Farmer Treatment – 110kg Ktill Plus	2	3	8
Treatment 3	Farmer treatment plus 35kg biochar	3	7	1
Treatment 4	Farmer treatment plus 70kg biochar	4	8	3
Treatment 5	Control 2 – straight biochar 70kg	5	1	6
Treatment 6	50% Famer Treatment plus 35kg biochar	6	5	7
Treatment 7	50% Famer Treatment plus 70kg biochar	7	4	5
Treatment 8	Control 3 – 50% Farmer Treatment	8	2	2
		3	1	8
4	Changed to trt 1 as biochar didn't drop	2	6	4
5	Changed to trt 1 as biochar didn't drop	5	7	1

Ongoing management of the trial was carried out by DAFWA this included pre and post emergent spraying and application of FlexiN.

Pre & Post Treatments

Date	Action	Treatment	Rate	Product	Comments
27-Apr-16	Sprayed	Whole Trial	200ml	Lorsban	
27-Apr-16	Sprayed	Whole Trial	200ml	Dominex	
27-Apr-16	Sprayed	Whole Trial	118gm	Sakura	
27-Apr-16	Sprayed	Whole Trial	2lt	Sprayseed	
27-Apr-16	Top dressed	Whole Trial	50kg	Urea	
27-May-16	Sprayed	Whole Trial	800ml	Velocity	+ 1% hasten
27-May-16	Sprayed	Whole Trial	80lt	UAN	100ltr water rate
01-Jul-16	Sprayed	Whole Trial	800ml	Velocity	+ 1% Hasten
11-Jul-16	Sprayed	Whole Trial	200ml	Dominex	
11-Jul-16	Sprayed	Whole Trial	300ml	Prosaro	

Trial was harvested on the 27th of October 2016.

5.0 RESULTS

Yield

2016 Treatment Layout			kg/plot	T/ha	kg/plot	T/ha	kg/plot	T/ha
1	6	4	8.67	2.68	9.94	3.07	9.56	2.95
2	3	8	9.49	2.93	9.69	2.99	9.36	2.89
3	7	1	9.4	2.90	8.48	2.62	8.21	2.53
4	8	3	9.67	2.98	8.07	2.49	8.98	2.77
5	1	6	8.3	2.56	8	2.47	8.28	2.56
6	5	7	8.33	2.57	8.24	2.54	8.67	2.68
7	4	5	8.24	2.54	8.06	2.49	8.21	2.53
8	2	2	8.21	2.53	8.77	2.71	9.51	2.94
3	1	8	8.32	2.57	8.23	2.54	9.2	2.84
2	6	4	9.24	2.85	9.42	2.91	9.67	2.98
5	7	1	9.89	3.05	10.14	3.13	10.7	3.30

	2016 Treatment Protocol	Average Yield/Treatment
Treatment 1	Control – No fertiliser	2.70
Treatment 2	Farmer Treatment – 110kg Ktill Plus	2.86
Treatment 3	Farmer treatment plus 35kg biochar	2.81
Treatment 4	Farmer treatment plus 70kg biochar	2.81
Treatment 5	Control 2 – straight biochar 70kg	2.67
Treatment 6	50% Farmer Treatment plus 35kg biochar	2.78
Treatment 7	50% Farmer Treatment plus 70kg biochar	2.74
Treatment 8	Control 3 – 50% Farmer Treatment	2.69

ROI and Gross Margin

		Average Yield/Treatment	Wheat Price \$/tonne	Biochar Cost	Fertiliser Cost	Total Cost	Gross Margin	ROI %
	2016 Treatment Protocol	T/ha	\$ 250.00	\$ 500.00	\$ 605.00			
Treatment 1	Control – No fertiliser	2.7	\$ 676			\$ -	\$ 676	
Treatment 2	Farmer Treatment – 110kg Ktill Plus	2.9	\$ 714		\$ 66	\$ 66	\$ 648	9.82
Treatment 3	Farmer treatment plus 35kg biochar	2.8	\$ 702	\$ 18	\$ 66	\$ 84	\$ 618	7.41
Treatment 4	Farmer treatment plus 70kg biochar	2.8	\$ 702	\$ 35	\$ 66	\$ 101	\$ 601	5.95
Treatment 5	Control 2 – straight biochar 70kg	2.7	\$ 668	\$ 35		\$ 35	\$ 633	18.09
Treatment 6	50% Farmer Treatment plus 35kg biochar	2.8	\$ 694	\$ 18	\$ 33	\$ 51	\$ 643	12.74
Treatment 7	50% Farmer Treatment plus 70kg biochar	2.7	\$ 685	\$ 35	\$ 33	\$ 68	\$ 617	9.08
Treatment 8	Control 3 – 50% Farmer Treatment	2.7	\$ 672		\$ 33	\$ 33	\$ 639	19.37

Note: gross margin calculation based on fertiliser and biochar cost alone

For soil & tissue tests please refer to attachments

6.0 CONCLUSION

In line with the first year (2015) results, there was no significant difference between any of the treatments. The fact that the control (with no fertiliser) yielded 2.7t/ha shows that there was enough nutrients in the soil to maintain a crop of this level.

We don't believe the evidence is strong enough to suggest that using biochar at low rates will improve crop productivity in the first or even second year however, as the work done by the SANTFA demonstrates, the long-term use of low rates of biochar, blended with the fertiliser and placed under the seed does improve fertiliser efficiency and crop productivity.

While the yields don't suggest any significant variation, the economic analysis is interesting. However, even these results would be highly suspect if the trial was carried out over a longer time frame. Treatment 5 – straight biochar and Treatment 8 – 50% farmer treatment returned the best ROI's, at 18% and 19% respectfully, with the benefit of hindsight, the farmer could have saved a lot of money

by using half the fertiliser. Treatment 6 – 50% farmer treatment and 30 kg of biochar is the treatment we are most interested in. At \$15/ha lower than the current fertiliser regime, there could be big saving to farmers bottom line. Ideally, a commitment for a 5-year trial using the same treatments on the same plots would be advantageous to really see if this practice had merit.

Soil and tissue tests were as expected and did not show any significant difference in nutrient levels, this can be attributed to the short time frame of the trial.

During this project, the sourcing of poultry litter became a problem and so it would not be possible to produce poultry litter biochar to meet all broadacre demand. However, the production and testing of feedstocks more available to farmers such as wheat, lupin and canola straw maybe prove to be more economically and logistically viable.

7.0 ACKNOWLEDGMENTS

Brad Wilson – Jib Jib Farms

Trevor Bell & Steve Cosh – DAFWA

Sarah Jeffery - NACC

8.0 REFERENCES

South Australian No Till Farmers Association (SANTFA) – [Targeted Biochar Use Can Reduce Input Costs](#)

Application of low rates of poultry litter biochar with traditional fertiliser to assess fertiliser efficiency and yield response' was delivered by Energy Farmers Australia. It was supported by the Northern Agricultural Catchments Council through funding from the Australian Government's National Landcare Programme