

Agro-economic valuation of biochar using field-derived data

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Introduction

Although there has been a significant interest in biochar recently, the implementation of the technology on a broad scale is still lacking. Scientific data on the agronomic benefits of biochar allows an economic evaluation to be developed. This is an industry enabling analysis to justify economic models of potential pyrolysis projects.

Results of this analysis will be used to assist in the market development process for biochar by quantifying the costs and benefits involved with the use of biochar as a soil amendment by land managers.

A number of replicated long-term field trials were established in a subtropical environment on the far north coast of NSW (29°S, 153°E), Australia. Trials are on an acidic red Ferrosol with low nutrient availability.

A cereal- legume rotation was established in 2007 to test the impact of two contrasting biochars: poultry litter biochar and papermill biochar amendments, compared with standard farmer practice, lime and compost application. Fertiliser included annual application of urea (400kg/ha), single superphosphate (300kg/ha) and muriate of potash (140kg/ha) before the summer crop. Both biochars were applied at 10t/ha, lime at 3t/ha and compost at 25t (wet)/ha. The site was sown with sweet corn in the 2007/2008 summer, followed by fababean as the winter legume. This rotation was continued until Feb 2010.

Results and Discussions

Chemical analysis of the biochars revealed significant differences in their nutrient content and liming capacity (Table 1). Both biochars influenced soil chemistry resulting in a reduction in soil acidity, and an increase in soil N, P, CEC and C. These changes in soil chemistry were sustained over the experimental period,

reflected by the sustained improvement in yield in the biochar treated plots.

Table 1: Basic chemical characterization of biochars used in field trial

	Poultry litter biochar	Papermill biochar
N (%)	2.2	0.44
P (%)	2.4	0.11
K (%)	2.1	0.047
CaCO ₃ (%)	14	7.50

An enterprise budget for sweet corn in northern NSW was specifically developed for this analysis, whilst an existing budget for fababeans in northern NSW (NSW DPI, 2009) was used in the analysis.

Two types of economic analyses were conducted;

1. Partial or marginal analysis
2. Benefit cost analysis (BCA)

The first of these analyses, the partial or marginal analysis, examined the elements of the enterprise budget which changed as a result of the change in the activity with all other elements remaining the same. Partial budgeting was used to assess the net benefits from investment in the biochar soil amendment allowing for comparison of alternative treatments.

In the net benefit analysis, we assumed a value of poultry litter biochar of A\$300 per t, and a cost of spreading of \$25 per t. It was shown that over the 3 crops described in Table 2, the net value of production was increased by \$5731 per ha compared to the standard farmer practice. This resulted in an incremental net benefit increase of \$2480/ha. This value was even greater in the papermill biochar treatment.

Table 2: Impact of amendments on crop yield

All treatments with farmer practice fertiliser	Corn 07/08 weight of cobs (t/ha)	Fababean 2008 dry bean (t/ha)	Corn 08/09 weight of cobs (t/ha)
Farmer practice	20.5	2.1	19.4
Poultry Biochar (10t/ha)	23.7	3.9	23.3
Papermill Biochar (10t/ha)	25.7	3.9	27.3
Lime (3t/ha)	22.3	4.6	24.9
Compost (25t/ha)	19.9	4.4	23.0

The field site at Wollongbar (Photograph 1) provides the basis for long-term evaluation of biochar (and other organic amendments) in sub-tropical cropping. It must be stressed that these economic valuations will vary significantly between regions and the value of the crop produced, and should therefore only be used as a guide. The presentation will also describe other methods for valuing the biochar, such as valuing the direct nutrient addition from the biochar, and evaluation of benefits such as increased biological N₂ fixation and the economic and greenhouse gas emission benefit associated with this.



Photograph 1: Fababean crop in 2008

Conclusions

This study has clearly demonstrated that biochar derived from poultry litter and biochar derived from papermill wastes has an impact on yield and amendment at 10t/ha provides significant economic gains when analysed over several cropping cycles.

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[†] NSW DPI (2009), *Farm Enterprise Budget Series*. Budget for fababeans available at http://www.dpi.nsw.gov.au/__data/assets/pdf_file/0006/175992/fababeans.pdf