

# Poultry Litter Biochar Fertiliser for Horticulture

Interim Report February 2017



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**Please note: This interim report is based on 1 year’s data only so the results can’t be substantiated. The demonstration has been extended for another year so a more comprehensive report will come out then.**

**Treatments**

- CPM Compound Poultry Manure
- NP Nitrophoska
- BC Biochar

|           | CPM  | NP   | BC   |
|-----------|------|------|------|
| Treatment | T/ha | T/ha | T/ha |
| Control 1 | 9    | 5    |      |
| T1        | 9    | 5    | 7    |
| T2        | 9    | 5    | 13   |
| T3        |      |      | 13   |
| T4        | 1    | 2    | 7    |
| T5        | 1    | 2    | 13   |
| T6        |      |      | 33   |
| Control 2 | 9    | 5    |      |

**Assumptions**

- Treatment Cost
  - Nitrophoska \$1.56/kg
  - Poultry Manure \$0.76/kg
  - Biochar \$0.76/kg (Have based biochar price on poultry manure)
- Cucumber Price \$2.60/kg

**Discussion**

Based on the above assumptions, treatment 2 was highest performing treatment, returning a yield of 1057kg and a gross margin of \$2,720/row. This is a gross margin of \$487/row higher than the average of the two controls. The Return on Investment (ROI) of this treatment is 18.9%.

Treatments 3 & 4 represent the highest ROI at 22.2% and 22.1% respectively. This is due to the low cost of inputs at under \$10/ha. While these numbers indicate that using low and no rates of pre plant fertiliser with biochar is beneficial economically, it would need to be proven up in controlled trials over a number of years. The application rates could also be a little “rubbery” and again would need confirmation through ongoing trials. (Refer appendix 1)

The graph (Appendix 2) represents the cumulative in crop growth weight in Kgs of cucumbers over the growing season for each treatment against an average of the two controls, which are indicated by the horizontal line at 0.

What this graph clearly shows is that Treatment 2 is the best in terms on yield and Treatment 4 the most economical response (this graph was made before we did the economic analysis). However, what is interesting is with Treatment's 3 and 6, both with biochar only.

Its seems as though at around day 35 to 40, the yield of the treatments started to go into the negative until day 90 where there was a positive increase in yield, particularly in treatment 3. Our assumption is that the biochar started to absorb any applied nutrients early in the trial making it unavailable to the plants until the char reached a point where it began to release the nutrients it was holding. This is consistent with schools of thought that biochar can "tax" soil of nutrients unless pre-charged. It will be interesting to observe what happens next season.

In terms of Mycorrhizal activity (Refer Appendix 2), treatment 4 was the highest at 12%, far above any of the other treatments, the next being treatments 5 and 6 at 3%. The relationship of mycorrhizal fungi and biochar is a complex one but the research suggests that increases in mycorrhizal activity increases the availability of the plant to utilise soil nutrients. As to why there is such variation between the various treatments is not fully understood and may need further investigation.

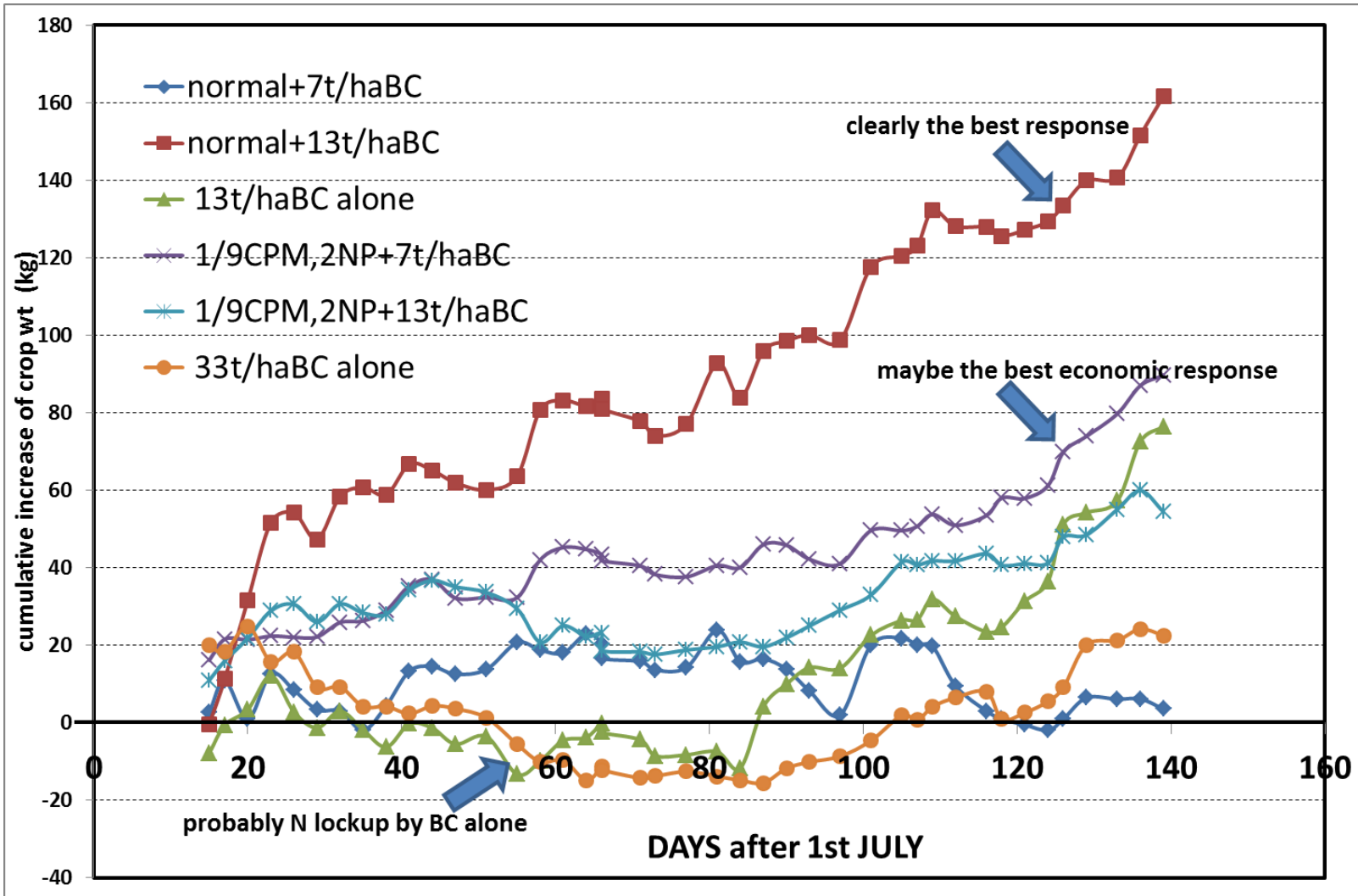
Leaf analysis was taken during the season for nutrient content (Refer appendix 3) however there is no significant variation between the treatments for all the nutrients.

#### Appendix 1 - Yield and Gross Margin Analysis

| Treatment                     | Control 1 | 1       | 2       | 3       | 4       | 5       | 6       | Control 2 |
|-------------------------------|-----------|---------|---------|---------|---------|---------|---------|-----------|
| Yield Kg/Row                  | 933       | 917     | 1057    | 951     | 944     | 889     | 837     | 795       |
| Return \$/Row                 | \$2,427   | \$2,384 | \$2,745 | \$2,472 | \$2,455 | \$2,312 | \$2,178 | \$2,068   |
| Cost \$/Row                   | \$14.64   | \$19.96 | \$24.52 | \$9.88  | \$9.20  | \$13.76 | \$25.08 | \$14.64   |
| Gross Margin                  | \$2,412   | \$2,363 | \$2,720 | \$2,462 | \$2,445 | \$2,298 | \$2,153 | \$2,053   |
| Average GM of the 2 Controls  | \$2,233   |         |         |         |         |         |         |           |
| Return above/below Control GM |           | \$132   | \$487   | \$229   | \$213   | \$65    | (\$80)  |           |
| ROI                           |           | 5%      | 18.9    | 22.2%   | 22.1%   | 3.8%    | -4.2%   |           |

Note: Gross Margin Analysis does not take into account cost of fertigation fertilisers through the season and is based on pre seeding treatment only.

Appendix 2 - Cumulative Crop Growth



**Appendix 3 - Cucumber Leaf Mycorrhizal Root Colonization**

| Treatment   | Leaf number | Leaf Dry wt (g) | Mycorrhizal % |
|-------------|-------------|-----------------|---------------|
| Control 1   | 3           | 1.3             | 1             |
| Control 2   | 3           | 1.2             | 1             |
| Treatment 1 | 3           | 1.8             | 1             |
| Treatment 2 | 3           | 2.2             | 1             |
| Treatment 3 | 3           | 1.7             | 1             |
| Treatment 4 | 3           | 2.5             | 12            |
| Treatment 5 | 3           | 1.3             | 3             |
| Treatment 6 | 3           | 2.7             | 3             |

**Appendix 4 - Cucumber Plant Nutrients**

| Sample ID | N   | Al    | Ca   | Co    | Cu    | Fe    | K    | Mg   | Mn    | Mo    | Na   | P    | S    | Zn    |
|-----------|-----|-------|------|-------|-------|-------|------|------|-------|-------|------|------|------|-------|
|           | %   | mg/kg | %    | mg/kg | mg/kg | mg/kg | %    | %    | mg/kg | mg/kg | %    | %    | %    | mg/kg |
| Control   | 4.0 | 293   | 4.17 | 0.2   | 24.3  | 251   | 2.50 | 0.89 | 539   | 34.2  | 0.73 | 0.48 | 1.05 | 407   |
| Treat 1   | 4.1 | 415   | 4.98 | 0.2   | 19.1  | 345   | 2.45 | 1.09 | 478   | 25.9  | 0.59 | 0.50 | 1.03 | 380   |
| Treat 2   | 4.4 | 449   | 5.16 | 0.2   | 17.6  | 365   | 2.49 | 0.99 | 502   | 31.5  | 0.61 | 0.48 | 1.12 | 385   |
| Treat 3   | 4.7 | 199   | 4.40 | 0.1   | 15.5  | 206   | 2.59 | 1.05 | 455   | 20.3  | 0.56 | 0.59 | 0.86 | 365   |
| Treat 4   | 4.2 | 486   | 3.73 | 0.2   | 17.5  | 329   | 1.42 | 0.73 | 336   | 21.3  | 0.56 | 0.47 | 0.96 | 382   |
| Treat 5   | 4.9 | 284   | 3.28 | 0.2   | 35.8  | 209   | 2.63 | 0.78 | 348   | 23.3  | 0.65 | 0.67 | 0.80 | 285   |
| Treat 6   | 3.2 | 1040  | 3.48 | 0.7   | 14.7  | 101   | 1.18 | 0.67 | 362   | 23.0  | 0.36 | 0.34 | 0.80 | 346   |

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