

# Increasing Nutrient Efficiency with New Organic Amendments

## KEY POINTS

- ▶ The effectiveness of animal manures is being examined in two trial sites.
- ▶ The results to date are inconclusive, due to poor site selection and difficult seasonal conditions.
- ▶ There has been a similarity in yield between animal manure and synthetic fertiliser, which is the trial objective, however there was also no rate response.

<b>Project title</b>	Increasing Nutrient Efficiency with New Organic Amendments
<b>Project code</b>	4.2.005
<b>Project partners</b>	Southern Cross University, NSW DPI, NSW EPA

<b>Funding partner</b>	Soil CRC
<b>Trial Site Locations</b>	TAIC, Tallimba NSW
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## INTRODUCTION

Many farmers have access to manures or other organic amendments, but transport and spreading costs along with uncertainty over crop responses and longer-term impacts on soils have limited their use. Crop responses can be inconsistent because organic amendments can have variable effects on soil nutrient cycling and longer-term soil carbon stores. This is due to the complex interactions between soil microbes and soil carbon, and the additional nitrogen, phosphorus, sulphur and carbon inputs from organic amendments.

When carbon, nitrogen, phosphorus or sulphur are added to soils, and one element is in short supply, soil microbes typically obtain the missing nutrient to sustain their growth by degrading existing soil organic matter to release the needed element. As a result of these processes, and following the death of soil microbes, crop plants may accumulate more of a given nutrient than was applied in the fertiliser or amendment. This

is often simplistically seen as 'enhanced nutrient use efficiency (NUE)'. However, while there may be some short-term nutrient gain, it comes at the expense of native soil organic matter degradation, and this will have longer term consequences for both soil processes and crop nutrition.

The project is examining the impact organic amendments, mainly manures, have on soil carbon levels and nutrient availability in the field and will determine the effectiveness of manures as phosphorus fertilisers compared to synthetic fertilisers. A range of soil health parameters will also be assessed to investigate whether manures have any effects on soil health compared to synthetic fertilisers. Ultimately the project will develop recommendations for the use of new organic amendment products to give growers confidence to replace or partially replace mineral fertiliser inputs with organic amendment products.

## METHODOLOGY

As part of the Soil CRC funded project, FarmLink have been managing two field trial sites. One site is located at the Temora Agricultural Innovation Centre (TAIC), and the second at Tallimba, NSW. These two sites will evaluate soil health and nutrient use efficiency of organic amendments over a 3-year period.

### Tallimba Trial Site

This trial is focused on measuring Phosphorus (P) uptake in plants as a result of applying organic amendments. Chicken manure from a local poultry farm was the chosen amendment and analysis was performed to determine the available nutrient content of the manure. Once the P concentration was known, different amounts of manure were applied to treatments to meet target concentration of P applied in kg/ha. Separate treatments also had the same P concentrations applied in the form of single super phosphate (SSP) fertiliser. These treatments are outlined in Table 1.

Table 1 - Treatment list of the Tallimba trial site

No.	Treatment	P Rate (kg/ha)
1	Manure	0
2	Manure	5
3	Manure	10
4	Manure	20
5	Manure	30
6	Manure	45
7	Manure	60
8	SSP	0
9	SSP	5
10	SSP	10
11	SSP	20
12	SSP	30
13	SSP	45
14	SSP	60

The treatments were applied in a randomised small plot trial design. Once the manure was applied, half of each plot was incorporated using an offset disc so that incorporation versus nil incorporation (incorporated by sowing) could also be compared. The SSP was applied using a small plot seeder. Canola was sown across the whole trial with no additional fertiliser applied with the seed. A combination of urea, sulphate of potash, copper and zinc fertilisers were applied to the trial as granular fertiliser. 500kg/ha of urea was applied in split applications, pre-sowing and two post emergent applications. The other products were all applied pre-sowing. The nutrients were applied to make sure any confounding effects of nutrients contained in the manure would be balanced out across all treatments and the focus of the trial would be phosphorus. During the season, biomass cuts were taken in select treatments so that the P concentration of the plant material could be analysed to identify if there was any difference in P uptake between SSP and the manure. All treatments also had a harvest index cut taken at windrow timing for the same purpose. Grain yield was also recorded, and P concentration of the grain analysed.

### TAIC Trial Site

This site has had a range of manure products and synthetic fertiliser treatments applied during the 2021 season to measure nutrient use efficiency and soil health. However, the site was established on a heavy clay soil with underlying issues such as sodicity. Due to very wet conditions during the 2022 season, the site was inaccessible and unable to be sown. The site has been abandoned and will be reestablished at a new site in 2023.

## RESULTS

Due to lengthy delays in getting P concentration analysed, the results from the 2022 trial are incomplete. Analysis of both grain and biomass samples will be conducted to determine if there is a difference in P concentration between fertiliser applied as SSP or manure. This includes regular biomass cuts that were taken through the year on select treatments. Grain yield results are shown in Figure 1. Although there is an increasing rate of P applied for both manure and SSP, there does not appear to be a significant response as the P rate increases. However, there is also not a difference between manure and SSP either unploughed

or ploughed. The purpose of the trial is to see if manure and SSP applied at the same rate will have the same effect on yield which is shown. However, these results are inconclusive as there is no rate response.

P concentration levels may identify treatment differences, but the trial results may be just reflective of the wet seasonal conditions during 2022 which may have limited yield potential. The trial will be repeated in 2023 with wheat grown across the site to determine if this crop type, in different seasonal conditions, will have a similar response.

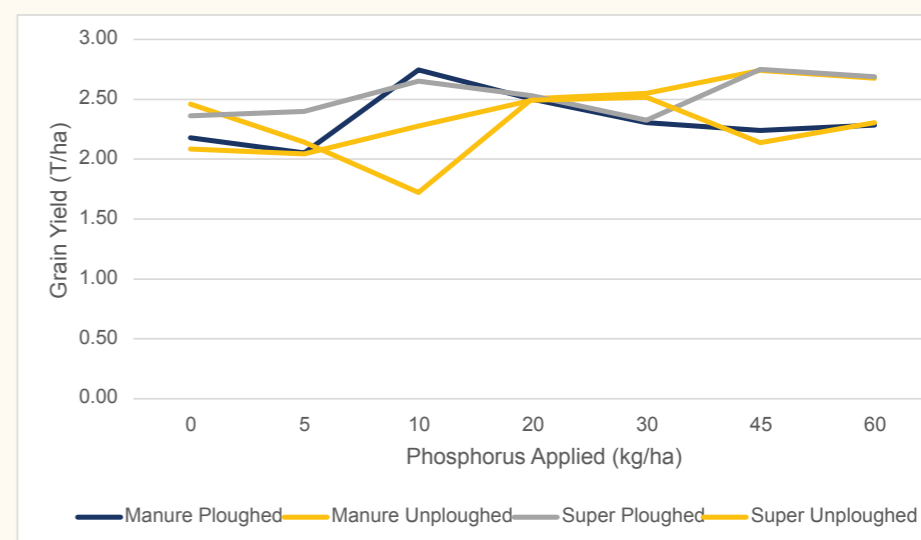


Figure 1 - Canola grain harvest results from the 2022 trial to show any comparison between manure and SSP with increasing rates, or incorporation method.



## CONCLUSION

Access to animal manures by growers may be just as effective as applying synthetic fertilisers and may even improve nutrient use efficiency. However, the trial results from this project to date are inconclusive due to poor site selection and very wet seasonal conditions. The P response trial did show that the yield from both animal manure and synthetic fertiliser treatment were similar, however, there was also no rate response recorded. P concentration level of both grain and biomass may determine stronger treatment differences but these results are yet to be recorded. The trial will continue in 2023 to hopefully identify both a rate response and included nutrient concentrations in plant and grain material.