WOADY YALOAK
Productive Catchment Management

Update on local lime and biological products in the Woady Yaloak Catchment (2012 – 2016)

Australian Government | National Landcare Programme

CORANGAMITE CMA

GRDC GRAINS RESEARCH & DEVELOPMENT CORPORATION

About these notes

These trial results have been prepared by Cam Nicholson, Nicon Rural Services for the Woady Yaloak Catchment Group. They combine results from four years of investigation (2012-2016) funded through the Corangamite CMA, National Landcare Program and the Grains Research and Development Corporation.

Disclaimer

Background

Farmers in the Woady Yaloak Catchment continued to host a range of crop and pasture trials, to generate local information on the response to various inputs such as lime, fertilisers and alternative products. The trials are currently monitored by Southern Farming Systems and continue the experimental program started by the Catchment Group in 2009. This report summarises the key findings from a period from 2012 to 2016.

Lime

Lime was applied at a range of rates and at most crop and pasture sites. To simplify interpretation only the 1.25 t/ha and the 2.50 t/ha rate (1 t/ac) is presented and compared to the control or Nil treatment (no lime applied). Lower lime application rates are also being monitored to further understand the best rate and frequency of lime to apply but the findings are not reported at this time.

Pasture

Pasture dry matter results are combined across multiple cuts and multiple years to give a total level of production for the period. This takes out any unusual variation from one cut or season and represents the response across both favourable and dry years (table 1).

Table 1: Combined change in pasture dry matter production by liming at 1.25 t/ha or 2.50 t/ha compared to no liming

Location	Pittong	Illabarook	Mt Mercer	Mannibadar	Rokewoood (sth)	Linton
Years	2012-2015	2012-2015	2012-2016	2013-2016	2014-2016	2014-2016
Year lime applied	2012	2012	2012	2009-2011	2014	2014
Pasture type	Perennial ryegrass, sub clover	Cocksfoot, subclover, annual weeds	Tall fescue, cocksfoot, sub clover	Perennial ryegrass (Vic), subclover	Phalaris, subclover	Annual grasses, subclover
Cuts	11	14	19	12	8	9
pH ($CaCl_2$) on Nil treatment	5.2	4.9	4.8	4.5	5.2	4.8
Response to lime @ 1.25 t/ha	**0%**	**6%**	**5%**	**5%**	**4%**	**1%**
Response to lime @ 2.5 t/ha	**4%**	**1%**	**7%**	**Not applied**	**9%**	**-1%**

There was no significant dry matter response to liming at any site. This is not surprising given the starting pH at all sites (except for Mannibadar) were at or about the accepted threshold pH for where lime would result in a response. In effect the results confirm the accept benchmark that a likely lime response in pasture will not occur at pH_{CaCl2} of more than 4.6.

Crop

Grain yield responses were recorded for canola (table 2) but not for wheat (table 3).

Table 2: Change in canola yields by liming at 1.25 t/ha or 2.50 t/ha compared to no liming

Location	Pittong	Rokewoood (west)	Werneth	Rokewood (nth)	Cape Clear
Measurement year	2016	2014	2012	2012	2012
Year lime applied	2012	2012	2012	2012	2009-2011
pH ($CaCl_2$) on Nil treatment	5.1	4.7	4.7	4.8	4.8
Response to lime @ 1.25 t/ha	**-18%**	**16%***	**8%***	**21%***	**10%**
Response to lime @ 2.5 t/ha	**15%**	**0%**	**1%**	**38%***	**Not applied**

* = significant at p=0.05

Table 3: Change in wheat yields by liming at 1.25 t/ha or 2.50 t/ha compared to no liming

Location	Rokewood (west)	Werneth		Rokewood (nth)			Cape Clear		
Measurement year	2015	2013	2015	2013	2014	2016	2013	2014	2015
Year lime applied	2012	2012		2012			2009-2011		
pH (CaCl) on Nil treatment	4.7	4.7		4.8			4.8		
Response to lime @ 1.25 t/ha	**0%**	**1%**	**-5%**	**-2%**	**5%**	**10%**	**-3%**	**16%**	**34%**
Response to lime @ 2.5 t/ha	**4%**	**0%**	**0%**	**2%**	**-5%**	**6%**	**Not applied**		

Canola is considered more sensitive to soil acidity (and the corresponding soil aluminium) that wheat and these results would tend to support this conclusion. Wheat yields under liming were generally within a few % of the nil treatment. The yield increase at Rokewood (nth) in 2016 and Cape Clear in 2014 and 2015 may indicate a response as the soil pH on the no lime treatment acidifies further over time. Soil testing in 2017 will confirm the change in pH.

Lime movement in the soil and subsoil acidity

Lime was surface applied at all sites. The rate of lime movement through the soil has been relatively slow (table 4). This is consistent with results from the initial work conducted by Woady Yaloak in 1999 and 2000.

Table 4: Change in soil pH down the profile in April 2015 from a May 2012 surface application of lime at 2.50 t/ha

Depth (cm)	Rokewood (west)		Werneth		Illabarook		Pittong		Mt Mercer	
	Nil	**Lime**	**Nil**	**Lime**	**Nil**	**Lime**	**Nil**	**Lime**	**Nil**	**Lime**
Type	Crop		Crop		Pasture		Pasture		Pasture	
0-10	4.7	5.4	4.5	5.2	5.3	6.2	5.1	5.5	4.9	5.6
10-20	5.1	5.6	5.1	5.0	4.9	4.8	4.6	4.6	4.7	4.8
20-30	6.4	6.5	5.8	5.7	5.1	5.1	4.5	4.5	4.9	4.9

The slow movement of lime through the soil is of concern if the subsoil (below 10 cm) is acidifying to a level that is toxic to plant roots. Indications from these results would suggest that one site has high subsoil acidity (Pittong). Sampling at 10 additional sites in the Woady Yaloak Catchment in 2014 as part of the Corangamite soil monitoring network revealed four sites had a pH_{CaCl2} in the 10 – 20 cm layer less than 4.7, with one site as low as 4.3. Work is underway to determine what effect this acidic layer may have on plant growth and what practices can be used to encourage the movement of lime to depth in the soil.

Alternative fertilisers and biological products

The Woady Yaloak Catchment Group evaluated a range of alternative fertilisers and biological products from 2009 to 2011 (report available of the Woady Yaloak website). Product application continued at several sites despite no external funding (although no measurements were taken) until further support was received through the National Landcare Program (late 2013) and the Corangamite CMA (2014). A summary of the main findings are presented.

Animal manures

The most promising alternative fertilisers were the animal based manures (pig and poultry) however there remained a question around how long a single large application of manure (1.9 t/ha dry or 5 m^3) would last compared to annual applications of traditional inorganic fertiliser. One trial received poultry manure in 2009 and again 2014 at a rate of 1.9 t/ha (5 m^3). The total difference in dry matter production (2009 to 2016) from the manure or inorganic fertiliser compared to no fertiliser was 9% and 13% respectively. In the first two years after application the manure grew higher amounts of dry matter compared to the inorganic fertiliser but this declined in the third and subsequent years (figure 1).

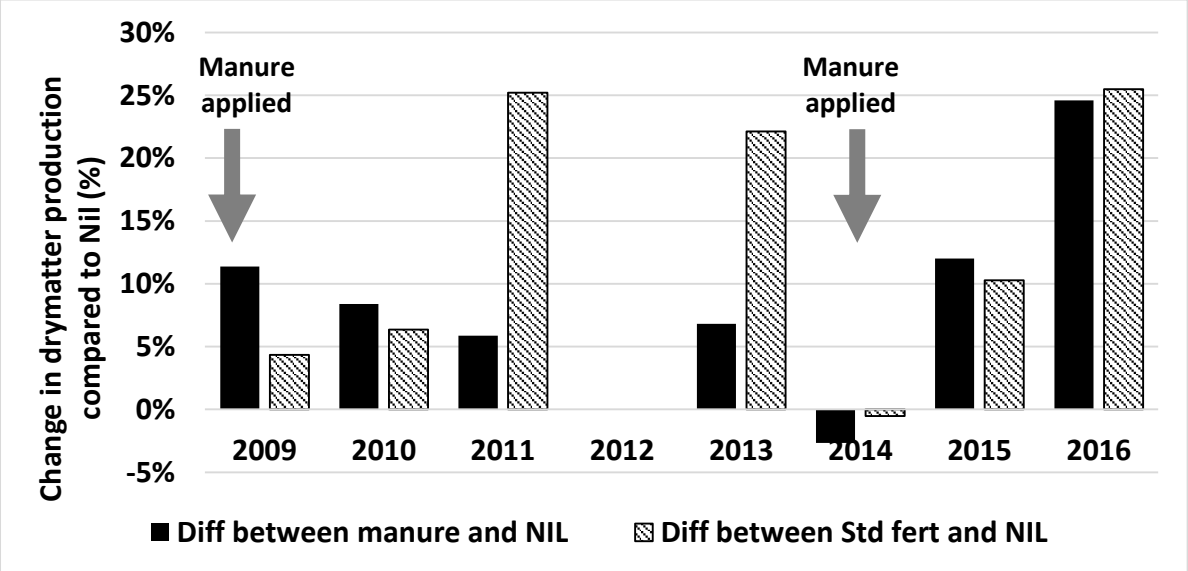

Figure 1: Difference in dry matter from annual application of inorganic fertiliser[1] or poultry manure compared to Nil application at Mannibadar (no measurements taken in 2012).

[1] 375 kg/ha super potash 5:1 for first 3 years, then subsequent 125 kg/ha of single super

A second more recent poultry manure trial that commenced in 2014 has shown a 6% increase in dry matter production compared to the Nil treatment. This was 5% higher than the inorganic fertiliser application.
This information would suggest animal manures are an alternative to inorganic fertiliser and the response to a single large application is about 3 years.

Alternative products

Compost and solid humates (a rich organic material) were applied to new trial sites established in 2014. While only three years of data is available, there was no significant drymatter response to the humates on pasture (+1%) compared to the Nil treatment. The compost, while also not significant, measured 6% more drymatter than the Nil treatment.

The liquid product *TM* (previously *TM 21*) was applied with fertiliser at three sites in the initial work conducted in 2009-2011. Responses were mixed, with a significant increase in drymatter production due to *TM* at one lower fertility pasture site (i.e. after taking into account the fertiliser applied), no response on a highly fertile lucerne site and a response in one or three year at a crop site. Further investigation was warranted and additional sites were established.

Four pasture sites and four crop sites received application of TM in combination with traditional inorganic fertiliser. Yield responses compared to inorganic fertiliser for the pasture (table 5), canola (table 6) and wheat (table 7) are presented. None of the responses were significantly different to the inorganic fertiliser.

Table 5: Combined change in pasture dry matter production by application of TM[2]

Location	Pittong	Illabarook	Mt Mercer	Mannibadar
Years	2012-2015	2012-2015	2012-2016	2013-2016
Pasture type	Perennial ryegrass, sub clover	Cocksfoot, subclover, annual weeds	Tall fescue, cocksfoot, sub clover	Perennial ryegrass (Vic), subclover
Cuts	11	14	19	12
Inorganic fertiliser compared to Nil	29%	5%	9%	15%
TM + inorganic fertiliser compared to Nil	25%	8%	10%	21%

Table 6: Change in canola yields by application of TM[3]

Location	Pittong	Rokewood (west)	Werneth	Rokewood (nth)
Measurement year	2016	2014	2012	2012
TM + inorganic fertiliser compared to inorganic fertiliser	11%	5%	2%	11%

[2] 250 ml/ha, twice in 2014 (April & July), once in 2015 (June) and once in 2016 (June or July)
[3] 250 ml/ha, twice in 2014 (April & July), none in 2015 and twice in 2016 (April & August)

Table 7: Change in wheat yields by application of TM[4]

Location	Rokewood (west)	Werneth		Rokewood (nth)		
Measurement year	2015	2013	2015	2013	2014	2016
TM + inorganic fertiliser compared to inorganic fertiliser	7%	0%	0%	-2%	3%	7%

Two other liquid based products (*Nutrisoil* and *Seasol* with *Powerfeed*) were applied over 8 years at one crop and one pasture site established in 2009. No significant drymatter response was recorded compared to the no fertiliser treatment for the *Seasol* with *Powerfeed*[5] (+1%) or Nutrisoil[6] (+7%). However there was a significant drymatter response with traditional inorganic fertiliser compared to the Nil treatment (+15%). There were no significant crop yield responses in any year compared to the Nil treatment.

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[4] 250 ml/ha, twice in 2012 & 2013 (April & July), none in 2015 and twice in 2016 (April & August)

[5] 5 l/ha of Seasol and 5 l/ha Powerfeed twice in all years except for once in 2015 and 2016

[6] 5 l/ha of Nutrisoil twice in all years except for once in 2015 and 2016