IN THE MATTER	of the Resource Management Act 1991 ("**the Act**")
AND	
IN THE MATTER	of the Resource Management Act 1991 and the Environment Canterbury (Temporary Commissioners and Improved Water Management) Act 2010
AND	
IN THE MATTER	of the hearing of submissions on the Proposed Land and Water Regional Plan

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STATEMENT OF EVIDENCE BY DUNCAN MCLEOD FOR HORTICULTURE NEW ZEALAND
2 APRIL 2013

QUALIFICATIONS AND EXPERIENCE

1. My name is Duncan McLeod. I am a self-employed agronomist, mainly specialising in arable and vegetable cropping.

2. I have a bachelor of agricultural science with honours from Lincoln University, and a McCains Certificate in Agronomy (two year course) specialising in Potato management.

3. I have completed a Massey University course in sustainable nutrient management.

4. I have worked for 6½ years for McCains specialising in potatoes, and for 2½ years with PGG Wrightson specialising in cereals.

5. I have been an external consultant for the last three years. Combined among different operations, I am now providing agronomy services for over 7½ thousand hectares of arable/vegetable cropping in Canterbury. I provided evidence in 2004/2005 for a resource consent hearing in South Canterbury regarding agronomy in vegetable and arable cropping.

6. I have been provided with a copy of the Code of Conduct for Expert Witnesses contained in the Environment Court's Consolidated Practice Note dated 1 November 2011. I have read and agree to comply with that Code. This evidence is within my area of expertise, except where I state that I am relying upon the specified evidence of another person. I have not omitted to consider material facts known to me that might alter or detract from the opinions that I express.

OVERVIEW

7. This evidence is to be read in conjunction with the statement from Roger Lasham. The focus of my evidence is to comment on the practice of deep nitrogen testing and the results obtained in relation to arable and vegetable cropping.

8. In my view there are some key things that have changed and vegetable and arable cropping in Canterbury over the last 15 years. In particular, fallow times have reduced significantly. This is mostly because of the costs of leaving land in fallow. Winter cropping and grazing is now key to the maintenance of an economically sound regime.

9. Over the last 10 years I have been able to collate data from a wide range of cropping situations in Canterbury. The data includes the results of many individual "deep N" tests on discrete paddocks used for arable and vegetable cropping.

WHAT IS DEEP N TESTING?

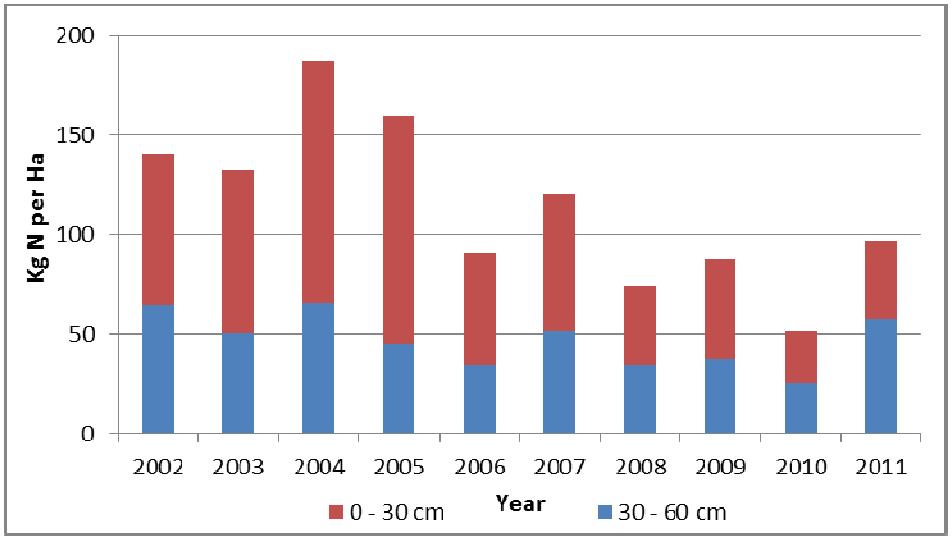
10. Deep N testing is a method of soil sampling for total nitrogen found below the root zone. It is a way of finding out whether the target application of nitrogen has been utilised by the plant or not. It aids the production of high yields because it provides the opportunity to variably apply nutrients according to the nutritional requirements of plants, based on the levels of residual nitrogen and other essential nutrients in the soil.

11. It involves driving a pipe to 300 mm and 600 mm depths at stratified but random intervals within a cropped paddock, following a "W" shaped walking pattern through the paddock. The results are then tested at an accredited laboratory for a range of nutrients.

12. Between 2002 and 2011, Roger Lasham, and I both did work for PGG Wrightson's Ltd. We did deep N testing every year for between 80 to 100 growers, covering between 100 and 120 fields per year. PGG Wrightson's started this; and has discontinued it this year. The responsibility has been pushed to Ballance and Ravensdown. The reason for it being discontinued was because of the significant reduction in deep soil N. The view was that the testing regime was not worth the economic effort given the residual levels of N in later years. I still consider there is value in the test, but it may be more practical to measure the first 300 mm and model down to 600 mm. In my opinion there is probably a correlation that could be applied.

13. The graph below describes combined results on all paddocks for all years between 2002 and 2011.

Graph demonstrating the average decline in available N at two depths in the soil between 2002 and 2011.

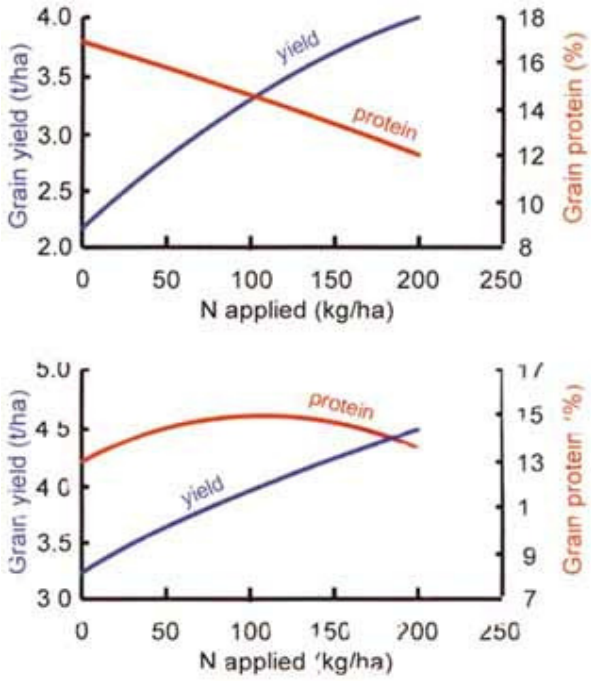


14. The graph does not describe what is being leached. It does show a significant decline in Nitrogen measured. In my opinion the decrease has been a result of the adoption of many new practises and far more nutrient management within the industry.

15. These are very significant reductions and there is a range of reasons for the reductions. Mainly, it is due to changes in philosophy related to canopy management, and the use of testing to increase our understanding of what mechanisms are driving yield. The need to increase yield is driven by market forces. To compete with other countries with lower labour and capital costs, growers are increasingly using technology to produce higher yields. The right combination of nutrients is crucial to establishing the highest possible yield in all years of rotational cycle. Notably, yield response to nitrogen does not increase in a direct relationship to the level of nitrogen applied. In effect, agronomists are looking to maximise quality - not yield so the right combination of nutrients, applied at the right time is what becomes

important. The graph below describes a yield response curve for a typical arable/vegetable crop to nitrogen application.

Example graph[1] showing yield response of wheat to Nitrogen, and the variance in levels of protein.



16. There are many management practices and investments that have led to better nutrient management in arable / vegetable cropping operations in Canterbury. Listed below are some that are key:

- Better tractors with higher levels of accuracy able to accomplish more tasks in shorter time
- Calibrated fertiliser spreading equipment
- Controlled traffic farming technology to increase application efficiency and soil management,
- Advanced farming systems that make use of GPS mapping and aerial photography,

[1] http://www.fao.org/docrep/006/Y5146E/y5146e09.htm#TopOfPage

- Better soil / nutrient testing, including more representative and detailed testing on a programmed basis
- Better record-keeping
- More accurate irrigation technology
- Highly automated irrigation systems that allow more frequent applications of less water
- Increased training of operators
- Increased demand from customers for accreditation and traceability.

GOOD MANAGEMENT PRACTICES

17. Attached to this evidence as Appendix 1A is a diagram that describes what I consider to be good management practices (GMP) in relation to fertiliser application and nutrient management. I have also given my opinion on what I consider to be currently best management practices (BMP's).

18. I have worked on this diagram with Roger Lasham and we both concur on the description of these practices.

D McLeod

2 April 2013