

Waikato Regional Council Healthy Rivers Plan Change 1  
Round 3 Hearings Presentation to the PC1 Hearing Commissioners  
Tuesday 17<sup>th</sup> September 2019, 11am The Link, Hamilton



Presented by Anna Mayne – Founder  
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# My history in the Dairy Industry of New Zealand

A man with grey hair and a mustache, wearing a grey and black jacket with red accents, stands in a rural landscape. He is leaning on a wooden fence post. The background features rolling green hills, a large mountain peak in the distance, and a clear blue sky. The text is overlaid on the left side of the image.

Robin Boom is a qualified agronomist from Lincoln University.

He consults and provides independent Restorative Fertiliser Recommendations for 250 dairy farms and 200 sheep and beef stations and 3 kiwifruit orchardists.

Robin has used the Broad Soil Test approach and selective use of the Olsen P Test for over 32 years.

# Soil Carbon ( C )

Houses the Bacteria & Fungi

Bacteria eat a ratio of Carbon & Nitrogen

Bacteria & Fungi sequester or build carbon in soil

Water Holding Capacity

Organic Matter %  
(OM%)

## Phosphorus Soil Testing Methods

Cornell University annually publishes the "Cornell Guide for Integrated Field Crops Management". This document includes phosphorus (P) fertilizer guidelines for a large number of field crops grown in New York. The guidelines are based on field research in New York that shows that the Morgan soil test, the agronomic soil test used at Cornell University, can be used to predict likelihood of a yield response to additional P for crops grown under New York growing conditions.

**What is an agronomic soil test?**  
The agronomic P soil test is an index of P availability which means that we can use the soil test to determine likelihood of a response to additional P. An agronomic soil test extracts only a small portion of the total amount of P in the soil as not all of that P is available for crop growth. Agronomic soil test results are classified as low, medium, high or very high based on crop response to additional P; crops grown on soils that are already high or very high in P are not likely to respond with a yield increase if additional P fertilizer is added. On the other hand, soils that are low or medium in P will likely show higher yields if extra P is added. For more information on P fertilizer use for corn, see Agronomy Fact Sheet 8: Starter Phosphorus Fertilizer for Corn.

**(Modified) Morgan soil test method**  
To determine the Cornell Morgan soil test P of a soil, the soil is shaken (extracted) with a chemical solution (sodium acetate buffered at pH 4.8) in a particular soil to extraction solution ratio (1:5) and for a certain amount of time (15 minutes). The extract is filtered (Figure 1) and the P concentration in the filtered extract is measured in the laboratory (colorimetrically). Cornell University is not the only university that uses the Morgan soil test. This same test is the basis for fertility guidelines of the University of Massachusetts at Amherst. The Morgan soil test (ammonium acetate instead of sodium acetate) is used for fertility guidelines at the Universities of

Ketterings and Barney 2005  
Cornell University

Maine, Vermont, Connecticut, and Rhode Island. The Morgan and Modified Morgan soil tests give similar results as long as the soil to solution ratio, scoop sizes, shaking time, filter paper, and instrumentation used to determine P concentration in the extracts, are identical and samples are corrected for weight and moisture content.



**Other soil testing methods**  
Several other tests were developed for the same purpose: to predict if additional P is needed for optimum economic yields. The most commonly used tests are the Mehlich-3 soil test, the Bray-1 and the Olson P tests. These three tests use a very different chemical extraction solution. The Mehlich-3 extraction solution is an unbuffered solution of acetate, ammonium nitrate, ammonium fluoride, nitric acid, and ethylenediaminetetraacetic acid (EDTA). The Bray-1 solution is an unbuffered dilute HCl and ammonium fluoride solution. The procedures for the Mehlich-3 and Bray-1 extractions call for a 1:10 soil to solution ratio and 5 minutes of shaking time. **The Olsen procedure contains sodium bicarbonate and was specifically developed for calcareous soils.**

# Phosphorus testing method: Olsen P



340  
39

*Circular* No. 939  
March 1954 • Washington, D. C.

UNITED STATES DEPARTMENT OF AGRICULTURE

**Estimation of Available Phosphorus in Soils by Extraction With Sodium Bicarbonate<sup>1</sup>**

By STERLING R. OLSEN, senior soil scientist, C. V. COLE, soil scientist, FRANK S. WATANABE, soil scientist, and L. A. DEAN, principal soil scientist, Soil and Water Conservation Research Branch, Agricultural Research Service<sup>2</sup>

United States Department of Agriculture in cooperation with the Colorado Agricultural Experiment Station

**CONTENTS**

	Page		Page
Introduction.....	1	Evaluation of method—Con.	
Development of method.....	2	Relation of phosphate-fertility level to yield response.....	9
Theoretical basis.....	2	Greenhouse experiments.....	9
Extraction details.....	4	Field experiments.....	11
Time of extraction.....	4	Measurement of NaHCO <sub>3</sub> -soluble phosphorus in relation to yield response.....	12
pH of extractant.....	5	Correlation of 'A' values with various methods.....	13
Method of extraction.....	5	Discussion.....	15
Evaluation of method.....	7	Recommendations.....	17
Soil samples.....	7	Summary.....	17
Experiment 1.....	7	Literature cited.....	18
Experiment 2.....	8		
Experiment 3.....	8		
Experiment 4.....	8		
Experiment 5.....	8		
Experiment 6.....	9		

# Phosphorus testing method: Olsen P

- The Olsen P test has been the preferred test used in Aotearoa for over 50 years.
- This is quite confusing, as it is only appropriate for calcareous, high pH soils.



# Phosphorus testing method: Olsen P

- Aotearoa has very little agricultural calcium-carbonate soil.
- Using the wrong soil P test may result in miscalculations and over application of P fertilizer.



# Minimum Soil pH

## The NZ Agricultural 'P Dilemma'

## Olsen P Test should only be used where pH > 7.5



### Key (pH)

- High (7.6 - 8.3)
- Moderately high (6.5 - 7.5)
- Near neutral (5.8 - 6.4)
- Moderately low (5.5 - 5.7)
- Low (4.9 - 5.4)
- Very low (4.5 - 4.8)
- No data

pH is a measure of the acidity or alkalinity of a soil. This data shows minimum pH at 0.2 - 0.6 m depth. Nutrient availability and aluminium toxicity are related to a soil's pH.

The data is derived from the dominant soils depicted in the 1:63,360/1:50,000 scale New Zealand Fundamental Soil Layers.

Additional information can be found [here](#).

Base map contains data sourced from LINZ Crown Copyright Reserved.

Click map for info...

He taught me all this and more, now what?



27<sup>th</sup> October 2017

## Dairy 20/20 2017 Project



Source: G Taylor - Robin Boom lifts a soil he has advised nutrients on for over 20 years, Davies Farm, Gordonton, Waikato, NZ, May 2013

Findings from 20 Waikato/Bay of Plenty dairy farms, covering 2,524 hectares, now practicing 'broader' soil testing, evidencing that positive environmental and economic impact of dairy farms is possible via Restorative Agriculture.

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# Restorative Agriculture is the Enviro-Economic Win-Win NZ seeks

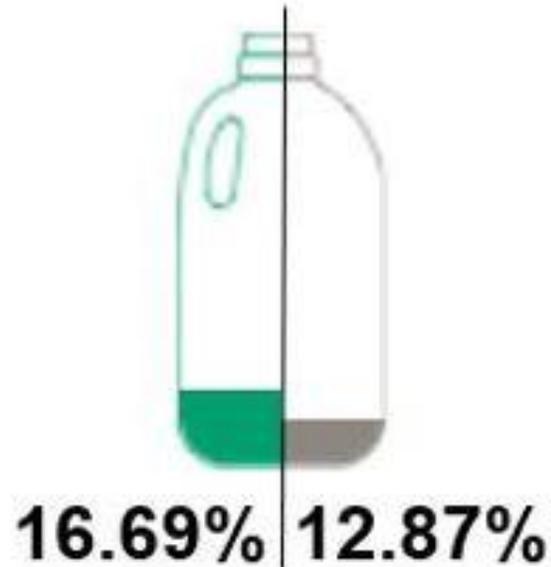


Fig 1. Dairy 20-20 Average gain in **milk production** per cow over 5 seasons (2010-2015)

Key: ■ Dairy 20-20 ■ NZ industry average

'Dairy 20-20' farms milk production percentage increase average (season 1 vs season 5), was 16.69% vs the industry average of 12.87%. (*Fig 1*)

# Restorative Agriculture is the Enviro-Economic Win-Win NZ seeks



Fig 2. Dairy 20-20 Average **fertiliser cost** per kg of milk solids over 5 seasons (2010-2015)

■ Dairy 20-20 ■ NZ industry average

- 80% of the 'Dairy 20-20' farms' fertiliser costs were below the industry average of \$0.57c/KgMs - 'Dairy 20-20' farmers: \$0.38c/KgMs (*Fig 2*)

# Restorative Agriculture is the Enviro-Economic Win-Win NZ seeks

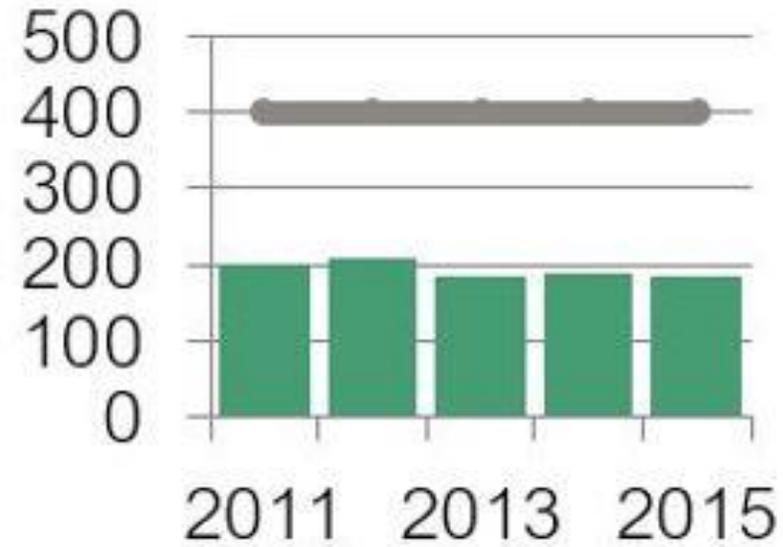


Fig 3. Dairy 20-20 Average **somatic cell count** (000s) per farm, against NZ Dairy maximum over 5 seasons (2010-2015)

■ Dairy 20-20 ■ NZ industry maximum

- Somatic cell count across 'Dairy 20-20' herds also decreased (*Fig 3*)



## Restorative Agriculture

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towards a genuinely  
clean, green  
Aotearoa