

Can Agriculture in New Zealand Become Sustainable?

Agriculture has depended on chemical fertilizers to grow crops and grass for 70 years, but with much environmental damage now recognized to be caused by intensive farming, new technologies must be adopted if current production volumes are to be sustained in the longer-term future.

Soil has been seriously degraded by chemical fertilizers, impacting adversely on fertility. Soil is also the world's largest organic carbon store.

There are complex problems to solve, but without significant changes to farming practices the adverse impact on the environment will worsen, and sustainable agriculture will not be achieved.

Agriculture in New Zealand today

Food products are in high demand internationally and our primary industries are an important foundation of the economy. But at what cost to New Zealand's environment?

Agriculture contributes almost 50% of the country's total greenhouse gas emissions, which is by far the highest percentage of any OECD country and without limiting further intensification or the adoption of mitigating technologies, this can only increase.

Dairy farming is widely recognized as responsible for the serious degradation of fresh water resources throughout the country.

Various organizations are now expressing concern about the situation that has developed and in particular that freshwater quality has been degraded to an unacceptable level.

The "Green" image of New Zealand has been tarnished and there are concerns being expressed by the tourism sector that freshwater pollution will have a long-term negative impact on the contribution it can make to economic growth. "100% Pure New Zealand" is a myth of the past.

The present situation requires urgent action, and there is now continuing advocacy that Government places a moratorium on expansion of intensive dairy farming, to enable remediation of the negative effects on the environment.

The issues are well understood and a number of corrective measures have been initiated, but without more rapid innovation the present pace of change will not result in agriculture becoming sustainable nor will the country meet its obligations to reduce emissions.

The future of Agriculture in New Zealand.

The root cause of the country's water quality problem and agriculture's high contribution to total greenhouse gas emissions is excessive use of chemical fertilizer.

Solving this requires landowners to adopt new technologies that support a sustainable environment for the benefit of future generations.

Chemical fertilizer companies need to think in terms of re-inventing themselves because worldwide, there is a rapidly growing consumer market willing to pay premium prices for foods grown organically or sustainably, and this should be agriculture's long-term focus.

Principal Sources of Pollution and Adverse Effects on the Environment

1) Air pollution

Methane - Approximately 1/3rd of all greenhouse gas emissions is methane, which is belched by ruminant animals.

Current research programmes may ultimately solve this problem, but it seems unlikely that a vaccine will be found in the short-term.

Nitrous oxide gas - which is approximately 300 times more potent than carbon dioxide is released from chemically fertilized soil that becomes anaerobic.

Thus, animals and nitrogen fertilizer are the main sources of greenhouse gas emissions from agriculture.

2) Water Pollution

The main source of water pollution is chemical nitrogen and animal urine with a high nitrogen content. These leach in surface run-off water that enters local streams, rivers and lakes, or into underground aquifers.

The only way to mitigate these adverse effects is to introduce new farm management practices, adopt new technologies, or reduce the national herd count as proposed recently.

Research is being conducted to identify animals that produce urine with a low nitrogen content. Interesting, but how likely and in what time frame?

Reducing the national herd is not a solution for various reasons. Nor is it necessary because bio-fertilizer technology available now can mitigate the present unacceptable effect on the environment. But, it needs to be adopted.

Much work has been done to improve the efficient use of chemical fertilizers, on-farm management of animals to minimize urine discharge onto pasture, and by fencing-off waterways.

None of these initiatives solve the real problem - chemical fertilizer.

Government has delegated responsibility for its National Policy on Freshwater Management to Regional Councils' with an unrealistic timetable.

I believe the Government's plan is inadequate, and it must introduce regulatory controls to prevent more intensification of dairying and limit the use of chemical fertilizers.

Some progress is being made by Regional Council's introducing changes to their District Plans that reduce the permitted discharge rates of nutrients into freshwater resources such as *Bay of Plenty Regional Council, Plan Change 10, Nutrient Management, Lake Rotorua.*

However, in the above example, all affected parties opposes any changes and implementation is going to be delayed by self-interested parties appealing to the Environment Court.

Constraints are being imposed on increasing the country's production capacity through major capital programmes such as the Ruataniwha Water Storage Scheme not proceeding. This has been blocked primarily by environmental issues, which would likely be overcome if bio-fertilizer was to be used on land to be irrigated.

The Bio-fertilizer Option

Relatively new bio-fertilizer technology can make a significant contribution to reducing emissions, limiting nutrient discharge, and improving freshwater quality. Such technologies are now available in New Zealand; one being SumaGrow (www.sumagrow.com) from the USA. The science is well understood, but primary industry research organizations continue to focus on improving the efficiency of chemical fertilizer despite knowing about poly-microbial fertilizers and having an opportunity to evaluate the benefits for dairy farming.

Bio-fertilizers enable plants to access atmospheric nitrogen, and unbind phosphorus and potassium existing in soil which are not otherwise accessible to plants.

Why is research not being conducted with new biological technology?

Agricultural lobby groups and the chemical fertilizer industry have held sway with recent Governments. Ministers and Government scientists have been informed about bio-fertilizer technology, but none have shown any interest.

Research has been focused on improving the efficient use of chemical fertilizer, which is funded by Government through MPI and AgResearch, by the chemical fertilizer companies, and levies paid to industry research organizations.

In the absence of a directive from Government, these parties choose to believe that the only way to fertilize agriculture land effectively is with chemicals, and to date have shown no interest in evaluating bio-fertilizer technology.

What contributions can bio-fertilizers make to sustainable agriculture?

1) Reduce methane emissions by animals

Pasture fertilized with chemical nitrogen promotes the growth of methanogen bacteria that process feed in the animal rumen. These bacteria digest feed with high nitrogen content much better than would the optimal rumen bacteria.

It is the methanogen bacteria that create the methane belched by the animals. If feed is grown with a bio-fertilizer animals will belch significantly less methane.

2) Reduce nitrous oxide greenhouse gas emissions from soil

The primary source is from chemical nitrogen in soils that become anaerobic.

3) Improve Freshwater Quality

- i) Reducing chemical nitrogen applied to soil will lower the amount of nitrogen in surface run-off. This also applies to super phosphates.
- ii) Feed grown with reduced chemical nitrogen (e.g. maize) or no nitrogen (pasture and hay) will result in a lower level of nitrogen in both cow's milk and urine.
- iii) Pasture grown with a bio-fertilizer will be less compacted and will retain significantly more moisture including cow urine, which will not only contain less nitrogen, but the urine will be retained in the rhizosphere and be absorbed by pasture as a slow release fertilizer.

A substantial reduction in the use of chemical fertilizer will be very beneficial to the quality of the country's freshwater resources.

What needs to be done? Establish the facts about the benefits of bio-fertilizers as they apply in the New Zealand environment.

This must be a Government driven initiative.

New Zealand's agriculture universities have the resources and experience to make a comprehensive evaluation of bio-fertilizer technology, but they need a directive to undertake it, adequate funding, and no interference from the chemical fertilizer industry.

While I am not a scientist, experience with arable and vegetable crops in Europe have proven that grower standard chemical fertilizer application rates can be reduced by 50% without any detrimental impact on crop yield, and there is a large volume of scientific evidence supporting this statement.

There is equally strong scientific evidence that nitrogen is not required to grow pasture for animal feed.

A comprehensive research programme can be expected to conclude the following;

- i) Poly-microbial bio-fertilizers enable farmers and growers to reduce by half or completely eliminate a chemical fertilizer programme, depending on the crop, soil conditions, and management practices.
- ii) Soil fertility will improve and organic matter (carbon) will increase. This will help to reduce New Zealand's carbon footprint.
- iii) There will be a significant reduction in nitrogen leaching in surface run-off and therefore improved freshwater quality.
- iv) There will be a reduction in methane and nitrous oxide gas emissions, which would assist New Zealand to meet its emission reduction targets.
- v) There would be more nutrient content in grass and hay.
- vi) There would be less nitrogen in cow urine and milk.
- vii) Bio-fertilizer will satisfy Assure Quality certification as an organic input and the milk will attract a higher price.
- viii) Soil will be less compacted, retaining more moisture and animal urine, helping to improve freshwater quality
- ix) Healthier animals will reduce the cost of veterinary visits and use of antibiotics which is another problem for agriculture.

It is highly likely that farm operating income will increase, as higher organic matter in soil will increase the productivity and value of land.

The adoption of bio-fertilizer will have an immediate beneficial effect on emissions and freshwater pollution, which will increase with the passage of time and widespread adoption by farmers.