

A Critique of the Living Water Literature Review on Fine Particle Application Fertilisers

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Background

In early 2017, the Fertiliser Association of New Zealand contracted myself (Agronomist/Soil Scientist), Professor Russell Tillman (Soil Scientist) and Dr Alan Morton (Plant Physiologist) to review the research that had been carried out on fine particle application (FPA) fertilisers. This literature review was completed in October 2017 and then submitted to the NZ Journal of Agricultural Research as a research article in February 2018. The review included all relevant published results and unpublished reports that had been funded by Ravensdown and Ballance. The review considered mainly statistically analysed results although some published results that had not been statistically analysed were included but given a much lower weighting. Also included were the results from comparing pasture production responses between granular and liquid fertilisers as liquid fertilisers were considered to be an even more effective means of applying nutrients mixed with water than FPA fertilisers. It is accepted that the author of the Living Water Literature review did not have access to the unpublished reports.

Living Water Review

Comment will be made on each part of the review that requires critique.

Executive Summary

As for granular fertilisers, application of FPA fertilisers will only result in less loss of ammonia if a urease inhibitor is included with the fertiliser. There is now widespread use of these with granular fertilisers and this required acknowledgement.

Economics of the use of granular vs FPA fertilisers is mentioned but any analysis is incomplete without consideration of the application costs of both forms.

What is fine particle application?

The claims made for the superior performance, both agronomically and environmentally, of FPA over granular fertiliser are conjecture unless supported by sound experimental evidence. The conclusions of the Morton et al. review/research article, based on such evidence, do not support the claims made in the Living Water report. These claims will be considered in detail but the one asserting that the better distribution of the finer FPA fertiliser particles compared with granular fertiliser particles is the cause of increased plant growth, if true, would lead to liquid fertiliser where the fertiliser particles are largely dissolved, also resulting in increased plant growth compared with granular fertilisers. The Morton et al. review presents several experimental comparisons of granular and liquid fertilisers where no statistically significant difference is measured between these two forms of fertiliser.

Winton trial

Although the trial results show an arithmetical increase of 10% in pasture yield for FPA compared with granular urea, there has been no statistical analysis carried out so there is no way of knowing whether the response is a treatment effect or a chance effect. An appropriate statistical analysis to

calculate the probability of the occurrence of a treatment effect, using analysis of variance is an essential component of the scientific method and without it, trial results have very low credibility. Similarly without objective measurements, the observation of greater ryegrass content with FPA compared with granular urea carries little weight.

Zaman et al. 2009 trials

Again the results of these field trials have not been statistically analysed so although there are reported increases in pasture production for FPA compared with granular urea, a claim that this is a treatment effect cannot be scientifically substantiated. It should be noted that the Massey University FLRC Workshop Proceedings will publish papers that are not refereed by peer reviewers and do not need statistical analysis of trial results. Peer-reviewed journals will not publish research results without sound statistical analysis.

Dawar et al. 2010 trials

As stated in the Morton et al. review, this trial included higher rates of N than were applied to most of the field trials and the FPA treatment was sprayed on to much smaller areas of pasture than small plot field trials which may have allowed foliar uptake of the urea through the foliage. Hence the positive pasture production response in those plots urea differed markedly from the lack of response in the statistically analysed small plot trials which were closer to practical reality.

In Table 7 of the Living Water review, there is no significant difference in ammonia loss between urea in the granular or FPA form which indicates that applying urea in the FPA form will not reduce volatilisation losses.

In Table 8 of the Living Water Review, although there were significantly lower N leaching losses from FPA compared with granular urea, the difference was only small (about 1 kg) and these low N leaching rates are consistent with the low direct losses from N fertiliser compared with urine.

Mahoney trial

The results did show a significant increase in FPA over granular urea in terms of plant growth but it was surprising that both liquid N treatments were significantly lower producing than granular urea even when in a form where the urea was dissolved and with the addition of a urease inhibitor.

Zaman et al.

There was no significant difference in DM yield between FPA and granular urea.

Quin et al. 2005

There was no statistical analysis of these results so they lack credibility when compared with statistically analysed results.

Korte et al. 1996

These trials are included in the Morton et al. review as the same N and P rate comparison between granular and slurry DAP which for the slurry was the commercial recommendation at the time and resulted in no significant difference in pasture DM production.

Overall summary

When FPA fertiliser is applied to pasture at the same rate of nutrient(s) under the same environmental conditions and carefully controlled trial protocols, the weight of scientific evidence

shows that there are no significant differences in terms of pasture production between applying a fertiliser as FPA or its granular equivalent.