AGKNOWLEDGE 2024 LTD
THE INDEPENDENT FERTILISER EXPERTS

Spring
2026

Fertiliser Review

ISSUE 55

[Editorial note: This edition of the Fertiliser Review is a little different. Normally the Fertiliser Review includes 3-4 topical issues and, like most science writing, is presented in the third person. This issue of the Fertiliser Review focusses on only one subject, the fertiliser additive agrotain, and I have, in places, reverted to the first person. I have done so deliberately because of the importance of the topic and to make the story more personal. I hope that farmers will get the message that at times it can be difficult to get sound, science-based information which they need, into the public domain].

AGROTAIN TREATED UREA

Both fertiliser co-ops sell urea treated with the chemical Agrotain under the brand names SustaiN (Ballance) and NProtect (Ravensdown). Agrotain, you will recall from previous Fertiliser Reviews, is a urease inhibitor which slows down the conversion of urea to ammonium in the soil and thus reduces the potential for the volatilisation of ammonia - the conversion of soil ammonium to the gas ammonia (Figure 1). In theory, this should increase the efficiency of urea by increasing plant yield per kg nitrogen (N) applied.

This is an important issue as the world struggles to find ways of making fertilisers generally more efficient, for both environmental and economic reasons. In other words, the stakes are high and the desire to be seen as a market-leader is strong. The inclination to introduce new products with overstated claims is tempting, as this case demonstrates. I have been warning about the claims made for these Agrotain-treated products since 2004 (Fertiliser Review 13 and 15).

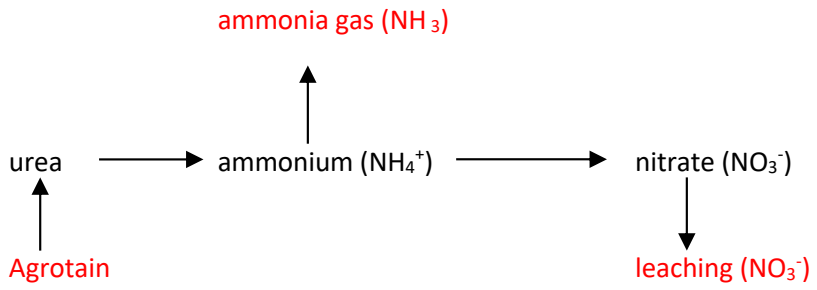


Figure 1 Adding Agrotain to urea slows the conversion of urea to ammonium in the soil and hence the amount of N that can be volatilised as ammonia gas.

Background

The fertiliser company, Summit-Quinphos Ltd, started the ball rolling in 2005 with claims that fertiliser urea was only about 50% efficient and that the reason for this was the large volatilisation losses of nitrogen as ammonia from urea (see Figure 1). These advertising claims were widely broadcast in the farming press (see Fertiliser Review 15). Having set the scene to the farming audience, it was only small step to introduce a new product, SustaiN - urea treated with Agrotain - with the claim that it was much more efficient than straight urea.

> *[It is interesting to note that a similar technique was used in the 1980s to promote the sale of direct application of Reactive Phosphate Rock (RPRs). First, a problem was created. In this case it was claimed that the quality and effectiveness of superphosphate was poor and, because they contained soluble P, it was not good for the environment. With this background, RPRs were introduced into the New Zealand market with the claim that they were as effective agronomically as super, cheaper as a source of phosphorous (P), and, better for the environment.]*

Up until this time very little attention had been given to the problem of N volatilisation of ammonia from urea. There was a reason for this. Many field trials were conducted in the 1970s comparing the agronomic effectiveness of urea with other nitrogen fertiliser which, because of their different chemistry, did not volatilise ammonium into the gas ammonia. It turned out that there was very little difference agronomically between these two types of N fertiliser. In other words, scientists, while aware of the possibility of ammonium volatilisation, saw it as minor matter in the overall scheme of the N cycle – at worst it could amount to a loss of 0-5%, depending on the climatic conditions.

This view was reinforced by the results from ten recent field trials (2009), conducted in New Zealand, which compared SustaiN with urea, applied at different rates of N and in different seasons. The differences were small and not statistically significant (Fertiliser Review 22). This initial conclusion was reinforced as the results from further field trials became available. But, despite these results, the advertising claims being made for SustaiN continued unabated. For example, it was now claimed that "…on average 50% of the N applied from the ordinary urea you apply, is lost on application" (see Fertiliser Review 23).

As time ticked on, further trial data was accumulated and by autumn 2015, Dr Robert McBride and myself, compiled a data-base consisting of the results from 105 trials, comparing urea, with urea-treated with Agrotain. This included trial results from both New Zealand and overseas. From this larger set of results, it was possible to quantify the effect of Agrotain-treated urea, relative to urea, on plant growth yields. Our best estimate at this stage was that the effect was small and within the margin of error for field trial work - about 2% +/- 1% (Fertiliser Review 34).

At about this time Ballance AgriNutrients Ltd purchased Summit-Quinphos Ltd, but the bold advertising continued. The new owners claimed that "SustaiN reduces ammonium volatilisation by 50%" and that "SustaiN increases the amount of pasture you can grow per unit N applied". Also, the other co-op, Ravensdown, not to be outdone, introduced their own Agrotain-treated urea product under the brand name NProtect.

All of the information above, at least all the summaries of the data presented in the various Fertiliser Reviews, was in the public domain. Despite this, there was no reaction from the fertiliser industry. I wondered why? A possible reason was that very little of this material was in the peer reviewed scientific literature and, in these circumstances, it is reasonable to place less weight on such results and conclusions.

Grasslands Paper

For this reason, I decided to prepare a comprehensive paper for publication in the peer-reviewed scientific literature. Together with my colleague, Dr Robert McBride, we redoubled our steps and made a thorough search of the national and international literature. We found 45 studies in which the effect of Agrotain-treated urea, relative to straight urea, on plant yields, were reported. Importantly, only results from replicated and randomised field trials, with statistical analysis, and available in open access publications, were included.

Many of these studies included multiple sites, over multiple years and crop types, and hence the results were summarised on a site x year x crop type basis. A total of 348 records were recorded. In other words, the marginal effect of Agrotain-treated urea relative to urea alone on plant growth, was measured 348 times. The results were sumarised on the basis of crop-type (Table 1) and on the basis of the rate of urea applied (Table 2).

These results, together with a relevant introduction and discussion, were published in the peer reviewed paper in the Journal of New Zealand Grasslands, 85: 149-153 (2023), under the title: *An assessment of the agronomic effectiveness of N-(n-butyl) thiophosphoric triamide (nBTPT) - treated urea on dry matter yields of clover-based pastures, grasses and arable crops,* noting that N-(n-butyl) thiophosphoric triamide (nBTP) is the chemical name for Agrotain.

Table 1. Effect of crop-type on the marginal response of Agrotain-treated urea relative to urea on plant dry matter (DM).

Crop type	Number of observations	Mean DM yield response (%)	Range of DM yield response (%)	95% confidence interval (%)
All crop types	348	3.1	-23 to +32	0.9
Arable crops	114	2.8	-23 to +26	1.8
Grasses	234	3.2	-18 to +32	1.0
Clover-based pastures	153	2.9	-13 to +32	1.1

The results for the aggregated data, and for the subsets of data, based on crop-type, are similar and are normally distributed around a mean of about 3%. There is a wide range, from -13% to +32%. The data indicate that the effect of Agrotain does not depend on the type of crop tested.

In comparison, the effect of Agrotain was related to the rate of N applied. The marginal response of Agrotain-treated urea, relative to urea, on plant dry matter (DM) increased with increasing rate of N application (Table 2). At rates of N < 50 kg N/ha the mean response is 1.4% increasing to 7.5% when the N application is > 200 kg N/ha.

Table 2. Effect of the rate of fertiliser nitrogen (N) on the marginal response of Agrotain-treated urea, relative to urea, on the plant dry matter (DM).

Rate of N fertiliser application (kg N/ha)	Number of measurements	Mean DM response (%)	Range (%)	95% confidence interval (%)
0-50	104	1.4	-18 to +23	1.4
51-100	126	2.6	-18 to +30	1.6
101-200	53	4.9	-23 to +26	2.6
+200	34	7.5	-13 to +32	3.1

It is important to note that these results are derived using cumulative distribution functions. This is a statistical method which can be applied to great effect when there is a large population of trials, as has been discussed elsewhere in the scientific literature.

These results are consistent with other results reported in the international literature in terms of the size of the effects of Agrotain and an interesting feature in all these studies is that the measured effects of Agrotain treatment are both "positive and negative." It is unlikely that Agrotain would have detrimental effects on plant growth and hence the measured negative effects are attributed to the biological variability – the background noise – present in all field trials. If this is accepted, then logically the range in the "positive" responses will also reflect this variability, and should not necessarily be attributed to real treatment effects. The average response in the current data-set is about +3% (Table 1), which indicates that the normal distribution is moved slightly to the right, suggesting that nBPTP has a small effect on plant DM growth, which lies within the limits of error in field trial work. This phenomenon is seen in other large sets of data where the observed effects of products are small in relation to the background variability.

At a practical level, it is noted that most of the urea used in New Zealand is applied to clover-based pastures. Typically, it is applied at 20-30 kg N/ha (43-65 kg urea/ha) per application. The data in Table 2 indicate that Agrotain treated urea has little effect on plant DM yields at this rate of N application, because the confidence interval of 1.4% includes the mean of 1.4%, and hence the yield effects, at these low rates of applied N, are not statistically significant. At high rates of N applied it appears that sufficient N is conserved resulting in significant increases in plant yield and hence Agrotain treated urea may have a useful role in cropping situations, where higher rates of N are used.

This suggests that at low rates of N application either a) the amount of N volatilized from urea applied to the soil is typically small or b) that any conserved N is not taken up by the plant or c) the conserved N is incorporated into the soil N pool and is not accessible to the plant. These later two suggestions are unlikely given that the yields from clover-based pastures, grasses and crops are always limited by N, and respond to applied fertiliser N up to very high rates of N.

Despite this, the fertiliser industry, through the "Fertiliser Association of New Zealand", seem proud of their ongoing promotion of the use of Agrotain-treated urea. In a "Fact Sheet", downloaded on the 30th August 2026, they reported that the sales increased rapidly in the last decade and by 2023 made up about 60% of the sales of urea. This serves to illustrate that Agrotain-treated urea is a big deal. In the words of the Association:

> *"The industry has promoted the use of enhanced fertiliser products such as urea coated with urease inhibitor because it reduces atmospheric emissions associated with nitrogen fertiliser products. More importantly, by retaining more nitrogen in the soil, farmers and growers can expect to reduce the amount of nitrogen fertiliser they apply, while still achieving the same production benefits. Under average conditions it might be assumed farmers can reduce their application by 10% using coated fertilisers and achieve the same result as an uncoated product."*

Industry Response.

The Grasslands paper was presented at their annual conference held at Rotorua in late 2023. Technical representatives from both of the fertiliser co-ops where present. There was no reaction to the paper and hence in August 2024 I sent an email to their technical reps, reminding them of the paper and asking what they - the co-ops - were doing about it? I received no reply. I repeated my request in January 2025 adding that if they were doing nothing, I would publish a summary of the paper in the Fertiliser Review. Once again, I received no immediate response but in April 2025, I got the terse message; "that you will get no response from Ravensdown"!

It occurred to me, given the serious nature of the issue, that perhaps the senior management of the co-ops were not being adequately briefed on this matter. I decided in January 2026 to contact the respective CEOs directly:

Dear Sir,

An assessment of the agronomic effectiveness of N-(n-butyl) thiophosphoric triamide (nBTPT) - treated urea on dry matter yields of clover-based pastures, grasses and arable crops.

As you are aware both co-operatives market urea-treated with agrotain (nBTPT) under the trade names SustaiN (Ballance AgriNutrients) and N Protect (Ravensdown). Attached is a paper by Edmeades and McBride, examining the agronomic effectiveness of agrotain-treated urea on 348 trials including clover-based pasture, grasses and crops. These results are summarised from the national and international literature. This paper was published in the Journal of New Zealand Grasslands 85: 149-15 3 (2023).

Importantly the results are normally distributed and the average response, including all crops, was about 3% with a range -23% to + 32% and a confidence interval 0.9%. The size of the responses to agrotain are related to the rate of N application. At rates of < 50 kg N/ha the response was about 1.4.%, within the confidence interval of +/- 1.4%. When applied at high rates (>200 kg N) the average was 7.5% with a confidence interval of +/- 3.1%.

It is important to note that these results are derived using cumulative distribution functions. This is a statistical method which can be applied to great effect when there is a large population of trials, as has been discussed elsewhere in the science literature.

These results indicate that yield responses are typically small. In particular it is noted that most of the urea used in New Zealand is applied to clover-based pastures. Typically, it is applied at 20-30 kg N/ha per application in the spring and autumn. The data indicate that agrotain has little effect on plant DM yields at these rates of N application, because the confidence interval of 1.4% includes the mean of 1.4%, and hence the yield effect of agrotain is not statistically significant. It also follows that, at these low rates, agrotain-treated-urea has little effect on ammonium volatilisation and hence any potential effect on the greenhouse gas N20.

The fertiliser co-op's have been strongly promoting the use of agrotain-treated urea as reported in the Fertiliser Association of New Zealand, Fact Sheet, Nitrogen Fertiliser viz:

> "The industry has promoted the use of enhanced fertiliser products such as urea coated with urease inhibitor because it reduces atmospheric emissions associated with nitrogen fertiliser products. More importantly, by retaining more nitrogen in the soil, farmers and growers can expect to reduce the amount of nitrogen fertiliser they apply, while still achieving the same production benefits. Under average conditions it might be assumed farmers can reduce their application by 10% using coated fertilisers and achieve the same result as an uncoated product."

These claims being made by the industry are inconsistent with the conclusions that can be derived from the research summarised above by Edmeades and McBride. It is suggested that some of the claims currently being made by the fertiliser industry will need to be reassessed based on these recent results.

Yours sincerely

I received no reply to my letter dated January 2026 and hence, in March 2026, I reminded the CEOs of my January letter. I received no reply from Ravensdown but the Ballance CEO replied, "I understand there has been considerable past dialogue on this subject and our technical team is well aware of the respective views." This of course is nonsense as the above litany demonstrates. In July 2026 I received an email from the Ravensdown CEO directing me to the Fertiliser Association of New Zealand.

The Press.

I was making no progress in terms of getting the "Agrotain story" in front of farmers. I decided to contact Mr Richard Rennie, a respected agricultural journalist, and outlined the situation. He contacted the two fertiliser CEOs, and the CEO of the New Zealand Fertiliser Association for comment. He published his report in July 2026, in the Farmers Weekly, under the heading "Fertiliser companies called out on inhibitor claim". Finally, the story was at least in the public domain.

Some of the comments from the fertiliser industry are interesting. They continued to assert that Agrotain-treated urea increases pasture production by 10%, relative to urea alone, and that the average volatilisation in New Zealand is 15% and that the inhibitors like Agrotain reduce this by 50%. Further they stated that "there is no way of predicting if there will be a high or low volatilisation rate when a fertiliser recommendation is made, therefore urease inhibitors should be viewed as a risk management tool" and "Agrotain is sold and promoted as a tool to mitigate potential N losses through volatilisation".

These claims, I assert, are inconsistent with the scientific evidence as discussed above earlier.

My Reflections

There was a time, I'm going back to the years leading up to the 1980s, when the fertiliser co-ops were very science-focused. There was a close, healthy and interactive relationship been the technical reps of the co-ops and the soil scientists and agronomists: We needed them to tell us what technical problems they were struggling with and they needed us to develop and explain the science.

Two major reforms took to place over the next two decades which have greatly altered these dynamics. First, the fertiliser industry underwent major reforms and was required by the powers that be to adopt a competitive model. They focussed on competing for market share and their focus was no longer on the farmer shareholder, as it was under the cooperative model. Over the same period of time agricultural research was transitioned from the old Public Service model to a corporate model. Scientists focussed on competing for research funding.

Taken together, these fundamental changes have meant that agriculture research, farmers and the fertiliser industry were no longer on the same "page". The consequence was that products like Agrotain-treated urea, and indeed Reactive Phosphate Rocks before it, were introduced into the market without proper scientific scrutiny. The sole loser in this game was the unsuspecting farmer, who had little option but to buy products which failed the science test.

At the personal level I am appalled with how the two fertiliser co-ops have handled this issue. Warning signs were first raised in the Fertiliser Review as far back as 2004 and reinforced with further articles in the Fertiliser Review 22 (2009) and Fertiliser Review 34 (2015). The publication of the Grasslands paper (2023), plus the follow-up emails in 2024 and 2025, should have jolted some action! Unfortunately, my letter to the two fertiliser co-ops in 2026 had no impact. It was for these reasons I felt justified in going over the top of the fertiliser industry and directly to the farmer with this Agrotain issue.