An Independent Scientific Assessment of the Efficacy of Avail® and Nutrisphere®

By

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For

TaurusAg Pty Ltd

EXECUTIVE SUMMARY

- Publicly available reports of field trials designed to test the efficacy of either Avail® or Nutrisphere® were sourced via the Internet and/or by email correspondence with specific authors.
- A database was established summarizing these results. Each trial (defined as a trial-year) was categorized as either: Very Reliable (VR), Reliable (R) or Not Reliable (NR) depending on the scientific quality and rigor of the trial design, conduct and reporting. For example all non-replicated trials were rated as NR.
- The plant yield responses to either Avail or Nutrisphere were calculated as the difference between the control and the treatment, expressed as a percentage of the control (either + or -) and the cumulative distribution functions of these results were defined.
- In total 210 trial-years of data were recorded for Avail and 121 for Nutrisphere.
- For the product Avail the distribution functions for the various sets and subsets of data indicated the following:
    - For the VR data, and after removal of obvious outliers, the measured yield responses were normally distributed around a mean of 1.2% and confidence interval of 1.0% and a range of -12% to +13%.
    - For the VR plus R trials the range of the measured responses was -24% to + 29%, with a mean of 2.4% and confidence interval of 1.3%.
    - For all trials (NR, R and VR) the measured yield responses to plant growth ranged from -24% to +71% with a mean of 4.9% and confidence interval of 1.4%.
    - The plant yield responses to Avail were not related to the P responsiveness or the soil pH of the site.
- For the product Nutrisphere the distribution functions for the various sets and subsets of data indicated the following:
    - For the VR trials the measured yield responses ranged from -8% to +12% (mean 0.05% and confidence interval 1.3%).
    - For the R and VR trials the range was -11% to + 12% (mean 0.4% and confidence interval 1.2%).
    - For all trials the responses ranged from -11% to + 71% (mean 5.1% and confidence interval 2%).
    - The plant yield responses to Nutrisphere were not related to the N responsiveness of the site.
- ***It is concluded that neither product has any practical effect on plant yield when applied as directed by the manufacturer (SFP) and the global sales marketer (Simplot).***
- ***It follows that the claims made about both products (namely: 10-15% increase in plant yield) are false and are not supported by rigorous scientific analysis***.
- The data from those trials designated NR show a bias (used in the biometrical sense) in plant yield responses to Avail and Nutrisphere of about + 10-12% and the cumulative distribution functions for the NR trials are similar to the data-set supplied by Dr Tindall of Simplot and available on the Simplot website.

- The evidence suggests therefore that un-reliable trial data has been deliberately selected from the total set of available data to give the impression that both products are effective when in-fact they are not. If this is so then it represents an example of pseudo-science, which can be defined as "a claim, belief, or practice which is presented as scientific, but which does not adhere to a valid method, lacks supporting evidence or plausibility, cannot be reliably tested, or otherwise lacks scientific status." (http://en.wikipedia.org/wiki/Psuedoscience).

BRIEF

TaurusAg (Australia) have retained the services of agKnowledge Ltd (New Zealand) to review and summarize the international literature on two fertilizer enhancers: Avail® and Nutrisphere® both developed and owned by SFP and marketed through Simplot. TaurusAg are licensed to distribute both products in Australia.

agKnowledge Ltd is a privately owned company, which specializes in conducting meta-analyses of field research on fertilisers and related products. Importantly, the primary technique used in this type of research (cumulative distribution functions - see text) has been accepted in the peer reviewed international literature (Edmeades 2002). Products examined using this technique include: liquid fertilizers (Edmeades 2002), EcoN, a proprietary nitrification inhibitor (Edmeades 2008), ProGibb®, a proprietary gibberelllic acid product (Edmeades 2010a) and LessN, a proprietary nitrogen fertiliser enhancer (Edmeades 2010b).

PRODUCTS DEFINED

Avail®

Avail is a polymer that is coated onto granular P fertilisers or mixed with liquid phosphate fertilisers to enhance their effectiveness. It is claimed to increase phosphate efficiency, improve potential yield (by 10-15% "based on university research") and increase farm profitability.

The mode of action is defined thus: the polymer sequesters the cations (Ca, Mg, Al and Fe) in the soil solution in the vicinity of the fertilizer granule inhibiting their reaction with the fertiliser P which would otherwise render the P unavailable for plant uptake. In effect it reduces what is referred to as "P fixation". It is claimed to be effective on a wide range of soils and crops.

Nutrisphere-N®

Nutrisphere is a polymer that can be coated onto granular N fertilisers or added to liquid N fertiliser that enhances their effectiveness. It is claimed to reduce volatilization of ammonia, leaching of N as nitrate and the denitrification of N and thereby increases the efficiency of N use.

Nitrosphere-N acts by slowing the hydrolysis of urea to ammonium and the oxidation of ammonium to nitrate.

PRODUCT CLAIMS

TaurusAg have asked agKnowledge to specifically assess the veracity of the claims made for these products as listed below:

Avail®

1. **Claim 1:**"Developed by SFP, AVAIL® is undoubtedly the most important fertiliser advancement in 30 years." (SFP Brochure 2009).
2. **Claim 2:** "Avail increases phosphorus fertiliser efficiency by creating a virtual shield around phosphorus molecules to block the bonds of attraction between chemical elements in the soils and your valuable phosphorus, keep more available for your crops to utilize." (SFP Brochure 2009).

3. **Claim 3:** "By making sure more phosphorus is available to your crops, AVAIL can increase yield potential by 10-15%." (SFP Brochure 2009).
4. **Claim 4:** "University studies and independent field trials show that acres where AVAIL was added to the phosphorus fertilizer applications yielded 10-15% above acres that were treated with fertilizer alone." (SFP Brochure 2009).
5. **Claim 5:** "Tests have been conducted world-wide on a variety of crops in a variety of conditions." (SFP Brochure 2009).
6. **Claim 6:** "Any crop, any soil, any time. Together or separately. Whether you apply fertiliser in the fall, in the spring or both. Whether you use liquid or dry fertilizer. No matter what you grow, no matter where you grow. Plain and simple, AVAIL and Nutrisphere can improve your potential yield by improving nutrient availability." (SFP Brochure 2009).

Nutrisphere-N®

1. **Claim 7:** "Nutrisphere-N keeps enzymes at bay, keeping more nitrogen in its ammonium state before it gets converted to nitrates. This means less leaching, less volatilization and more available nitrogen to aid development, growth and yield potential." (SFP Brochure 2009).
2. **Claim 8:** "Good science. Great returns. Nutrisphere-N works to erase the effects of urease to a molecular level, allowing applied nitrogen fertilizer to enter the soil and keeping more available to crops whether applied in the fall, winter or spring." (SFP Brochure 2009).
3. **Claim 9:** "Tested. Proven. More nitrogen efficiency leads to higher yield potential. And that's confirmed by nationwide university studies and independent field trials pitting (sic.) acres where Nutrisphere-N was added to nitrogen fertilizer against acres where nitrogen fertilizer was applied alone. The conclusion – a 10-15% increase in yield potential can be expected when Nutrisphere-N is added to the mix." (SFP Brochure 2009).
4. **Claim 10:** "Any crop, any soil, any time. Together or separately. Whether you apply fertiliser in the fall, in the spring or both. Whether you use liquid or dry fertilizer. No matter what you grow, no matter where you grow. Plain and simple, AVAIL and Nutrisphere can improve your potential yield by improving nutrient availability." (SFP Brochure 2009).

METHODOLGY

Database

Publicly available reports on field trials designed to test the effect of either Avail or Nutrisphere on crop yields were sourced via the Internet and with email correspondence with specific authors. A database was established summarising these results. For each trial the following data was recorded: unique ID, researcher, year, site(s), crop, trial design, replication, rates of P (for Avail) or rates of N (for Nutrosphere), P or N responsiveness (yes/no, see text for definition), soil pH, statistical analysis (yes/no), control yield, Avail or Nitrosphere yield, response to Avail or Nutrisphere (as a percentage over control whether positive or negative) and statistical significance of the response. Each trial was categorised as either: very reliable (VR; trial design and full statistical analysis were available), reliable (R; no information about the trial design but the statistical significance of the treatment effects was available) or not reliable (NR; trials which were either non-replicated or

with less than 3 replicates or the trial design was not known or no statistical information or analysis was available or if there was doubt as to whether the entire data set was presented).

Where the effect of the products was measured across different levels of P (Avail) or N (Nutrisphere) the main effect of the product was recorded at the individual site-year available. Thus the lowest unit of recorded measurement was at the crop-year level.

For defined subsets of the data the rank and distribution, and hence the cumulative distribution, of the observed responses to either product was defined from which the mean and confidence interval was determined.

For the product Avail, 210 trials-years of data were recorded on a wide range of crops (root crops, cereals, corn, legumes, pasture grasses, lettuce and peas). One-hundred and twenty one trial years of data were identified for the product Nutrisphere on a range of crops including, corn, sorghum and cereals.

Theoretical considerations

The interpretation of results from field experiments is thwarted by difficulties especially when the potential effects of a given product on plant yield are similar to or less than the normal background variability which occurs in all biological experimentation and is typically about 5-10%, (expressed as the coefficient of variation, CV) in well designed, planned and executed trials.

In these circumstances the measured effects of a given product on plant yield are frequently not statistically significant and hence the interpretation of such results is problematic - is the product having an effect but the experiment is not sufficiently accurate to detect it, or, is the product having no effect and the observed treatment "responses" are due to the expression of the background biological variation? The converse situation also arises when an individual result is statistically significant – is the effect due to the treatment or is it due to the small but finite probability that the product is having no effect and the observed "response" is due to the background variability? These possibilities give rise to the classic Type I and II errors associated with statistical testing (Snedecor and Cochran 1967).

Reynolds (1987) has suggested a pragmatic solution to this problem. It arises when a given product has been tested many times, as in this case. This enables the frequency distribution of the measured treatment effects to be examined and compared with a normal distribution with a mean of zero. For convenience this is achieved by converting the distribution frequency and plotting the cumulative distribution function. Any displacement of the distribution, either positive or negative, can be taken to indicate a real treatment effect.

For example, the data in Figure 1 are from a set of experiments conducted by Wadsworth (1987) in which the effect of a small application of water (225 L/ha) on crop yields (on a range of crops) was measured relative to a nil treatment (no water). Such a small input of water would not be expected to have a sustained or substantial effect on crop yield. This is indicated by the fact that the observed effects of water are distributed normally around a mean of –0.6% with a confidence interval of 2.3%. Importantly the confidence interval includes 0% indicating that the treatment is

ineffective. The range in the observations is –22% to +32%, consistent with the variability normally associated with experiments of this nature allowing for the odd intrusion of other experimental errors (e.g. the data point at +33% in Figure 1 appears to be an outlier).

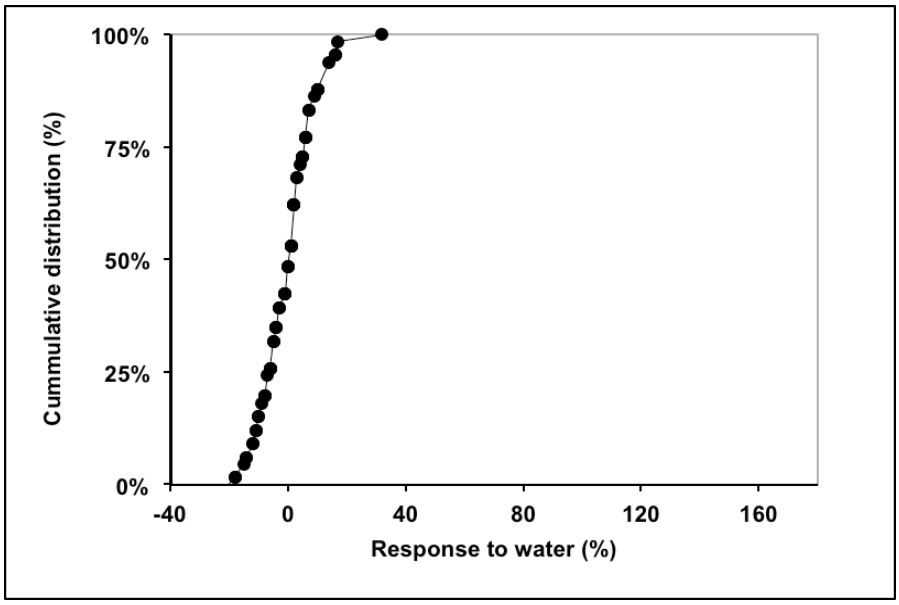

Figure 1. The frequency distribution of crop responses to water (225L/ha) expressed as the increase or decrease (%) relative to the control (see Edmeades 2002).

If a product is having a real and sufficiently large effect, the distribution of responses relative to the control moves to the right. This is observed in Figure 2, for a set of data derived from field experiments (n = 27) in which the effects of a proprietary gibberelllic acid product (ProGibb®) on pasture production has been measured. For this set of data the frequency distribution is moved to the right and the mean response to ProGibb is about 39%. The background variability is still apparent with the responses ranging from about -10% to +180%. Note once again the presence of an outlier in the data (+180% in Figure 2).

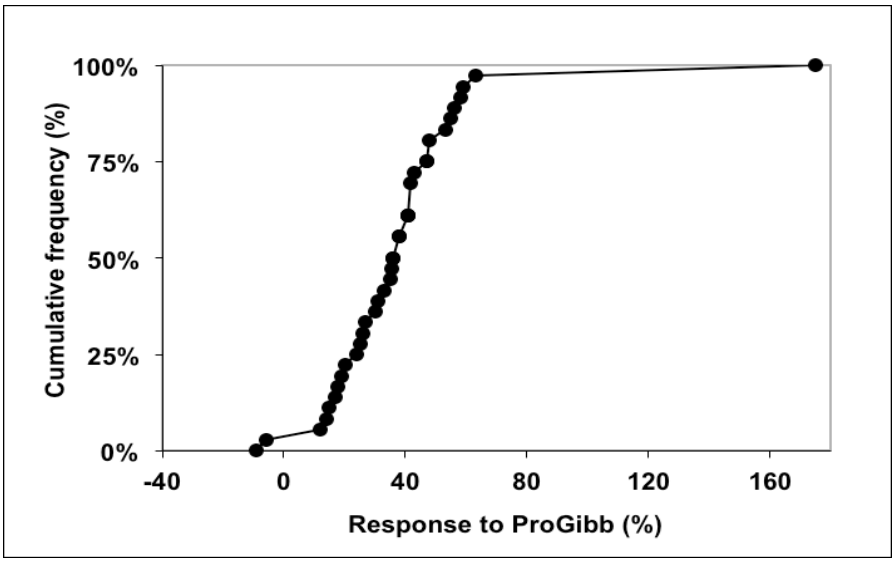

Figure 2. The frequency distribution of pasture responses to ProGibb expressed as the increase or decrease (%) relative to the control (Edmeades 2010a).

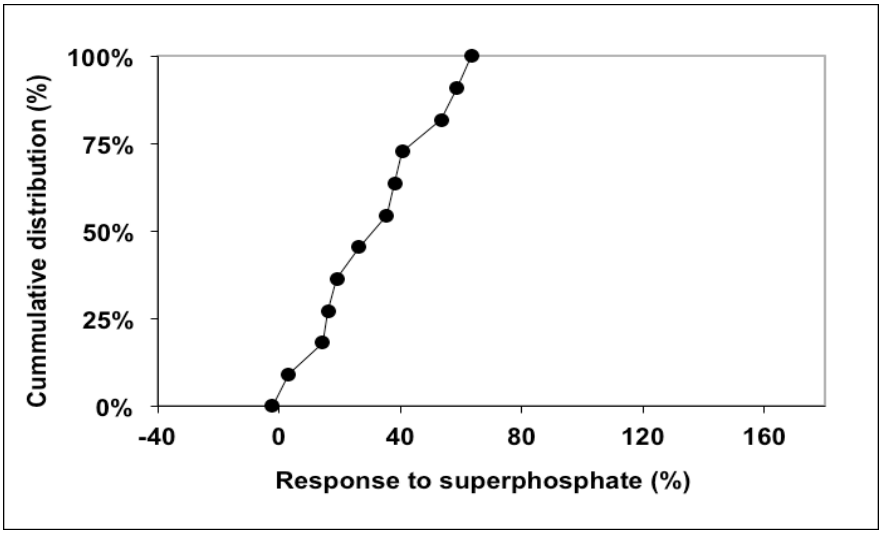

Figure 3 The frequency distribution of pasture responses to superphosphate expressed as the increase or decrease (%) relative to the control (Edmeades 2002).

Figure 3 shows the cumulative distribution function for pasture responses to superphosphate. In this case the mean response is about 27% with a range from -2% to +63%. The S shaped curve reflecting a normal distribution is not as apparent because of the smaller number of trials (n = 12).

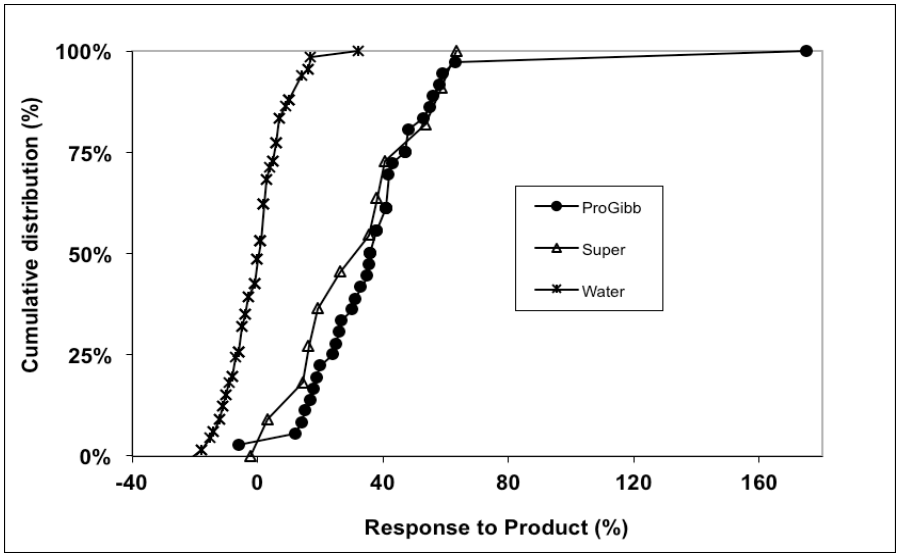

Figure 4. The frequency distribution of crop responses to water and pasture responses to superphosphate and ProGibb expressed as the increase or decrease (%) relative to the control.

Putting the data in Figures 1, 2 and 3 onto a common scale (Figure 4) shows the advantage of this approach - it is easy to visualize large sets of data and see the effectiveness or otherwise of a given product against the background of normal biological variation inherent in all such research. Furthermore the effectiveness of a

given product is not dependent on the statistical significance or otherwise of any given trial result. This also obviates the mathematical difficulties that arise when formally averaging trial results from trials with many different designs.

RESULTS: AVAIL

The cumulative distribution of the crop yield responses to Avail from all the trials in the database is shown in Figure 5.

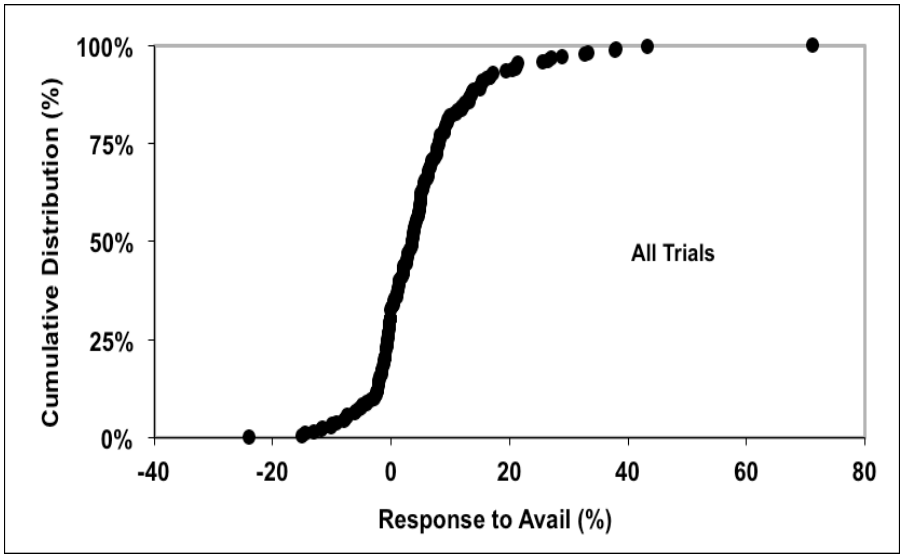

Figure 5. The distribution frequency of plant yield responses to Avail expressed as a decrease or increase (%) relative to control for all trials.

There are 210 trial-years of data and the measured responses range from -24% to + 71%. The data are distributed normally around a mean response of 4.9% with a confidence interval of 1.4%. There are some outliers. If all this data was accepted on face value it could be suggested that Avail is having a measurable, albeit small effect (about 5%) on plant yield. *However, the commonly accepted standards of science require that no weight should be placed on results from trials that are either: not replicated or the trial design is not known or there is no statistical analysis of the data. There are 70 trials-years of data in this category.*

Setting these unreliable (NR) results aside, the distribution of the data from those trials assessed as either R or VR (n = 140) is shown in Figure 6. The data are distributed normally around a mean response of 2.4% with a confidence interval of 1.3%.

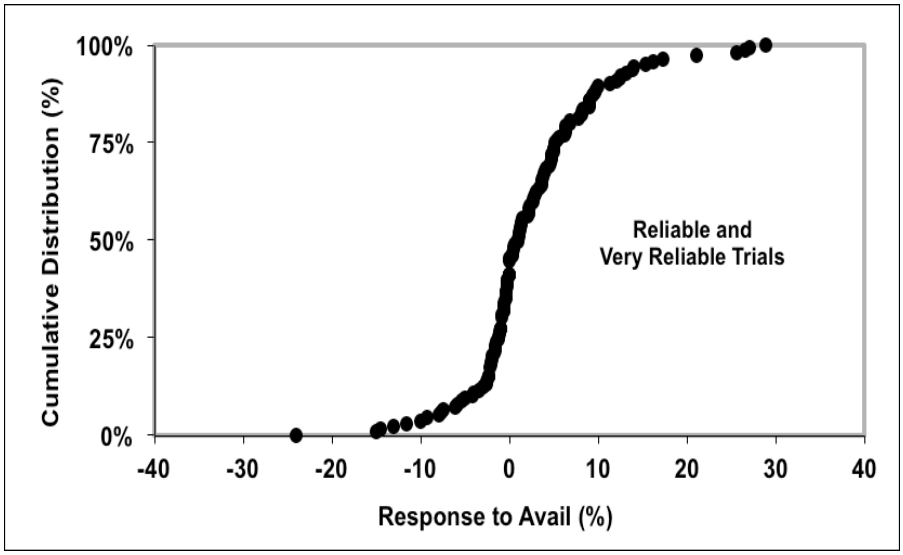

Figure 6. The distribution frequency of plant yield responses to Avail expressed as a decrease or increase (%) relative to control for a subset of trials that are defined as R or VR (see text for the definitions).

This data-set can be further refined by including only those trials categorized as VR – those trials for which the trial design was known together with a full statistical analysis of the data (n = 95) (Figure 7). This subset suggests a mean response of 1.4% with a confidence interval of 1.1%. Importantly the results are distributed normally around the mean with an approximate equal number of positive and negative "responses" reflecting the typical background variation which exists in all trial work of this type.

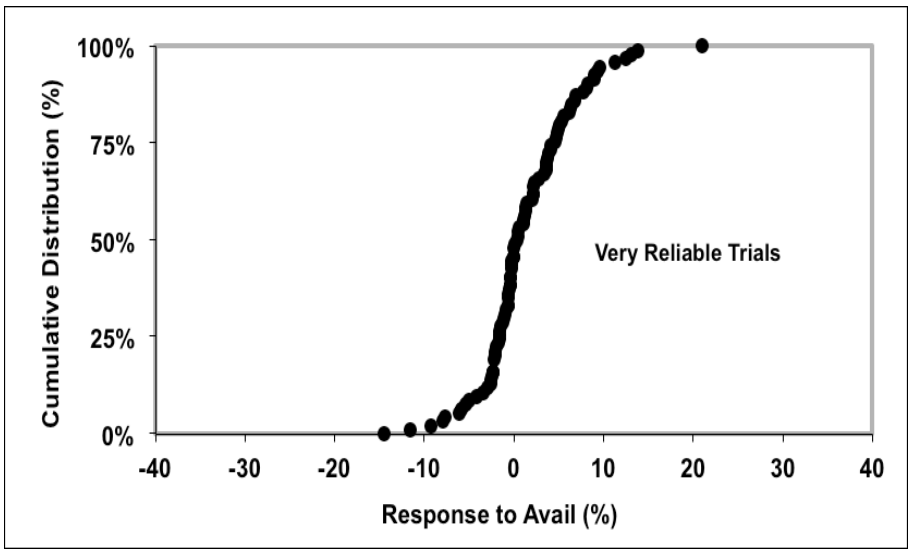

Figure 7. The distribution frequency of plant yield responses to Avail expressed as a decrease or increase (%) relative to control for a subset of trials that are defined as VR (see text for the definitions).

In most of the examples above there are outliers – results which appear spuriously high or low and which do not appear to "belong" to the data set. This occurs in all experimental research due to the intrusion of uncontrolled "errors" (e.g. mistakes in

implementing the trial protocol or uneven crop damage due to weather events). The standard practice is to remove such extreme outliers (i.e "responses" > 2.5 x SD). Figure 8 shows the consequences of doing so on the subset of VR trials (n = 92). The mean response is 1.2% with a confidence interval of 1.0, indicating that Avail has no practical effect on crop yield and that the measured "responses" ranging from -12% to + 13% are reflecting the underlying variability in the field trials.

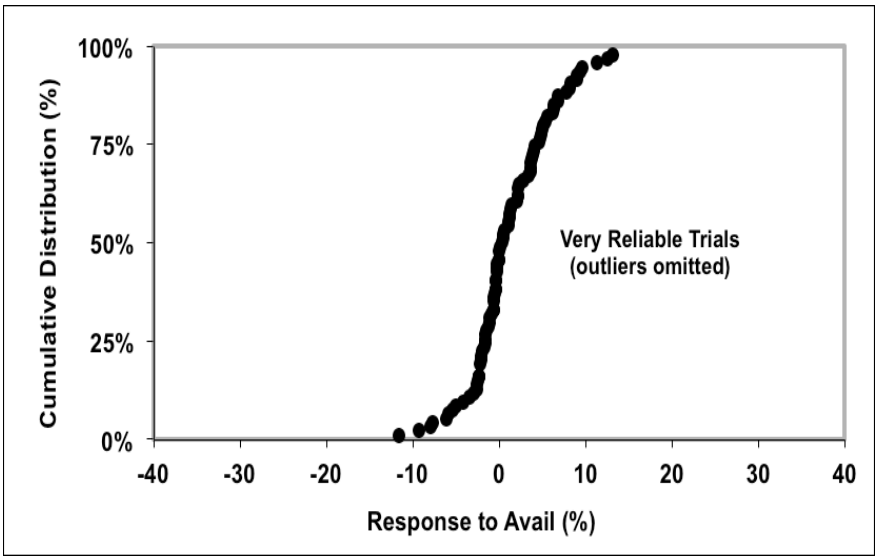

Figure 8. The distribution frequency of plant yield responses to Avail expressed as a decrease or increase (%) relative to control for a subset of trials that are defined as VR (see text for the definitions) after removal of the outliers (see text).

Effect of P Responsiveness

The data in the subset used in Figure 8 are from trials covering a range in soil P status. The purported mode of action of Avail is that it increases the availability of fertiliser P. Thus plant yield responses to Avail may not be apparent if there is abundant soil P prior to the application of the P fertiliser. Alternatively, it is predicted that Avail will result in larger plant yield responses in situations in which soil P, prior to the application of P fertiliser, is limiting.

Each of the sites in the set of VR trials was categorized as either responsive or non-responsive to applied fertiliser P, based on the whether the measured response to applied P was statistically significant or otherwise. Obviously this could only be applied to those trials in which there were at least 2 rates of applied P (no P and P).

The distribution of the plant yield responses to Avail for the P responsive and non-responsive sites is shown in Figure 9. For the non-responsive sites (n = 55) the mean plant yield response to Avail is 0.9% (confidence interval 1.2%), as expected given that Avail is unlikely to be effective on soils with already adequate available soil P. The mean response for the 31 trials, which where known to be responsive to applied P, is 2.1% (confidence interval 2.1).

These later results from the subset of VR trials, on sites known to be P responsive represents the most stringent test of the hypothesis: when applied as recommended, does Avail increase plant yield by increasing the availability of the applied fertiliser

P? *The fact that the distributions of the responses from the responsive and non-responsive sites are almost identical provides strong evidence that the product is ineffective*.

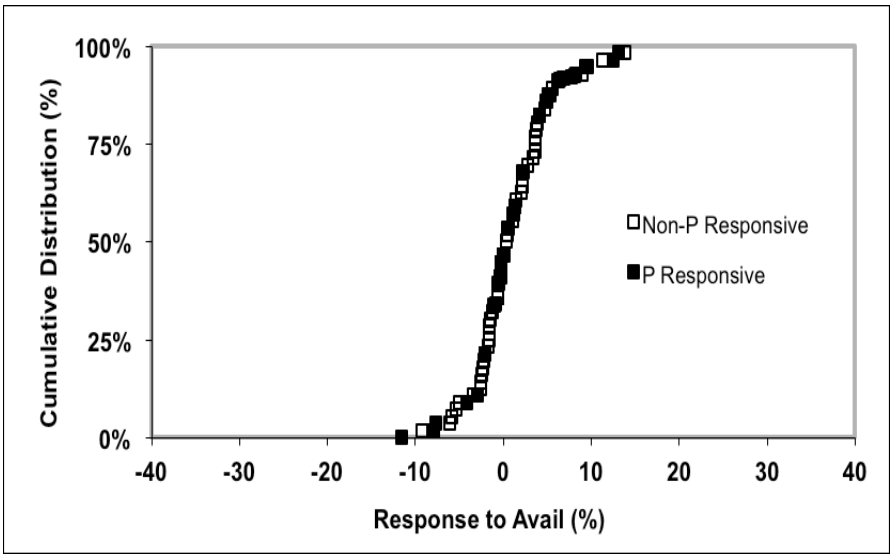

Figure 9 The distribution frequency of plant yield responses to Avail expressed as a decrease or increase relative to control (%) for a subset of trials which are defined as VR (see text for the definition) and categorized in terms of their response or otherwise to applied fertilizer P.

Effect of Soil pH

It can be inferred from the claimed mode of action that Avail should be more effective at either low soil pH, where Al and Fe are more abundant, or at high soil pH, where Ca and Mg are likely to be more available. Between these extremes of soil pH it is predicted that Avail will be less effective. The observed responses from the VR trials are not related to soil pH (Figure 10). Once again the evidence suggest that even if Avail has some effect on P fixation the extent to which it occurs is not expressed in plant yield.

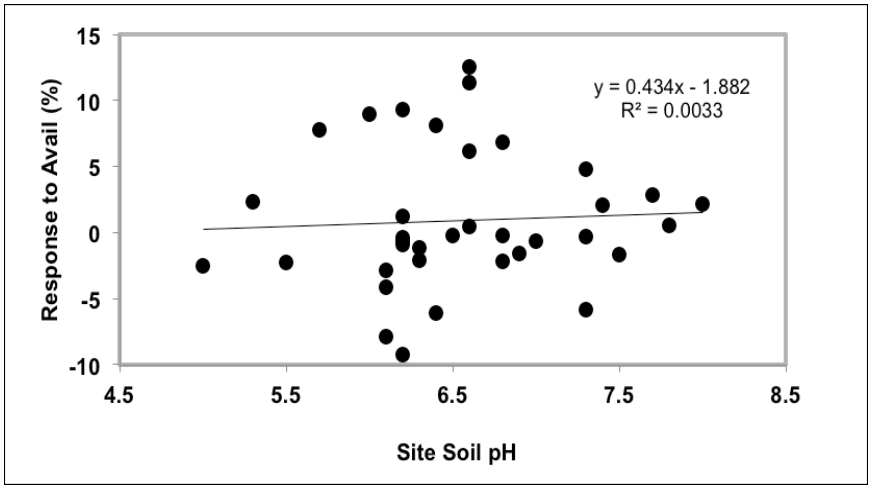

Figure 10. The relationship between plant yield response to Avail (%) and the soil pH of the site for the VR (see text for definition) trials.

RESULTS: NUTRISPHERE

Applying the same approach and process the crop yield responses to Nutrisphere for all the available data are shown in Figure 11. The data (n=121) is distributed normally around a mean of 5.1% with a confidence interval of 2% implying that the product is having some effect, albeit small, on crop yields.

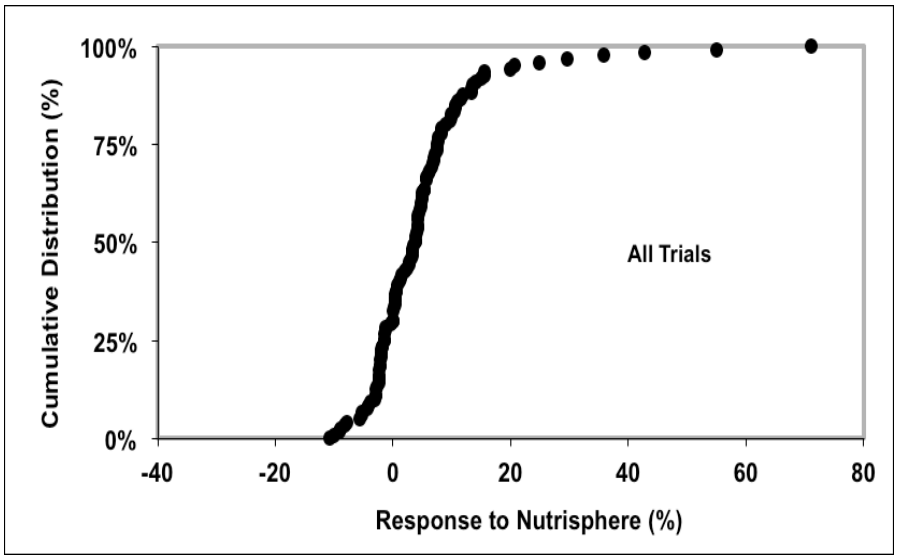

Figure 11. The distribution frequency of plant yield responses to Nutrisphere for all trials.

For the reasons given earlier, it is inappropriate in science to include results from trials which are not replicated or for which there is no statistical treatment of the data. Setting these results aside, the distribution of the responses from the R and VR trials is shown in Figure 12. For this subset of results the mean response is +0.4% with a confidence interval of 1.2% (n = 68). The confidence interval includes 0% and thus *the results indicate that Nutrisphere is ineffective, when used as directed.*

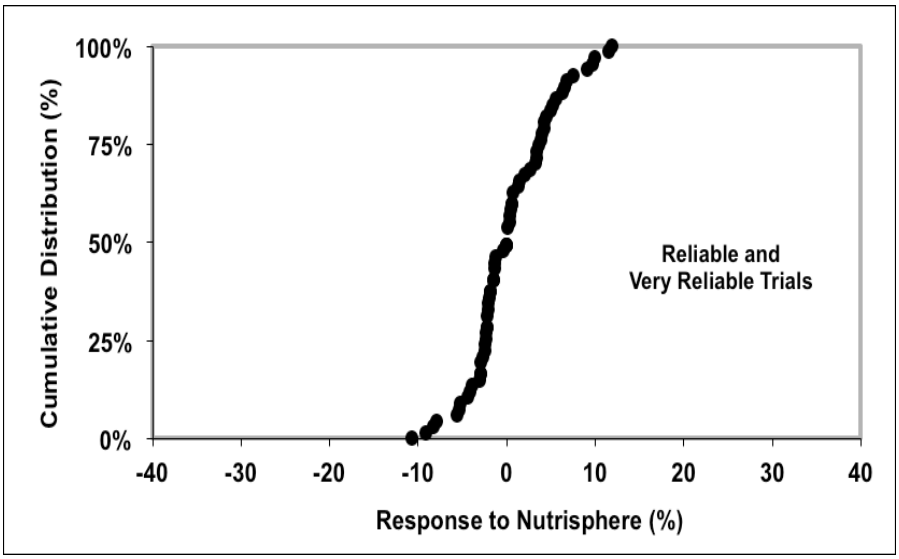

Figure 12. The distribution frequency of plant yield response to Nutrisphere for all R and VR trials (see text for definitions).

This conclusion is even more compelling when only the VR trials are considered (Figure 13) which shows a mean response of 0.05% (confidence interval 1.3%, n = 44). Removing the outliers (responses > +/- 2.5 SD), the mean response is -0.2% (confidence interval 1.2%, n = 43) (results not shown).

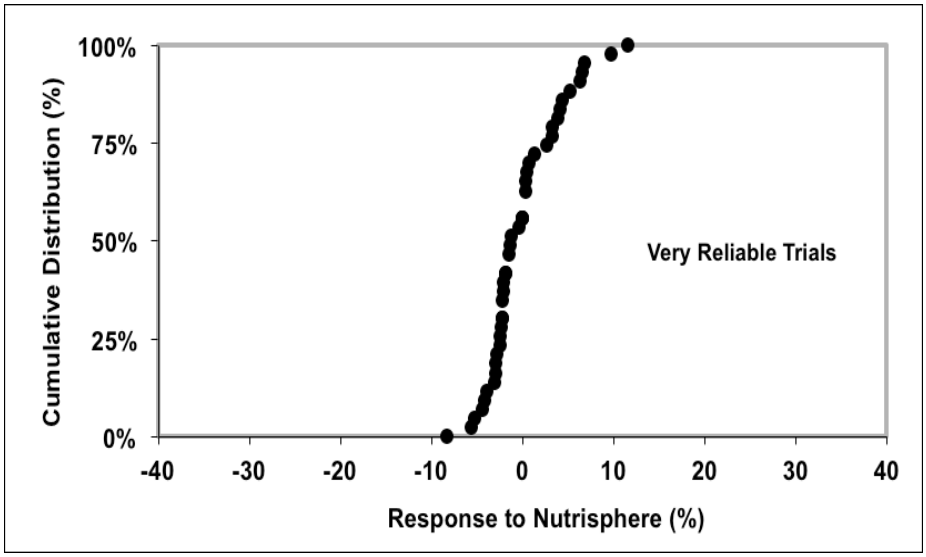

Figure 13 The distribution frequency of plant yield response to Nutrisphere for all VR trials (see text for definitions).

Effect of N responsiveness

It is claimed that Nutrisphere reduces the losses of fertiliser N making more available for plant growth. It is predicted therefore that Nutrisphere will be more effective on soils that are known to be N deficient – soils which are responsive to fertiliser N applications. Selecting only those trials that include at least 2 rates of fertiliser N (control and plus fertiliser N) the cumulative distribution of the plant yield responses to Nutrisphere on N responsive and non-responsive sites are shown in Figure 14. The mean responses are 0.9% (responsive sites, n = 47) and -1.1% (non-responsive sites, n = 15) with confidence intervals of 1.2% and 3.0% respectively. It is reasonable to conclude that *Nutrisphere is ineffective irrespective of the soil N status*.

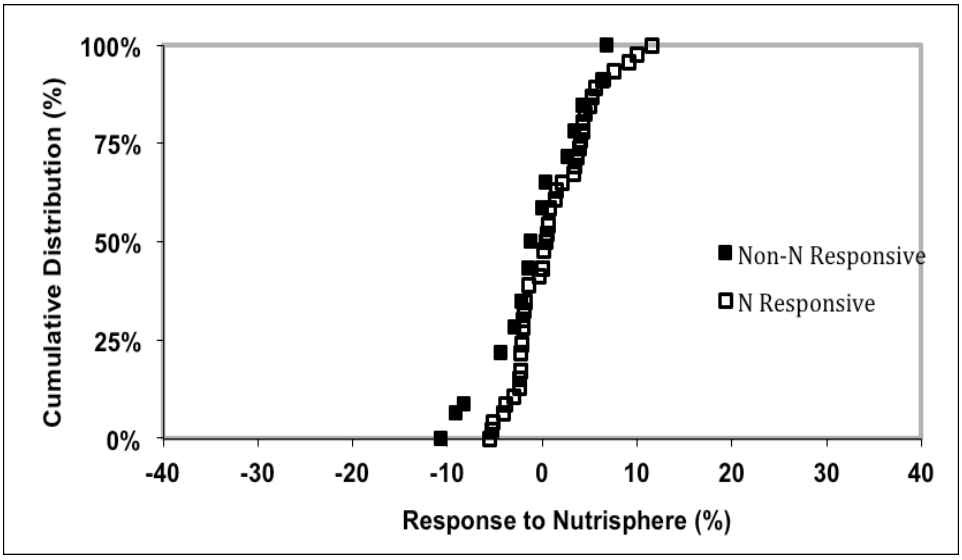

Figure 14. The distribution frequency of plant yield response to Nutrisphere for trials on sites which were responsive or non-responsive to applied fertiliser N (see text for definitions).

Franzen et al (2011) reported results from 10 field trials examining the effects of Nutrisphere on wheat (7 trials) and rice (3 trials). From these results, together with some more detailed glasshouse studies, they concluded that Nutrisphere was ineffective. The results reviewed in this report, based on 67 field studies, give considerably more weight to their conclusion.

SOURCES OF BIAS

It is claimed, as discussed earlier, that both products, Avail and Nutrisphere, increase plant yields by 10-15%. How can these claims be reconciled with the data presented above? How has this bias (again used in its biometrical sense) been introduced into the promotional literature for these products?

Not Reliable Trials

For Avail there are a total of 210 trial-years of data, of which 70 come from trials that are defined as NR and 95 trials designated VR. The distribution of these results is shown in Figure 15. The NR trials have a mean response of 10.1% with a confidence interval of 3.0% compared to 1.4% with a confidence interval of 1.1% for the VR trials The bias introduced by relying solely on the NR trials represents about +9%.

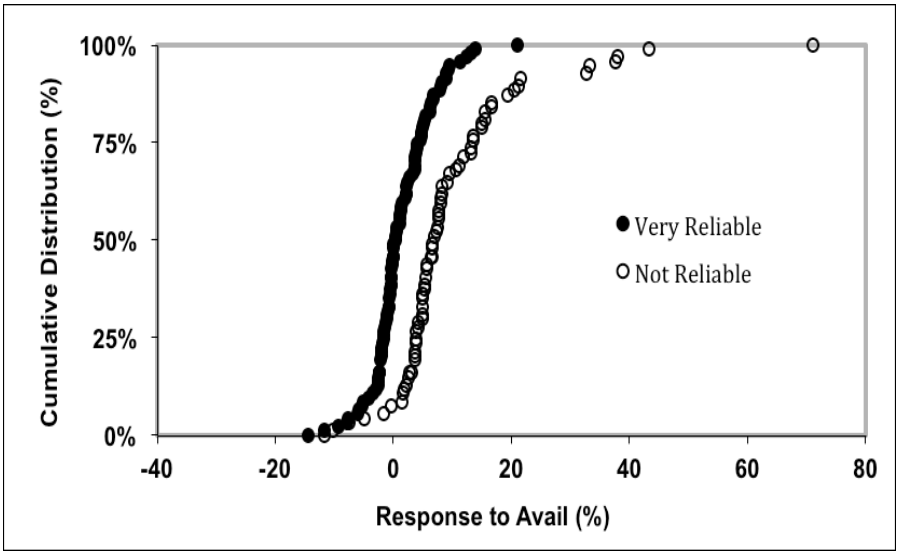

Figure 15. The distribution frequency of plant yield response to Avail for the subsets of NR and VR trials (see text for definitions).

The same applies to the data for the product Nutrisphere. The mean response for the subset of NR trials (Figure 16) is 11.1% with a confidence interval of 3.9% (n = 53) and for the VR trials 0.05 % (CI 1.3%, n = 44), an upward bias of about 11%.

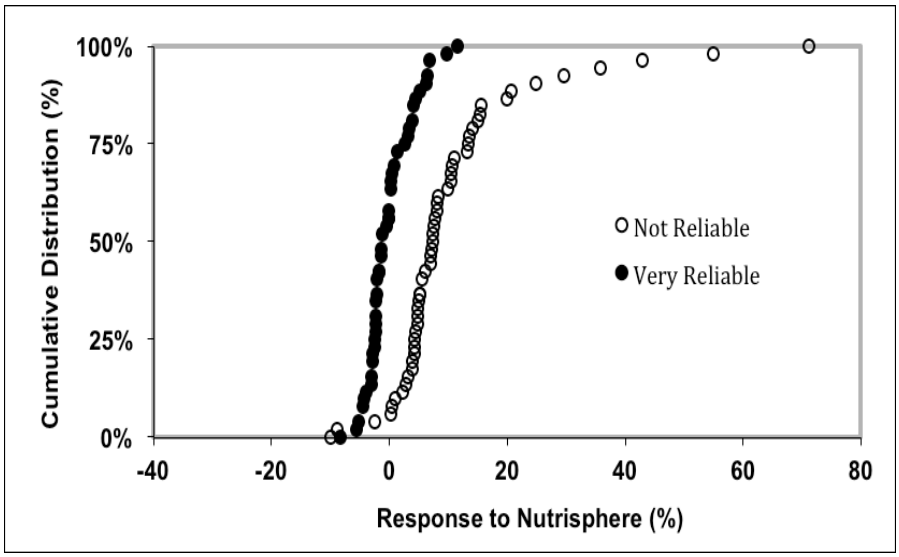

Figure 16. The distribution frequency of plant yield response to Nutrisphere for NR and VR trials (see text for definitions).

These results for the subsets of NR trials are consistent with the claim that both products, Avail and Nutrisphere, increase plant yield by 10-15%. This suggests that the promotional claims made for the products are based, wittingly or otherwise, on trials that *do not meet the basic standards for scientifically acceptable research*.

The Tindall Effect

This conclusion is given further weight by the subsets of data provided to the authors by Dr Tindall of Simplot Ltd. This information is also available on the SFP website. These results are presented as cumulative distribution functions in Figures 17 (Avail) and Figure 18 (Nutrisphere) relative the VR sets of data for both products.

For the product Avail the mean response of the Tindall data set is 11.0% (CI 3.1%, n = 84), relative to a mean of 1.4% (confidence interval 1.1%, n = 95) for the VR set of data, representing a bias of about +10%.

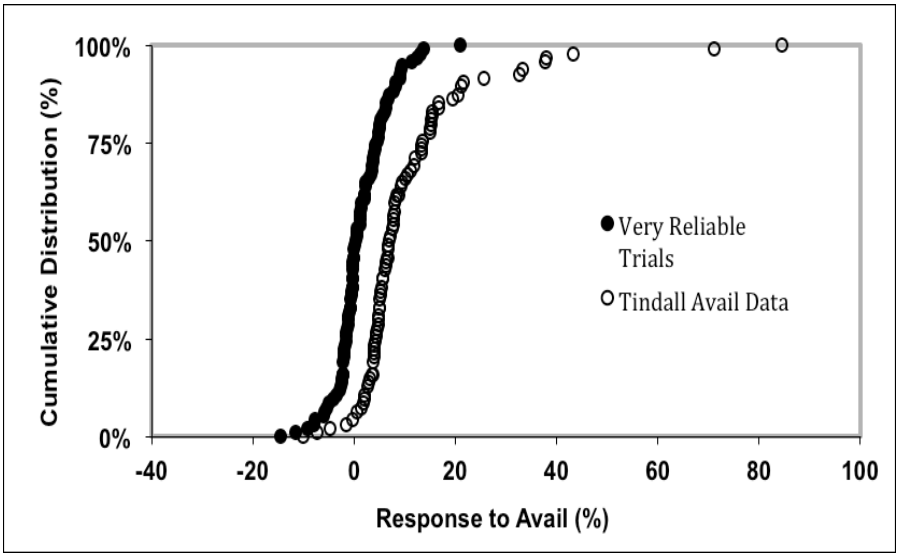

Figure 17. The distribution frequency of plant yield response to Avail comparing the Tindall and VR data sets (see text for definitions).

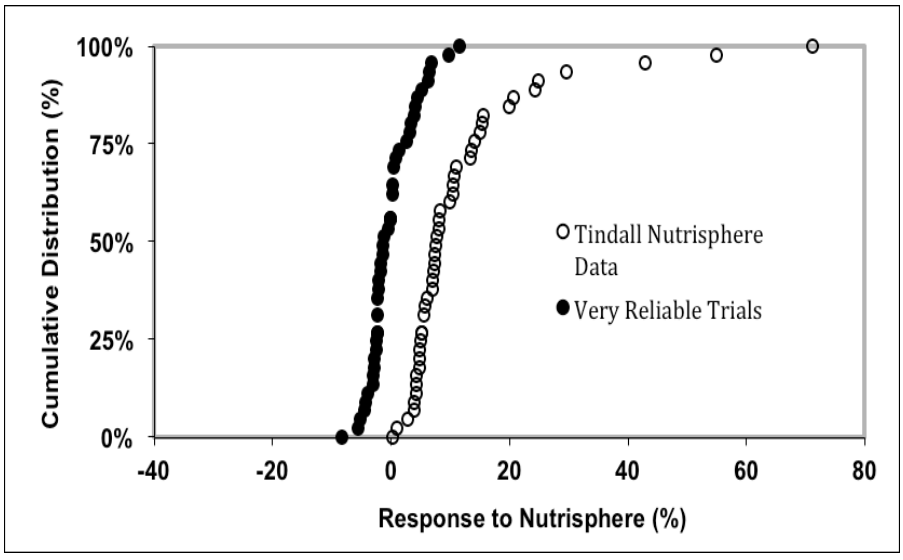

Figure 18. The distribution frequency of plant yield response to Nutrisphere comparing the Tindall and VR data sets (see text for definitions).

The mean response for Tindall's set of data for Nutrisphere is 12.6% (confidence interval 4.1%, n = 46). The mean response for the VR set is 0.05% (confidence interval 1.3%, n = 44) indicating a bias of about +12%.

The examples above demonstrate the danger of selecting subsets of data *without consideration of all the data.* This type of bias can happen unwittingly as the example discussed by Edmeades (2002) demonstrates. It was found the published peer reviewed literature on liquid fertilisers derived from organic materials was biased in favor of these products because there is no incentive to publish results about products that are negative. It is for this reason that it is essential when reviewing results for field trials examining the efficacy of products that all the available data – both published and unpublished - is included for consideration as has been done in this case.

However, in this case, the distribution functions between the NR trials and the Tindall trials (for both products) are very similar suggesting that mainly NR trials – un-replicated trials or trials with low replication (< 3) or for which there is no information regarding the design of the trials and/or statistical information about the accuracy of the results – have been selected. In other words data from poorly designed, conducted and reported trials has been deliberately and selectively chosen to demonstrate that these products are effective when in fact they are not, based on data from trials which meet the appropriate scientific standard for the conduct of field trials. If this is so, then it is an example of pseudo (false) - science, the dangers of which have been discussed elsewhere (Edmeades 2011).

TIMELINES

The trials reviewed in this report were conducted over the period from 2000 to 2011 inclusive and it is relevant to consider what type of trials were conducted over this time-frame and what reasonable conclusions, albeit tentative, could have been drawn from the results.

Avail

Figure 19 shows the number of R & VR and NR trials conducted in each year for the period 2000 to 2011. Up to and including the year 2006, 12 R & VR trials had been completed together with 20 NR trials. A large number of NR trials were conducted in the years 2006 to 2007 and the bulk of the R and VR trial work was conducted during the years 2008 to 2010 inclusive.

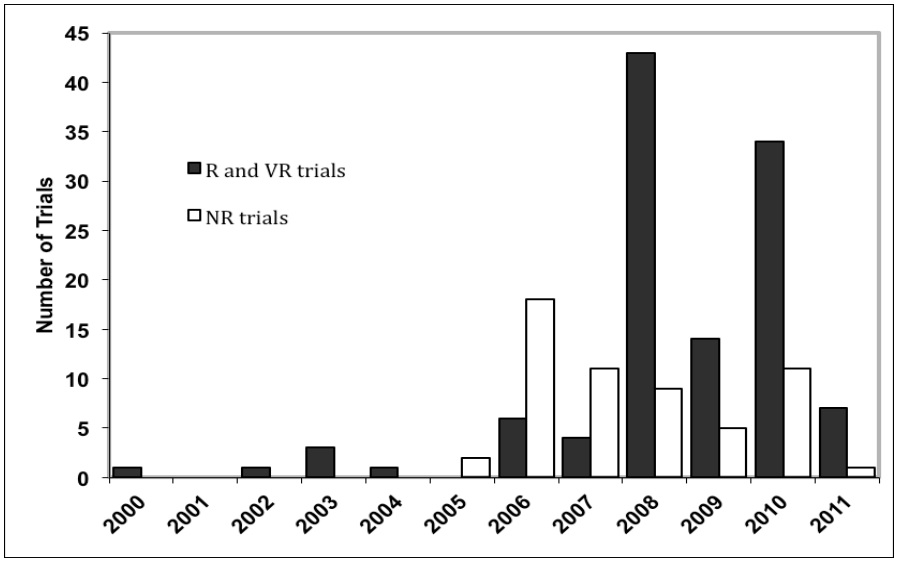

Figure 19 Number of trials (R & VR and NR) conducted in each year.

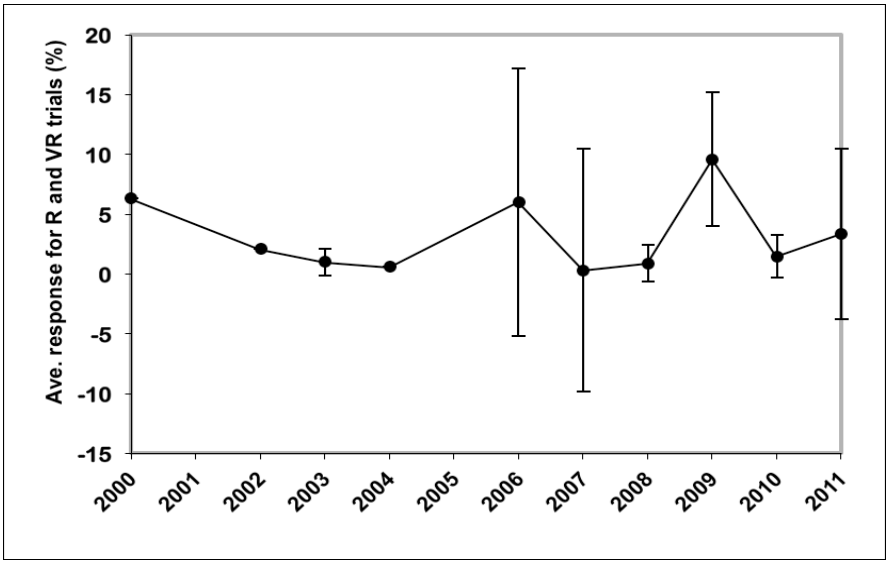

Figure 20 The average annual plant yield responses (and confidence interval where applicable) to Avail over the period 2000 to 2011.

The average plant yield responses, for a given year, from the R and VR trials, is shown in Figure 20. The average annual responses for the period 2000 to 2005 (n=6 trial) were 5% or less. In 2006, 6 further trials were completed and the range of the responses was from 17% to -6%. Thus, even at this early stage in the development of the product it should have been apparent to a scientist, applying the normal scientific standards, that the benefits of Avail on crop production where likely to be small. At least these early results from 12 bona-fide trials should have been sufficient to raise concerns about the product's efficacy. It is noted that Ward (2010) conducted trials funded by Simplot in the years 2008 and 2009, which indicated that Avail was not as effective as claimed. Although this thesis was not published until 2010 it is likely that the results obtained from the field trials would have been known to Simplot prior to the publication date. At no stage during the period 2000 to 2011 inclusive, did the average annual response from the R and VR trials fall into the range 10-15%, the yield response claimed for the product.

Nutrisphere

The situation is even more apparent with the product Nutrisphere. The numbers of R & VR and NR trials are given in Figure 21 and the average annual responses are given in Figure 22.

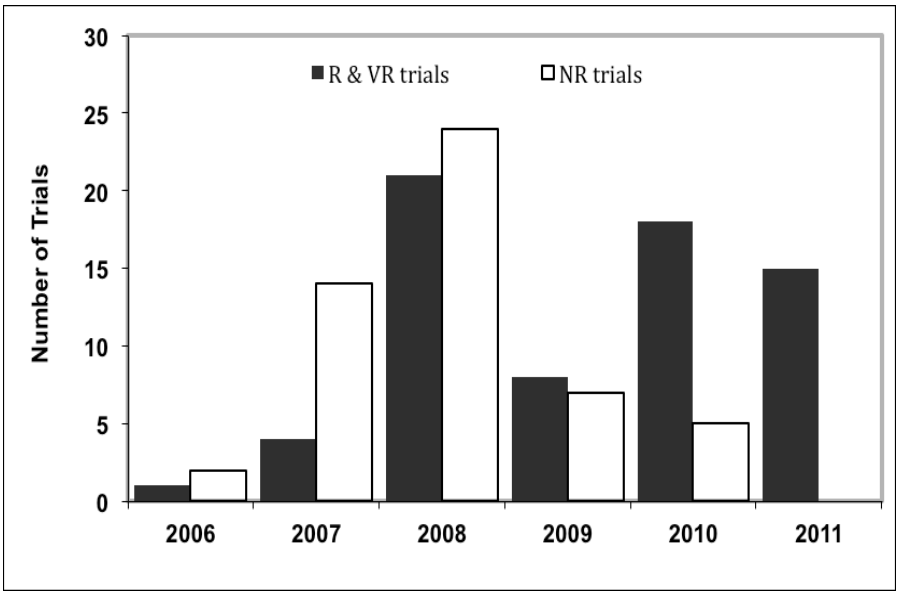

Figure 22 The numbers of R & VR and NR trials conducted with Nutrisphere for each year over the period 2006 to 2011.

The field research with Nutrisphere commenced in 2006. Initially a greater number of NR trials were conducted but this was reversed in the years 2010 and 2011. The average annual responses from the R and NR trials indicate that Nutrisphere was never effective and that the claims made for the product (vis. 10-15% increase in plant yield) have never been realized.

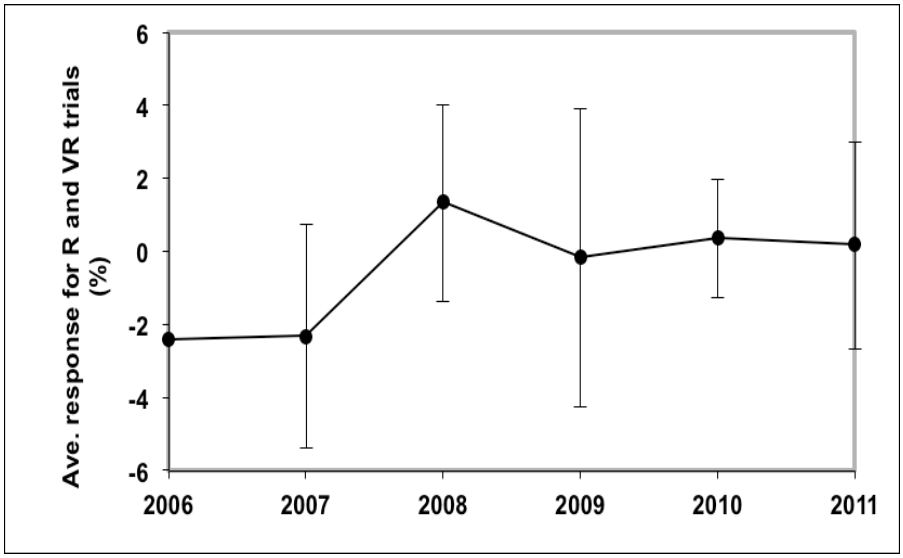

Figure 20 The average annual plant yield responses (and confidence interval) to Nutrisphere over the period 2006 to 2011.

CONCLUSIONS

Both products, Avail and Nutrisphere, are promoted to farmers for use in the broad-acre situation. It seems reasonable therefore when drawing conclusions from the results above to apply a practical standard – what would a reasonable farmer expect from these products given the claims made for them? At a minimum he would expect to do more than recover the cost of applying the product. Thus, while these products are claimed to affect the chemistry and biochemistry of soils the real test from the practical perspective is: what is the net result of these effects on plant yield?

The only reasonable conclusion to be drawn from the all the data reviewed in this report (a total of 331 site-years) is that the products Avail and Nutrisphere, when used as directed, have no practical effect on plant yield.

It is relevant therefore to comment (see below in italics) on the specific claims listed earlier, made by SFP for both products.

Avail®

Claim 1:"Developed by SFP, AVAIL® is undoubtedly the most important fertiliser advancement in 30 years." (SFP Brochure 2009).

In the light of the evidence discussed above this claim is fatuous.

Claim 2: "Avail increases phosphorus fertiliser efficiency by creating a virtual shield around phosphorus molecules to block the bonds of attraction between chemical elements in the soils and your valuable phosphorus, keep more available for your crops to utilize." (SFP Brochure 2009).

The theoretical calculations by Goos (undated) cast doubt on this possibility but in any case the empirical field evidence suggests that even if this does occur it has no consequential consistent practical effect on plant yield.

Claim 3: "By making sure more phosphorus is available to your crops, AVAIL can increase yield potential by 10-15%." (SFP Brochure 2009).

Based on the results from trials that meet the appropriate scientific standard this claim is false.

Claim 4: "University studies and independent field trials show that acres where AVAIL was added to the phosphorus fertilizer applications yielded 10-15% above acres that were treated with fertilizer alone." (SFP Brochure 2009).

The evidence does not support this claim. All of the reliable trials included in this review were conducted by either Universities or independent research agencies and the results from these trials show that Avail has no consistent practical effect on plant yield.

Claim 5: "Tests have been conducted world-wide on a variety of crops in a variety of conditions." (SFP Brochure 2009).

This claim is too broad. The trials included in this report have been conducted in the USA, Canada, Australia and New Zealand.

Claim 6: "Any crop, any soil, any time. Together or separately. Whether you apply fertiliser in the fall, in the spring or both. Whether you use liquid or dry fertilizer. No matter what you grow, no matter where you grow. Plain and simple, AVAIL and Nutrisphere can improve your potential yield by improving nutrient availability." (SFP Brochure 2009).

This is hyperbole - a very broad claim that is clearly false based on the empirical evidence.

Nutrisphere-N®

Claim 7: "Nutrisphere-N keeps enzymes at bay, keeping more nitrogen in its ammonium state before it gets converted to nitrates. This means less leaching, less volatilization and more available nitrogen to aid development, growth and yield potential." (SFP Brochure 2009).

This claim is false. Franzen et al (2011) found that Nutrisphere has no effect on soil enzymes. The evidence that Nutrisphere has no effect on plant yield implies it has no effect on N leaching or volatilization of N.

Claim 8: "Good science. Great returns. Nutrisphere-N works to erase the effects of urease to a molecular level, allowing applied nitrogen fertilizer to enter the soil and keeping more available to crops whether applied in the fall, winter or spring." (SFP Brochure 2009).

See above

Claim 9: Tested. Proven. More nitrogen efficiency leads to higher yield potential. And that's confirmed by nationwide university studies and independent field trials pitting acres where Nutrisphere-N was added to nitrogen fertilizer against acres where nitrogen fertilizer was applied alone. The conclusion – a 10-15% increase in yield potential can be expected when Nutrisphere-N is added to the mix." (SFP Brochure 2009).

This claim is false. It has been widely tested and has no effect on plant yields

Claim 10: "Any crop, any soil, any time. Together or separately. Whether you apply fertiliser in the fall, in the spring or both. Whether you use liquid or dry fertilizer. No matter what you grow, no matter where you grow. Plain and simple, AVAIL and Nutrisphere can improve your potential yield by improving nutrient availability." (SFP Brochure 2009).

This is hyperbole - a very broad claim that is clearly false based on the empirical evidence.

OVERALL CONCLUSION

Overall, the only conclusion allowed by the empirical evidence, applying the normal scientific standards for the conduct of field trials, is that both Avail and Nutrisphere, when used as recommended, have no practical effect on crop yields and that the claims made for them by SFP are therefore not supported by the evidence.

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