

Proc. 431: Preparation Methods and Release Mechanisms of Controlled Release Fertilisers: Agronomic Efficiency and Environmental Significance

by Avi Shaviv.

Discussion following presentation of the Paper:

Stephan Vermeulen, *Kemira Agro OY, Espoo, Finland.*

The mentioned the release distribution pattern of the coated fertilisers and you also mentioned that these release patterns are being modeled or have been modeled. What do you know about the latest development in terms of a model or model description of the release patterns of the coated fertilisers?

Avi Shaviv:

I knew that I had only 40 minutes presentation time and I didn't think of bringing the transparencies where I show the modeling! We made quite an intensive effort in the area of modeling the release patterns from different coated materials, but only from coated materials. Some of it is published and some of it is quoted in the paper so I think we covered the description of release from the current coated fertilisers. It's available and can be used.

Menachem Bareket, *SQM, Antwerp, Belgium.*

In the table where you have shown the limitations for the market of slow-release fertilisers, I think fertigation is one of the main reasons, which was omitted in this table.

Avi Shaviv:

I think it's a question of argument. Fertigation is one technique and of course if there wasn't fertigation maybe people would consider alternatives.

Menachem Bareket, *SQM, Antwerp, Belgium.*

Fertigation is developing very quickly and wherever you use fertigation controlled release is obviously not used there, so this is an alternative to slow release.

Avi Shaviv:

Yes, however let's remember that most of the world is not using pressurised irrigation systems so the potential is still big. For instance rice production is a potentially excellent market for controlled release, so still there is a lot to be done. But you are right, fertigation is a good alternative.

Joachim Ehrenberg, *European Commission (DGIII), Brussels.*

Our Directorate is responsible for EU Fertiliser legislation. Recently we had a discussion about slow release fertilisers and there was a concern about what

happened to the coating in the long-term. Is there any concern from the scientific point of view with regard to environmental effects?

Avi Shaviv:

Yes, there is concern that the rate of degradation in soil is one of the shortcomings of such materials. The industry knows it, and they are looking at different solutions, for instance like adding other materials or treating their coatings in a manner they will assist decomposition. At the moment I don't think there is any breakthrough with the current materials. I know about work done in different places in which people are trying to resolve it, but I don't think the fertiliser coatings in use now, even thermoplasts, provide a good solution for decomposition in soil. Some numbers which were mentioned about 8 years ago in a conference in the United States quoted half-life times of decomposition of polyolefines to be 20 to 30 years, which I think is optimistic. Imagine how much polyethylene that you will apply if you have to apply yearly something like 200 to 300 kgs of nitrogen per hectare over 20 to 30 years. That's a problem to be considered.

Paul Niehues, *Krupp Uhde GmbH, Dortmund, Germany.*

I have a similar question concerning urea formaldehyde. Urea formaldehyde is not only used as a slow release fertiliser, but all urea nowadays contains urea formaldehyde. When we install a new tank for urea formaldehyde a lot of precautions have to be made, but on the other hand we spread a lot of urea formaldehyde on the field. Is there any investigation into whether this has a negative effect on the human? Also, as you know, there are many investigations in the United States into whether this can cause cancer.

Avi Shaviv:

I know that people were worried about it, particularly considering building materials which are based on the condensation of urea with formaldehyde, and there were evaluations. I don't know about specific work but people concluded that this big biological filter that we call soil will take care of it. Perhaps somebody else in the audience could add something?

David Crerar, *Chairman and President.*

Has anybody got a contribution to that topic of urea formaldehyde toxicity? Apparently not!

Arnie Rainbow, *Consultant, UK.*

You mentioned I think that the rate of natural release from methylene urea is independent of particle size but surely if it's dependent on bio-degradation, the surface area to mass ratio of the particle will control the rate of release, so I would have thought the particle size would still have an effect on nitrogen release rate.

Avi Shaviv:

You are right, I stressed the fact that with IBDU, as it's dependent on hydrolysis only, they adjust the size to control the release. But any process which depends on the action of another agent, water or microbes, would be size-dependent. Even release from a granule would be size dependent.

Unidentified questioner:

One other way to achieve slow release is to add nitrification inhibitors such as DCD (dicyandiamide) which can be added to ammonium nitrogen products. How do you view that as a way to provide the slow-release effects?

Avi Shaviv:

I believe that if you have good control of the release and you synchronize your supply with demand, practically all nutrients coming out from the fertiliser can be utilised by the plant. So if this is the case I would not think of using DCD, although it's a possibility. However we had a discussion about fertigation. In that situation I would consider its use, because if fertigation is applied at intervals of days, you may have days between the application nitrogen and so it may be effective. But if you have continuous release I don't think it would be useful.

Ricardo Behn, *SQM, Antwerp, Belgium:*

The main nutrient which has been discussed in terms of controlled release fertiliser is the nitrogen. You mention that the majority is still being used in landscaping, golf-courses and so on. When thinking about introducing the technology to field fertilisers for wider use in agriculture, what about other nutrients which could benefit from the technique, especially potassium?

Avi Shaviv:

That's a question which often comes up. First of all the nitrogen is a nutrient which cycles more intensively in nature than the others, and the difference between high and low amounts required or available during the season is very large, so it's the most suitable one practically. If you go to sandy soils of course you should think of potassium but in most cases we grow in soils which have a reasonable cation exchange capacity and also can fix phosphorus. That's the reason why people are less bothered about potassium and phosphorus which are fixed or maintained in a way in the soil. You are right however that this technology will move more towards vegetables and towards light soils, where NPK compound fertilisers are important.

Ricardo Behn, *SQM, Antwerp, Belgium:*

And in that case it would apparently be more suitable to use the coating technology, because the urea formaldehyde is only for the nitrogen.

Avi Shaviv:

I am not aware of chemical binding opportunities for phosphorus or potassium. I would therefore expect that physical protection would be required, probably through coating.

Reinhardt Haehndel, *BASF, Limburgerhof, Germany:*

I would like to make a comment, following what was said about adding nitrification inhibitors to ammonium nitrogen. We stabilise the ammonium and we all know that ammonium can be absorbed by the plant. So for golf courses or grasses where the rooting is very very dense, the ammonium will be absorbed if there is a nitrification inhibitor or not. In this case there may actually be no slow release effect. This is different when there are no roots.

Avi Shaviv:

I would envisage that you would use controlled release where you have some crop. But if you want to have a fertiliser there to be available later on you may consider this.

Andy Eccles, *Omex Agriculture Ltd, UK:*

In the paper you made mention of urea-triazone solutions. Do you think they have a role as a slow release nitrogen form, for use in fertigation?

Avi Shaviv:

Again I think it's an issue of frequency of fertigation. As you go to more and more frequent fertigation you let the plant have exactly what it requires at that time. If you cannot go to very frequent fertigation and you have intervals of days or a week between fertigation events, probably you could consider different possibilities, for example this one, or the addition of nitrification inhibitors or cold water soluble urea formaldehyde.

The Chairman thanked the speaker for the paper and the discussion.