



# techtalk

## Improving fungicide efficacy

Micronutrient crop nutrition, in the conventional sense, involves applying nutrients to either correct a deficiency that is evident in a crop or to ensure that yields are not limited by insufficient access to essential trace elements.

In recent years, however, ProCam has developed a different approach by screening products that not only deliver vital nutrients but also interact with other crop inputs, such as fungicides and emerging biologically active substances, to contribute significantly to overall yield.



# Synergies enhance yield

**A more holistic approach to growing crops is capable of delivering cost-effective yield benefits to growers. CPM discovers how to unlock yield potential.**

*By Lucy de la Pasture*

**Plant breeders have done a great job producing varieties year on year with improved yield potential. The big problem growers and agronomists face is delivering the potential yield capability of these varieties — the failure to get anywhere near the genetic potential of our cereals is widely discussed in agronomy circles.**

Set against a background of increasing problems with resistance, a decreasing number of active ingredients to draw on and a world slump in commodity prices, achieving yield increases is becoming harder. Looking at

different ways of getting the best out of the chemistry available may be the route to unlock some of this hidden yield potential, believes ProCam technical director, Dr Tudor Dawkins.

### **Why look at micronutrients?**

It's a well-known fact that a healthy crop is better able to resist pests and diseases. It's also an established fact that correct nutrition is an integral part of keeping a crop healthy.

The key to building both crop yields and plant performance could be a change in approach to



*Tudor Dawkins has been looking at different ways of getting the best out of the chemistry available to unlock hidden yield potential.*

the nutritional support of plants and it's something ProCam has been working on, in conjunction with Dr Steve Rossall at the University of Nottingham.

Identifying interactions between mixtures of micronutrients and fungicides which can enhance fungicide efficacy has been one of the areas studied in ProCam trials, with further work planned to establish where biologicals may fit into the equation.

A key part of the process has

been creating an independent screening process to test the veracity of the plethora of nutritional and biological products on the market and identify which bring benefits to growers in a field situation.

### **What was previously known?**

Micronutrients are essential to biochemical processes within plants but aren't required in the same quantities as the better considered macronutrients.

Traditionally most crops haven't received the same nutritional support when it comes to trace elements, with crops first exhibiting deficiency symptoms before an application was considered to correct it. By this time, the crop has become stressed and yield potential is already lost.

The new approach to micro nutrition is much more proactive and broad spectrum in its approach, relying on soil and tissue testing in an attempt to prevent the troughs of 'hidden hunger' from robbing yield.

Benefits from applying micronutrients with fungicides at the key fungicide timings had been seen in ProCam trials and



“The key to building both crop yields and plant performance could be a change in approach to the nutritional support of plants.”



the results were repeatable. Yet product efficacy and cost-effectiveness still remains mostly shrouded in a veil of muck and mystery, especially where biologicals such as seaweed extract are included in the mix. An injection of science was needed.

### What did early results show?

Early ProCam field trials work established a significant yield and quality benefit from a micronutrient programme. Further trials highlighted the potential of plant stimulants and micronutrients to reduce the effects of disease in second wheats. Clearly something was going on.

As a means of assessing how products work, glasshouse trials at the University of Nottingham were established to screen products across a range of pot-grown crops — winter wheat, maize and oilseed

rape. Using clay beads as a substrate, instead of soil, enabled measurements of root and shoot growth to be taken without being skewed by differences in base nutrition.

By a process of elimination, the most interesting products have made it to ProCam field trials and demo sites and subsequently to farm-scale trials.

### So what's working?

There are a number of areas where strategic use of micronutrients and/or plant stimulants can deliver benefits in a field situation. Roots form an important part of the yield equation, with a 12t/ha crop of wheat having about 30km of roots/m<sup>2</sup>, whereas a 10t/ha crop will have about 20km/m<sup>2</sup>. Much of the potential of stimulants lies in encouraging root growth.

One of the two more promising



Glasshouse trials at the University of Nottingham were established to screen products across a range of pot-grown crops.

products identified by the University of Nottingham glasshouse trials contains mycorrhiza (a soil fungus). This encourages the development of better root and shoot growth by helping the plants scavenge for phosphate from the surrounding soil.

A second promising combination is an NPK foliar feed with additional ▶

## A nutritional eye-opener from blind trials



Nigel Scott didn't know which field received the nutritional programme and had to pick it out.

persuaded one of his growers, William Maughan, to do a trial across two fields, applying a nutritional programme alongside his fungicide programme on one field and not the other.

“When Nigel asked me to do a trial, I was happy to because we're always looking for things that will give us an edge and increase margins,” he explains. “But I thought it would be a bit of fun if we made it a blind trial so Nigel didn't know which field we put the nutritional programme on and had to pick it out.”

It was a challenge Nigel Scott readily accepted. “Having seen the pot experiments, I was pretty sure I could tell the difference by pulling plants and comparing the growth,” he explains.

To eliminate as many factors as possible that could potentially skew the trial, both of the fields chosen were of similar size and medium loam soil type. Both were mapped for phosphate and potash levels as well as assessed for nitrogen values, with a bit of help from satellite-generated precision maps to make sure the fields nutritional base was as even as possible.

“I chose KWS Lili as the variety

because it has good all round disease resistance so any yield differences at the end of the day wouldn't be due to disease control,” he says.

The chosen field had a nutritional programme of Universal Bio applied at T0 and T1 timings, followed by an application of Kudos at T2. Both fields received a full fungicide programme, with two SDHs, and remained clean throughout.

According to William Maughan, Nigel remained non-committal on which field was which until the T3 timing when he staked his reputation on his choice.

“I made green leaf area assessments at T1, T2 and T3 and there was a big difference in the green leaf area lower down the stem in the field I thought had received the nutritional programme. Here leaves 4 and 5 were still intact whereas in the other field only leaves 1-3 were fully green,” explains Nigel Scott.

At the T3 unveiling of the trial, it was confirmed that Nigel had made the correct choice. When the trial was taken through to yield the field with the additional nutritional programme yielded 11.69 t/ha compared to 10.99 t/ha with fungicide alone.

“The extra yield came from the bushel weights, which were higher in the treated field. More green leaf retention means better light interception,” he explains. What's more, a few loads from the treated field also reached milling spec, which was a bonus.

So what did William Maughan make of the trial? “Next year I'll be including the nutritional programme on a much bigger area,” he concludes.

As a result of the trial, William Maughan will be including the nutritional programme on a much bigger area next year.



With margins being squeezed across the board, the knee-jerk reaction is to cut input costs, explains ProCam agronomist Nigel Scott.

“It's easier to drop nutrients out of the programme than fungicides but when you look closely, the benefits of proactive nutrition on yield and disease control are so significant it's actually non-negotiable,” he says, pointing out that margins should be the focus rather than input costs.

To prove his point, Nigel Scott



## Improve fungicide efficacy: top tips

- **Plan to include a micronutrient strategy as part of a programme** – use products that have been demonstrated to improve rooting early in the crop's life-cycle to get it off to a good start.
- **Use regular tissue sampling during the season** – to establish if crops are running short of key nutrients.
- **Apply nutrients together with fungicides** – to get the best out of both.



*Much of the potential of stimulants lies in encouraging root growth – here, the pot on the right has been treated with a product containing mycorrhiza.*

► trace elements and seaweed extract, which last year gave a yield response of 0.9t/ha when used in the absence of fungicide in ProCam trials. When used within a fungicide programme, an additional 0.7t/ha was achieved.

### What about mycorrhiza?

With the evidence stacking up that some stimulant and micronutrient

combinations are very effective, could we still be missing a trick when it comes to biologicals like mycorrhiza and rhizobia?

Mycorrhizal fungi are naturally present in healthy soils and form a symbiotic relationship with the roots of many crop plants, though oilseed rape isn't one of these.

Using advances in technology to inoculate winter wheat with mycorrhizal fungi in the Nottingham glasshouse trials has shown improvements in shoot and root growth, but would this show a benefit in the field using soil-applied mycorrhiza? Early indications on spring barley show a yield response of 0.6t/ha.

One of the main advantages of mycorrhiza is that they effectively mine phosphate, meaning they supply crop plants with phosphate without the crop having to rely on the supply of phosphate in the soil, where it is often inaccessible to plant roots or 'locked up'.

### What about rhizobia?

Researchers at the James Hutton Institute have discovered a strain of elite rhizobia bacteria from high yielding crops of beans. These have the potential to improve the efficiency of atmospheric nitrogen fixation so that all bean crops could benefit and is something ProCam have in trials this season.

Beans are a crop where it's difficult to get a reasonable return, but using the most efficient strains of naturally occurring UK fungi and nitrogen-fixing bacteria may just tip the balance.



*No fungicide was applied in this field trial, but the crop on the left received a full programme of micronutrients and foliar feeds.*

Field beans in the ground this summer which received strains of both mycorrhiza and rhizobia at drilling were showing double the number of pods per node, indicating there may well be a synergistic effect from using the two biological systems.

### What conclusions can be drawn?

From the results so far, consistent benefits in yield can be obtained by changing the approach to nutrition, particularly by adopting a proactive approach to the needs of the crop. Additional yield responses are possible by aggregating trace elements and combining them with a plant stimulant, which makes them work more effectively.

Using natural soil inhabitants, such as mycorrhiza and rhizobia, to do the work for you in setting up the plant to make access to nutrients as easy as possible, looks promising. A combination of these approaches, tailored to

crop need, together with targeting other inputs more intelligently appears to be a real step forward in bridging the gap in achievable crop yields and yield potential.

Integrating existing fungicide technology with specific trace element treatments can add up to 1.2t/ha to wheat yields. The interactions between fungicides and micronutrients appear to deliver benefits greater than the sum of their two parts.

### Where next for this research?

With the increased interest in plant stimulants and micronutrients, maintaining a screening process is an important part in helping to identify new products with potential and understand how they are influencing plant growth.

Further work with mycorrhiza and rhizobia on a field scale is the next step to make sure the advantages promised will scale up. ■



*The field beans on the left received strains of mycorrhiza at drilling.*

## Sponsor message

ProCam's work with developing agronomic approaches that integrate fungicide programmes with nutrition and other cost-effective inputs to increase enterprise performance, is a good example of its overall crop-production philosophy.

The company's primary objective remains to deliver knowledge-driven solutions that help growers produce higher yields and minimise cost per tonne of crop output.

It's an approach that has been proven to deliver significant benefits over the years.

In 2015, ProCam 4cast analysis shows the average winter wheat

yield achieved by its customers was 10.08t/ha compared to a Defra national average of 8.8t/ha for the year with its top 25% of producers producing 11.4t/ha.

Looking at the past 15 years of ProCam 4cast data shows its customers achieved on average 0.8t/ha more wheat than the Defra national average with the company's top 25% producing 2.2t/ha more.



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