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Two Faces

THE POTATO GROWER | JUNE 21

Phosphite can act as both a fungicide and a biostimulant.

The "dual personality" of phosphite merits a closer look, says David Booty, technical development manager for Omex Agrifluids. Potato growers may find they have more than one opportunity to use it.

Yes, phosphate — not phosphate. While it's chemically similar to the widely used and essential phosphate — the "P" in the NPK fertilizer mnemonic — phosphite (PO3) is actually a "reduced form" of phosphate (PO4). One less oxygen atom makes all the difference; plants cannot access phosphorus in the phosphite form.

Some growers will already be aware of phosphite's role in a disease suppression program, where it has shown remarkable activity against diseases caused by oomycetes such as downy mildew and late blight. In numerous trials, researchers and agronomists have observed how phosphite, when applied in combination with reduced fungicide doses, was able to offer potato crops a similar degree of protection against late blight as full-dose fungicide treatments.

This has proven valuable in recent years, in the wake of ever-tighter crop protection product legislation that has curtailed the use of go-to fungicide actives such as mancozeb and chlorothalonil.

It's important to note that this is disease suppression, rather than disease control. Phosphites won't ever deliver 100 percent control, nor will they act against true fungal diseases like Septoria in wheat. And scientists are still debating the exact mode of action; it is thought to "switch on" certain key genes in the host plant (i.e., potato) that are instrumental in defense, but other theories abound as well.

What's also crucial — and where some growers have come unstuck — is that not all phosphites are created (or at least registered) equal. While they may be chemically identical, a grower who wants to adopt a form of integrated crop management through introducing phosphite to the fungicide program must use a product that has a pesticide registration. Omex Cell Power Phorcephite, for example, has full U.S. registration as a systemic fungicide for the control of downy mildew, Pythium, Phytopthora and other diseases, across a range of crops including potatoes, where an added attraction is its zero-day harvest interval.

But Omex also has another phosphite registration, a product called 4pHoric. This is registered as a fertilizer, because this is where phosphite starts to get really interesting.

Phosphites truly have two faces. Applied at high doses, they provide the fungicidal inhibition we've just discussed. But when applied at low levels, below that capable of providing fungicidal activity, they can also act as a valuable biostimulant.

Biostimulants have received increasing attention and column inches in recent years. They're a new class of crop protection chemicals that aren't easily categorized — neither fertilizer nor pesticide nor nutrient. But when applied to crops, they can affect growth and development in numerous ways, across the whole life cycle of the crop.

For example, some biostimulants affect seed germination, while others prime defense systems or stress responses. They can facilitate recovery from abiotic factors, such as extremes in moisture or temperature, improve nutrient and water acquisition, and improve the quality of produce (color or sugar content, for instance). Some even promote better interaction between

the plant's roots and the soil microbes in what's known as the rhizosphere.

So, what biostimulant properties does phosphite offer the potato grower? Well, the most striking effect is on root development, where studies have identified that phosphite triggers a genetic response within the plant. This prompts the plant to reprogram its enzyme activities, stimulating root development.

Studies have demonstrated root enhancement of up to 50 percent in some crops. That wasn't for potatoes, though a useful effect from application of a foliar phosphite treatment at tuber initiation has been observed in greenhouse trials. Tuber numbers increased by 12.5 percent. It's consistent with the theory that a potato plant with a more effective root system can support more tubers, while the accompanying increase in root biomass could also point to likely benefits from improvements in water and nutrient acquisition.

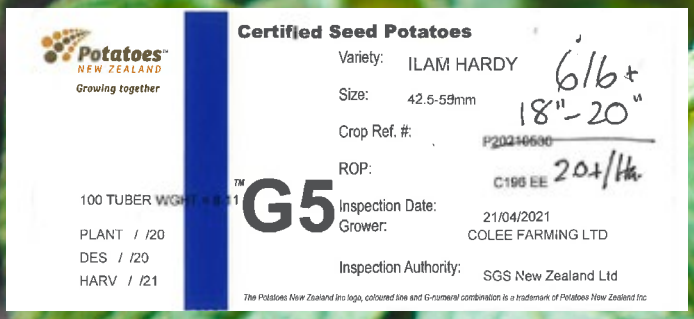
There's also evidence (the American Journal of Plant Sciences published results from an Argentine potato trial) that application of phosphite to seed tubers could not only reduce the time between planting and emergence, but also stimulate early growth — another biostimulant effect in action.

Will phosphite turn out to have more than these two faces? Quite possibly; it's a fast-moving area, and there remain many unanswered questions about phosphite's true mode of action. There's also the legislative aspect. The lack of recognition for biostimulants inevitably places them in something of a gray area, though U.S. proposals for regulation have been tabled.

What's certain is that with these two uses alone, potato growers shouldn't shy away from giving phosphite a priority place in the agronomic armory for 2021.

Understanding Potatoes – Part 2

SHANE SMITH - INTA-AG LTD



Do we have a sports car? SUV? or a bus? the bus having the biggest potential to transport the most offspring. Now we must decide what spacing to plant our seed based on the above information and final market intended.

Fortunately, the UK Potato industry has recently launched new guidelines which are very helpful.

On the next page is a very complicated table, but don't be put off as it is easy to use and only a guide.

At the top is the intended variety and yield based on target market,

Eg Small-medium tubers 55t/Ha
Large-v large tubers 80t/Ha

Then it gives three charts based on whether you think you have a sports car/October, SUV/November, or Bus/December.

Next if you take your Seed Cert Label it will have a 100 tuber weight, divide this weight into 50kg,

Eg 8kg / 100 tubers = 50 divided by 8 x 100
= 625 tubers per 50kg

Let's take it that our seed is the SUV variety and was planted in November. We don't want massive tubers, but we don't want small either, moderate size for Fresh Market is good.

Aiming for 60t/Ha.

Look down the side of the chart to your tuber numbers 625, move across to 60t/Ha plant density and 27,000/Ha – Seed rate 2.27+/Ha.

Next, we work out Seed Spacing, to achieve this you can round up the figures if you like.

Plant density 30,000 x Row width 64' = 1.8m ÷ 2 = 80cm

Eg 100,000 = Row spacing 100,000 = 42cm
30 x 80 2,400 16.8'

So, your rate per Ha is 2.3ton/Ha which is a spacing of 17' or 43cm.

This is obviously pretty large seed, and your ground is not perfect and your planter always plants 2' longer than set, so let us set our spacing at 13-14' or 32-35cm. If you wish you can work it backwards to get a ton/Ha.

The difference with this approach is it gives you a much more accurate idea of your seed size. This seed line was 45-55mm, but looking at the tuber count there were more between 50-55mm.

Now we can plant those suckers and hope that mother nature is kind with her inputs?

SEED RATE GUIDE FOR AGRIA FOR SPECIFIED YIELD WITH A TARGET AVERAGE TUBER SIZE OF 60MM† AND A PLANTING DATE OF 15 APRIL

Yield (t/ha)								
	55 ‡		60		65		70	
"Tuber count / 50kg"	Plant density (000/ha)	Seed rate (t/ha)	Plant density (000/ha)	Seed rate (t/ha)	Plant density (000/ha)	Seed rate (t/ha)	Plant density (000/ha)	Seed rate (t/ha)
Early seed (emerged October - Sports Car)								
2400	42	0.88	48	1.00	54	1.13	61	1.27
2000	39	0.99	45	1.12	51	1.27	57	1.43
1600	36	1.13	41	1.28	46	1.45	53	1.64
1200	32	1.32	36	1.50	41	1.69	46	1.92
1000	29	1.44	33	1.63	37	1.85	42	2.09
900	27	1.51	31	1.71	35	1.94	39	2.19
800	25	1.58	29	1.80	33	2.04	37	2.30
700	23	1.67	27	1.89	30	2.14	34	2.43
600	21	1.76	24	2.00	27	2.27	31	2.56
500	19	1.86	21	2.12	24	2.40	27	2.71
400	16	1.98	18	2.25	20	2.55	23	2.88
Standard seed (emerged November - SUV)								
2400	49	1.02	56	1.16	63	1.32	71	1.49
2000	46	1.15	52	1.30	59	1.48	67	1.67
1600	42	1.30	47	1.48	54	1.68	61	1.90
1200	36	1.51	41	1.72	47	1.95	53	2.20
1000	33	1.65	37	1.87	42	2.12	48	2.40
900	31	1.72	35	1.96	40	2.22	45	2.51
800	29	1.80	33	2.05	37	2.32	42	2.63
700	27	1.89	30	2.15	34	2.44	39	2.76
600	24	1.99	27	2.27	31	2.57	35	2.90
500	21	2.11	24	2.39	27	2.71	31	3.07
400	18	2.23	20	2.54	23	2.87	26	3.25
Late seed (emerged December - BUS)								
2400	64	1.34	73	1.52	83	1.72	94	1.95
2000	60	1.49	68	1.69	77	1.92	87	2.17
1600	54	1.68	61	1.91	69	2.16	78	2.45
1200	46	1.92	53	2.19	59	2.48	67	2.80
1000	42	2.08	47	2.36	53	2.67	60	3.02
900	39	2.16	44	2.46	50	2.78	57	3.15
800	36	2.25	41	2.56	46	2.90	52	3.28
700	33	2.35	37	2.67	42	3.03	48	3.43
600	30	2.46	34	2.80	38	3.17	43	3.59
500	26	2.58	29	2.94	33	3.33	38	3.76
400	22	2.71	25	3.09	28	3.50	32	3.95

†Average tuber size is the grade with the greatest proportion of yield. Assuming a coefficient of variation of 0.20, c. 50% of yield is 60-85mm where the average tuber size is 60mm. Yields indicated are the total tuber yields rather than marketable yields above a minimum size (where the average tuber size = 60mm, c. 5% of yield may be expected to be below 40mm).

‡Where yields >55t/ha are expected, seed rates shown in this column can be used but the average tuber size will be greater, increasing to 65mm at a yield of 70t/ha. The proportion of yield in the 60-85mm grade may be c. 60% where the tuber size average = 65mm, but a significant proportion of tubers may be >85mm. For red shaded area see Step Five in main text.

Boron, the underrated micronutrient

POTATO REVIEW | JULY/AUGUST 2021

Complacency can lead to unforeseen outcomes and it pays to keep an eye on levels, experts say.

FEW potato growers regularly use boron, yet there's evidence that this often-overlooked micronutrient increases yield, dry-matter content and tuber size during the critical bulking period.

Crop scientist and founder of Levity Crop Science, Dr David Marks, said boron deficiencies rarely result in visible symptoms so many growers don't see it as a problem, whereas those growing oilseed rape and wheat consider it as more of an issue.

"That illustrates boron's issue - of all the nutrients, it's the most variable in how it's used. What works on one crop won't work in another," he said.

"Every potato grower chasing yield is familiar with the challenge of balancing top growth against tuber development. Vegetative growth relies on nitrogen, but rising nitrate levels stimulate the production of auxin, the plant hormone that favours further vegetative growth.

"That's at the heart of the nitrogen management conundrum: Avoid the leggy top growth that's associated with sub-optimal tuber development."

But the more nitrogen a plant gets, the faster it grows and the more deficient in boron it becomes.

"Soil tests might suggest healthy levels of boron, but that won't stop a leaf deficiency developing during periods of rapid growth," David said.

Intensifying this issue is boron's interaction with plant hormones. Research from Germany's Liebniz Institute of Plant Genetics and Crop Plant Research revealed how increases in boron favour production of cytokinins and gibberellins, the hormones that favour root development, while plants deficient in boron make higher levels of auxins.

Fail to maintain boron levels and the 'nitrate effect' is increased, reducing tuber development at the expense of vegetative growth. By raising boron levels, favouring the production of cytokinins and gibberellins, the plant focuses on root and tuber development. Apply boron at the right time, says David, and the reduction in auxin synthesis puts a brake on vegetative growth.

ROLE IN SUCROSE MOVEMENT

But there's still another card to play. The starch that constitutes a potato tuber is derived from sucrose, the end-product of photosynthesis. To move the sucrose from the leaves to the tubers, boron forms a complex with sucrose, bis-sucrose-borate. "Boron not only encourages the correct hormones to direct the plant to focus on root and tuber development but ensures the plant can 'pull down' sufficient sucrose from the leaves to pack those tubers full of starch," said David.

Getting sufficient boron into the potato plant can be difficult, compounded by a very fine line between deficiency and toxicity. David pursued a novel approach: Formulate a low-rate product to avoid toxicity but combine it with a stimulant to trigger the plant into absorption and use.

That's the scientific principle underpinning Damu, Levity's high efficiency boron product. Used during periods of excess vegetative growth, it 'trains' the plant to focus on root growth.

Independent agronomist, John Sarup of Spud Agronomy, said: "Imagine you're squeezing the dry matter content contained within the canopy down into the tubers – that's a good way to describe the effect of Damu."

"It's a useful trigger for bulking and has the added advantage of opening up the canopy – something that growers see as very valuable in these post-diquat times. More importantly, it delivers a significant boost to dry matter, raising and evening out levels across the crop."

John recommends two regimes, according to crop habit. "For late-bulking indeterminate varieties, aim for weekly Damu applications of 1l/ha starting seven weeks before desiccation. More determinate varieties will respond better to a single application of 5l/ha, two weeks pre-desiccation."

Damu's proven effect on dry-matter content proved a decisive factor for Spud Agronomy client Fylde Fresh and Fabulous. The Preston-based firm is one of the UK's largest field-to-fork potato producers and processors, growing more than 850 acres to supply fresh chips and foodservice potato products.

Farm manager Sam Paterson said: "We've a relentless focus on dry matter and uniform maturity. We need an even rate across the crop to deliver a consistent product. If the dry matter isn't right, we don't have a crop.

"So when we had a field of Ramos that was harvest-ready but disappointing on dry matter, we saw the opportunity to apply Damu and followed John's 5l/ha recommendation. Results were fantastic. Within 10 days, we saw dry matter improve by a couple of percentage points, while its effect on the canopy was like we'd used diquat.

"I like the concept behind the product, particularly that it provides flexibility in being able to tweak it to fit your own situation."

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