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# Fertilizer INTERNATIONAL

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*Photo: ImagineGolf/istockphoto.com*

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# Fertilizer INTERNATIONAL

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## CONTENTS



## PHOSPHATES AND POTASH INSIGHT



## REGULARS

# Leave no resource unused


The International Fertilizer Association (IFA) released a new report on phosphogypsum (PG) in May, ahead of it Annual Conference in Monaco.

This landmark publication, as its title *From Waste to Inventory* suggests, highlights how a shift to reuse is helping make PG a cornerstone of the circular economy.

The report, also known as PG3, is the third instalment in a series published by IFA on PG management and use.

Being global in scope, with contributions from 28 leading companies and organisations across 18 countries, the report offers a consensus view on PG's potential as a valuable resource. Together, the report's contributors represent over 85% of global PG output, amounting to an estimated 245 million tonnes annually.

There is a compelling case for reclassifying PG from waste to inventory, in IFA's view, to the extent that full utilisation should be feasible by 2035. The Association's latest PG publication, by showcasing innovative applications and business models, demonstrates how PG can be transformed into a valuable resource for industries ranging from agriculture to construction materials, packaging and pharmaceuticals.

"This report is a call to action for industries worldwide to rethink their approach to phosphogypsum," explains Julian Hilton, Aleff Group chairman and the report's editor. "By reclassifying PG as inventory rather than waste, we unlock enormous opportunities for economic growth and environmental stewardship. It is about turning a liability into a global secondary raw material, with a range of potential applications."

IFA's new *Waste to Inventory* report highlights:

- Major changes in how the fertilizer industry views and manages PG – with a move away from its perception as a waste product to recognising its value as a resource within the circular economy.
- How PG is now being safely reused as a valuable product in diverse end markets – ranging from construction to agriculture to road building.
- The plethora of reuse options – with these being driven by the prioritisation of sustainability goals combined with a sea change in how PG is classified and regulated.
- How creating value from PG goes beyond the economic benefits – turning waste management costs into revenue streams – by also delivering significant environmental dividends, such as waste reduction and the conservation of natural resources.

**"By reclassifying PG as inventory rather than waste, we unlock enormous opportunities for economic growth and environmental stewardship. It is about turning a liability into a global secondary raw material."**

Historically, phosphogypsum – being classed as potentially hazardous or radioactive by some countries such as the United States – has been mandated for storage in managed waste stacks. Fortunately, PG is now being reclassified as a co-product, by-product, or secondary raw material in many jurisdictions – thanks to moves to overturn its classification as waste through scientific review and efforts by the International Atomic Energy Agency (IAEA), IFA and others.

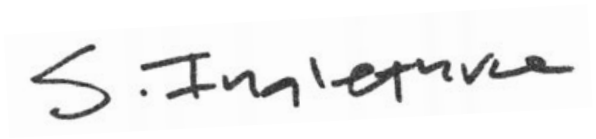
The resulting shift in how PG is regulated and classified has paved the way for its safe and beneficial reuse in many countries. China, notably, has a strong national 'comprehensive utilisation' policy that promotes and sets ambitious targets for PG reuse.

The economic case for PG reuse is also becoming increasingly compelling, the report suggests. The move away from costly waste disposal to revenue-generating activities instead is a particular dividend.

The development of markets for PG-based products and services can boost revenues for phosphate producers by creating new income streams. Examples of profitable PG businesses are highlighted in countries as diverse as Brazil, Belgium, Canada and Indonesia.

Ultimately, the report concludes that achieving 100% PG utilisation is now within reach. Although this will require more innovation, collaboration, supportive policies and investment. Internationally agreed standards for PG-based products and services are also seen as the next major step as an enabler of trade.

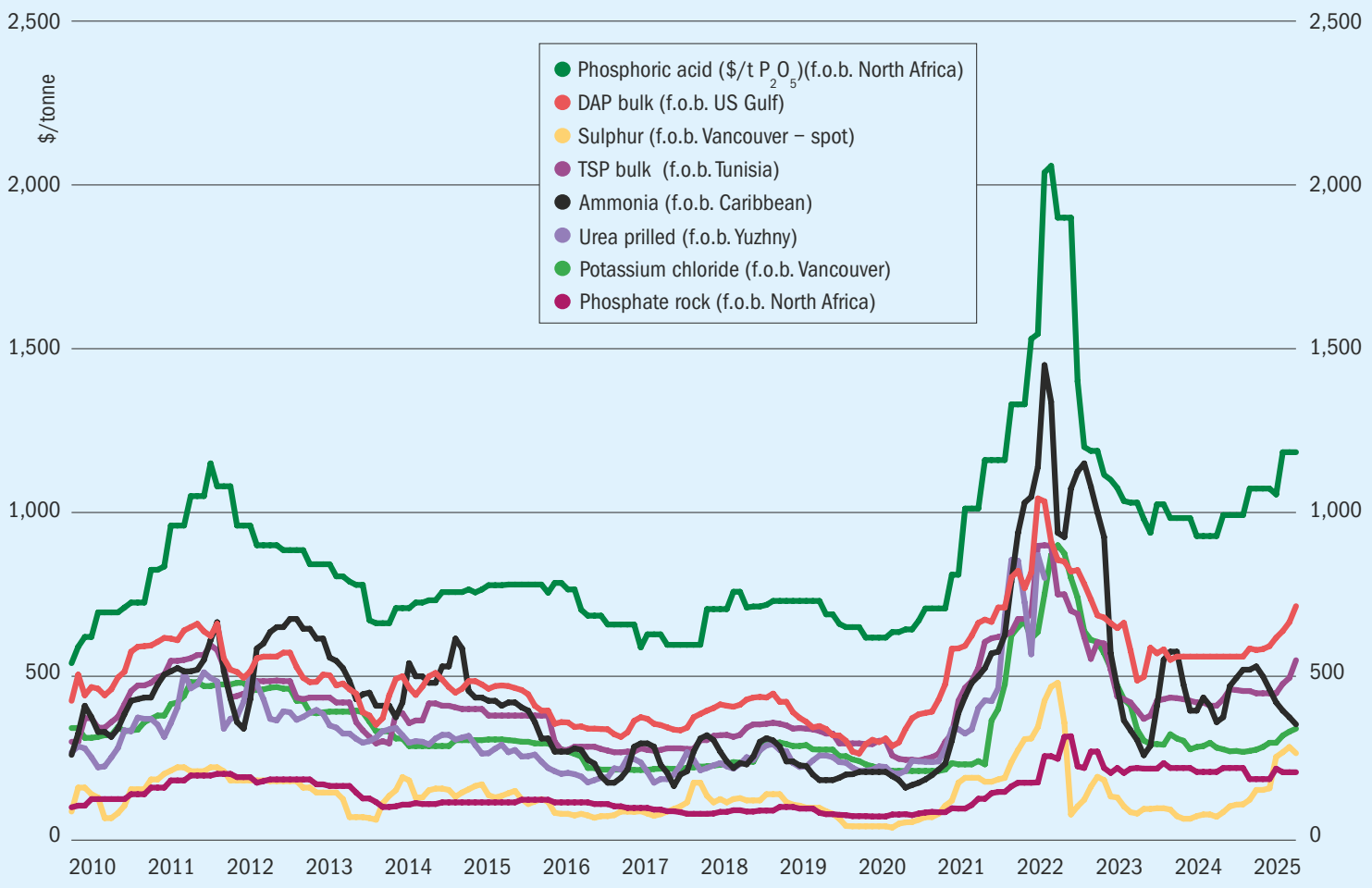
IFA's overarching message is to 'leave no resource unused' – emphasising that PG, once a liability, is now a valuable feedstock contributing positively to the industry's future. ■



*Simon Inglethorpe, Editor*

# Market Insight

**Historical price trends** $/tonne




*Source: CRU*



## PRICE TRENDS & OUTLOOK

**Market snapshot, 19th June 2025**

### Urea prices escalate as supply tightens

Global supply has been severely reduced due to the unexpected attack by Israel on Iran in mid-June and the consequent retaliation.

Gas supply from Israel to Egypt was cut on 13th June taking out potential exports as high as 400,00-500,000 tonnes a month. All plants in Iran were taken down on 16th June as a precautionary measure amid news that gas fields feeding the plants had been hit. About 500,000 tonnes/month of Iranian capacity has been taken out of production as a consequence.

Middle East prices made significant gains in the week 13-20th June. Sabic stepped in and sold a cargo for July at $402/t f.o.b., some $12/t higher than secured by Fertiglobe out of Ruwais on 12th June. It then placed another 40,000-45,000 tonne cargo at $450/t f.o.b.

Algerian prices also escalated immediately. A sale of 20,000-25,000 tonnes was reported from AOA at $417/t f.o.b. Arzew on 13th June. AOA kept selling with prices reported around $443-450/t, culminating in August tonnes trading at $471/t f.o.b. Sorfert then sold some smaller lots at $475/t and $500/t, peaking with the sale of 10,000 tonnes at $520/t f.o.b. on 19th June.

In India, NFL's 1.5 million tonnes import tender suffered from very unfortunate timing. Sellers were unwilling to commit as the market surged, although they now have until 23rd June to decide.

Russia also pulled back to assess the market – having agreed urea sales of $350/t f.o.b. for prills and $360/t f.o.b. for granular product prior to the conflict. Rises in prices of up to $400/t f.o.b. prills and $430-440/t f.o.b. granular were subsequently reported.

Brazil, meanwhile, has traded at $430/t cfr, largely due to Chinese availability.

The short-term urea outlook is firm. The market is on tenterhooks waiting for the next move in this conflict. Further price escalation is possible – if production is not resumed quickly.

### Middle East instability puts ammonia buyers on alert

For the most part, ammonia prices have remained stable, at least for now, with supply-demand dynamics still largely balanced – despite heightened tensions in the Middle East and subsequent impacts to regional supply.

Prices east of Suez registered only marginal movements, despite ongoing regional turbulence, with the Middle Eastern supply picture supported by the news that Ma'aden will export another 150,000 tonnes in July.

Talk of a $430/t f.o.b. sale out of Algeria reflected the overall bullish mood. If confirmed, the business would likely fetch at least $470-480/t cfr in NW Europe.

In the US Gulf, there is still little news

**Market price summary** $/tonne – mid-June 2025

| Nitrogen | Ammonia | Urea | Ammonium Sulphate | Phosphates | DAP | TSP | Phos Acid |
|---|---|---|---|---|---|---|---|
| f.o.b. Caribbean | 353 | - | f.o.b. E. Europe 292 | f.o.b. US New Orleans | 714 | - | - |
| f.o.b. New Orleans | - | 446 | - | f.o.b. N. Africa | 755 | 549 | 1,184 |
| f.o.b. Middle East | 290 | 390 | - | cfr India | 779 | - | 1,153 |
| **Potash** | KCl Standard | $K_2SO_4$ | **Sulphuric Acid** | | **Sulphur** | | |
| f.o.b. Vancouver | 340 | - | cfr US Gulf 149 | | f.o.b. Vancouver | 265 | - |
| cfr India | 349 | - | - | - | f.o.b. Arab Gulf | 270 | - |
| f.o.b. Western Europe | - | 694 | - | - | cfr China | 285 | - |
| f.o.b. Baltic | 295 | - | - | - | cfr India | 300 | - |

*Prices are on a bulk, spot basis, unless otherwise stated. Phosphoric acid is in terms of $/t $P_2O_5$ for merchant-grade (54% $P_2O_5$) product. Sulphur prices are for dry material. n.a. = not available. *$/short ton.*



on the next exports from the Gulf Coast Ammonia (GCA) complex in Texas. Further along the coast, CF is continuing to load at least three cargoes from Louisiana for export.

In the short term, prices may well have found a floor with both Iranian and Egyptian production offline, as of 19th June, with rising natural-gas prices also likely to support sentiment going forward.

## India drives bullish phosphates momentum

Global DAP/MAP prices continued to increase in mid-June. A range of benchmarks were assessed higher with India's DAP market remaining the main driver of bullish momentum.

Spot DAP prices in India were assessed at $775-782/t cfr, with at least one sale to a trader concluded above $800/t cfr. The current price mid-point is at its highest level since September 2022, being up from $636/t cfr in mid-March and $695/t cfr at the start of May.

OCP says it has sold 55,000 tonnes of DAP for July loading to India at $800-805/t cfr. The buyer is understood to be a trader.

MAP spot sales to Brazil were also assessed up at $740-750/t cfr.

DAP demand from Ethiopia has further tightened the market. EABC received a range of offers from traders for an additional 171,000 tonnes of DAP, with all offers for supply from China. The importer has issued a wave of DAP tenders over the past several months, soaking up DAP supply as it pivots away from NPS.

Phosphate prices are expected to increase further over the short term, as demand picks up while supply remains exceptionally tight. While affordability concerns persist, buyers have limited options. Any reversal in market direction now seems unlikely until at least the third quarter.

## MOP market sees price gains

Potash prices have risen across Southeast Asia, Northwest Europe, China and the US, following recent contract settlements, as the market closely monitors the Israel-Iran conflict for potential supply disruptions.

So far, production in Israel and neighbouring Jordan remains unaffected, despite Jordan's gas supply being cut off. The two countries each accounted for around 5% of global potash exports in 2024.

Despite the off-season, China's domestic market has seen a rise in potash buying inquiries and transactions due to market uncertainty following China's contract settlement at $346/t cfr on 12th June. January-May imports totalled 5.7 million tonnes, according to China Customs data.

Potash prices in Southeast Asia rose in mid-June despite seasonally slow demand. Standard MOP prices reached $345–360/t cfr, with July offers as high as $370/t cfr.

Indian importers have moved quickly with ongoing tenders from NFL and FACT after settling their potash contract at $349/t cfr on 5th June. Import volumes are expected to rise in coming weeks to replenish supplies and meet increased Rabi season demand.

Brazilian spot prices have remained flat at around $363/t cfr for the last six weeks. In the US, meanwhile, Nutrien announced its long-awaited summer fill prices for MOP, setting Midwest prices slightly above expectations at $390/st f.o.b.

Looking ahead, potash prices are expected to continue to adjust upwards in the coming weeks, although concerns over Brazil's price outlook are emerging, with some believing the market is nearing its ceiling.

## Middle East tensions limit sulphur declines

Global sulphur prices remained mostly stable, with the recent downward trend halted by the Israel-Iran conflict. The mutual attacks – while introducing uncertainty to Middle East pricing and its future direction – have yet to directly affect the market. Import demand in both China and Indonesia remains subdued, as buyers are sufficiently covered through June and July.

Several unsold Middle Eastern and Canadian sulphur cargoes destined for China were reported to have changed hands in mid-June. Domestic prices in China surged to RMB2,450-2,460/t FCA, in the aftermath of the Israel-Iran conflict, implying a delivered price near $292-294/t cfr.

Prices in the Mediterranean decreased amid a lack of activity and weakened regional demand. The latest transaction into Brazil also left prices unchanged in mid-June. Canada, meanwhile, saw stable Vancouver f.o.b. prices with limited activity taking place in the way of fresh exports.

Global sulphur prices are expected to experience a period of stability in the short-term, as the market adjusts to the Iran-Israel conflict. Buyers in Asia also remain covered throughout June and July. Only limited activity is therefore likely in coming weeks. ■

WORLD

# Urea market on edge

The escalation of the Iran-Israel conflict since mid-June has kept the urea market on edge. Having experienced price volatility throughout the year, the market now faces the prospect of a global supply crunch.

Generally, urea prices this year have remained elevated compared to 2024, with Middle East prices, for example, averaging around $55/t higher in the year to date. The market has been on a rollercoaster too. Factors such as on/off US tariffs (*Fertilizer International* 526, p7) and the proposed imposition of EU tariffs on Russia (*Fertilizer International* 525, p7), alongside production outages, hand-to-mouth buying, as well as the lack of clarity on Chinese exports, have all contributed to urea price volatility.

Amid early signs of global price easing, Israel's surprise attack on Iran on 13th June has upended urea market sentiment and spurred buying activity. Urea prices in Middle East, Algeria, Brazil and NOLA all jumped by $50-110/t in a week – with prices in Algeria hitting $520/t f.o.b.

In this 19th June CRU Insight, **Pranshi Goyal** and **Charlie Stephen** address three key questions – what is the current status of the global urea market, what supply sources are at risk and how could their absence affect short-term urea pricing?

## Supply disruptions could be severe

Iran operates 8.7 million tonnes of annual capacity from seven urea plants located in the west of the country. The country shut all its urea-ammonia production facilities on 16th June, following Iranian government safety guidance issued in the face of ongoing attacks by Israel, this translating to a loss of around 700,000 tonnes of monthly production. The complete shutdown, although said to be unrelated, came after the attack by Israel on Iranian natural-gas facilities on 14th June.

While the destinations for Iranian urea are limited, Iran remains an important supplier for both Brazil and Turkey. The country exported close to three million tonnes of urea in the second half of last year – volumes that are now at risk depending on the duration of the conflict.

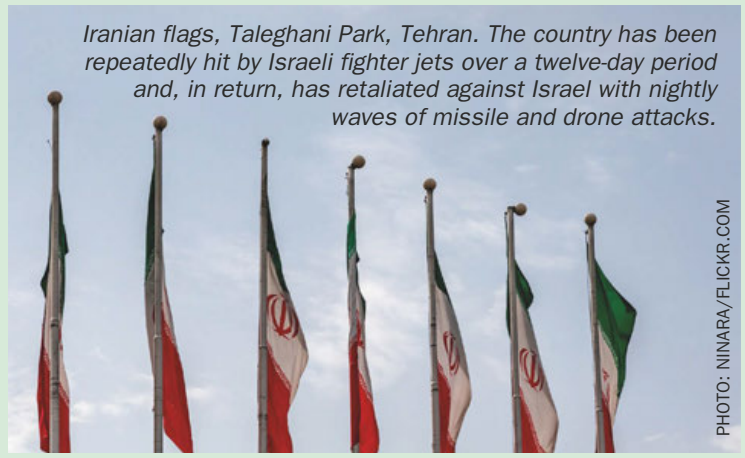
## Gas cuts hit Egypt's output

Production in Egypt has been facing challenges during summer months as gas is drawn away from fertilizer producers to meet domestic requirements for cooling. Mirroring the events in 2023-2024, Egyptian producers were forced to curtail urea production for a few weeks in May this year. Having just resumed operations in early June, the escalation of the conflict halted gas supply from Israel to Egypt on 13th June, triggering a fresh a wave of plant shutdowns.

Egypt's urea production amounts to approximately 7.7 million tonnes annually, predominantly serving the European and Turkish markets. Consequently, a disruption resulting in the loss of around 600,000 tonnes of monthly production from Egypt would precipitate an immediate supply shortfall across the region.

## Two Russian sites hit by Ukraine

Unrelated to the ongoing Middle East tensions, recent drone attacks by Ukrainian forces on the EuroChem-operated Novomoskovsk Azot (1.6 million t/a of urea capacity) and Nevinnomyssky Azot (1.0 million t/a of urea capacity) production complexes – in Russia's Tula region and the Stavropol Territory, respectively – are expected to significantly impact urea and nitrates availability from Russia. While the full extent of the damage is still under assessment, both sites collectively represent 20% of Russia's total production capacity and are understood to be offline currently. This development coincides with the period of limited Russian supply due to summer maintenance turnarounds, resulting in an additional reduction of roughly 200,000 tonnes of monthly urea production.



*Iranian flags, Taleghani Park, Tehran. The country has been repeatedly hit by Israeli fighter jets over a twelve-day period and, in return, has retaliated against Israel with nightly waves of missile and drone attacks.*

PHOTO: NINARA/FLICKR.COM

In summary, the ongoing Iran-Israel conflict marks a significant shift in global supply dynamics for urea, resulting in an estimated export loss of around:

- 600,000 tonnes from Iran,
- 450,000 tonnes from Egypt,
- 200,000 tonnes from Russia.

While it offers a burgeoning opportunity for China to ramp up exports and plug the gap, the Chinese government's restrictive export policy and the exclusion of exports to India is unlikely to alleviate the pressure, in CRU's view.

## Impact of supply shock on demand

India is currently the key driver in the market and is set to enter the seasonal Kharif demand period (July–September) and undertake a significant stock replenishment. A recent tender by NFL was scheduled to close on 16th June 2025, unfortunately coinciding with the Middle Eastern conflict escalation. Despite seeking 1.5 million tonnes of urea for West Coast India, a swift run up in urea prices meant NFL was unable to garner any acceptances except for 229,000 tonnes at an offer of $399/t cfr.

The situation is particularly concerning for India as the Middle East is one of the subcontinent's top urea suppliers, supplying three-quarters of total imports in 2024, a situation that is further pressured by the reduced Russian product availability (17% share of total imports). India will need to import approximately four million tonnes of urea through tenders during the second half of 2025 to meet domestic demand while maintaining year-end closing stocks.

## Ceasefire?

With characteristic showmanship, the Middle East woke on 24th June to an overnight social media announcement of an Israel-Iran ceasefire by US President Trump. The term of this truce, exactly how it had been brokered and its likely permanency were all unclear as *Fertilizer International* went to press. ■

## ALGERIA

### Sonatrach awards Saipem phosphate project FEED contract

Italy's Saipem has won a front-end engineering design (FEED) contract from Sonatrach for an integrated phosphate fertilizer project in Algeria.

The contract was awarded through a dual competitive process, enabling the design work to be conducted by both Saipem and a competitor company. Sonatrach will assess and compare the two FEED options from both parties, select the best technical and economic design, and then proceed with the direct award of an engineering, procurement and construction (EPC) contract to execute the project.

The FEED contract covers front-end services for the complete engineering design of a new fertilizer complex. This includes phosphate mining infrastructure in the Bled El Hadba area, together with process and ancillary units supporting fertiliser production in the Oued Keberit area. The scope of work also includes upgrading Annaba port for phosphate exports and construction of railway spurs connecting mining and production plants to the main rail line.

This is Algeria's first integrated phosphate project encompassing both ore mining and fertilizer production. Once operational, the project will have the capacity to extract 10 million tonnes of phosphate rock and produce six million tonnes of phosphate fertilizers annually.

Saipem has been operating in Algeria since 1968, developing hydrocarbon and transport infrastructure and power generation plants,

*A Saipem built urea plant. The Italian engineering giant is a major fertilizer industry constructor.*

PHOTO: SAIPEM

## CANADA

### Ostara launches CG P2X in Western Canada

US-headquartered nutrient recovery company Ostara has launched CG P2X – a 'next-generation' phosphorus fertilizer – in Western Canada.

The product will be offered to the Western Canadian market under an exclusive distribution partnership with Taurus Agricultural Marketing, who will support the launch via the national retail network, agronomic training, technical expertise and field-level service

P2X is root-activated by organic acids and designed to provide "a consistent supply of plant-available phosphorus that doesn't tie up in the soil". It builds on the company's existing struvite product Crystal Green (CG) and contains 'plant essential' magnesium as well as phosphorus.

"P2X is 2x more efficient than traditional phosphorus fertilizers, allowing growers to apply less product while achieving equal or better results," according to Ostara, who added: "Field trials also show that P2X helps improve soil biology by reducing salt and free acid load, supporting healthier microbial activity and a more resilient growing environment."

This, says the company, makes P2X good for return on investment, nutrient use efficiency, and for soils. The product's root-activated release properties should also ensure phosphorus is available to the crop during the periods of high demand from the earliest stages of vegetative growth onwards.

"P2X is clearly the most efficient, sustainable and economical phosphate fertilizer on the market. No other product can match the performance and value of P2X and there's no one better to drive the growth of P2X than Taurus" said Ron Restum, Ostara's chief commercial officer, Ostara.

"After nearly a decade working with Ostara, we've seen plant-controlled phosphate succeed across millions of acres," said Craig Davidson, President of Taurus Agricultural Marketing. "P2X takes it to the next level with a single-source, seed-safe phosphate that drives yield, supports soil health, and helps growers stay efficient and profitable in a tight-margin world."

Ostara hopes P2X will signal a new era in phosphorus fertility, one that delivers more yield with less input while building healthier, more productive soils.

### MustGrow and Phospholutions sign distribution agreement

Phospholutions entered into a distribution agreement with MustGrow in June. This allows MustGrow to sell RhizoSorb through NexusBioAg, its Canadian sales and distribution division.

RhizoSorb® is a patented technology designed to substitute for conventional commodity fertilizers such as monoammonium phosphate (MAP) and diammonium phosphate (DAP). The technology, because it can be integrated into the phosphate production process, offers the same ease of application as these traditional granular fertilizers, while requiring no changes to existing equipment or practices.

RhizoSorb® increases phosphorus efficiency by up to 50%, according to Phospholutions, allowing farmers to half the amount of phosphorus traditionally applied, while maintaining (and even improving) yield. By optimising fertilizer inputs and reducing costs without sacrificing yield, the resulting improvement in nutrient use efficiency translates to a better return on investment for growers – equating to potential savings of up to $20 per acre.

In addition to its economic benefits, RhizoSorb® delivers a host of environmental advantages, according to Phospholutions, such as reducing $CO_2e$ emissions by 45%, phosphorus runoff by 78% and leaching by 84%, compared to conventional MAP fertilizer.

"With approximately 94.5 million acres of crop production that depend on phosphate, Canada is a key market," said Craig Dick, sales and marketing VP at Phospholutions. "We are proud to partner with MustGrow to deliver RhizoSorb® to

retailers and growers across Canada."

"This partnership marks another major milestone in Phospholutions' journey," added Hunter Swisher, CEO of Phospholutions. "Partnering to bring more cost-effective fertilizer solutions to the Canadian market supports our broader global expansion efforts."

"MustGrow and Phospholutions share a common mission to improve the global food system through sustainable production solutions," said Colin Bletsky, COO of MustGrow. "Phosphorus is the second-most-used nutrient in global food production, making its efficient and responsible use a top priority for both our companies and the growers we serve."

Phospholutions also signed a US distribution agreement with The Andersons in May. This allows The Andersons to distribute RhizoSorb® from the 2026 crop year onwards.

"We are thrilled to expand our partnership with The Andersons through this distribution agreement," said Hunter Swisher. "Their trusted presence in the Midwest and long-standing commitment to innovation in agriculture make them an ideal partner as we scale RhizoSorb across the U.S."

Alongside this distribution agreement, Maumee Ventures, The Andersons venture capital arm, recently led an additional round of investment in Phospholutions, underlining their confidence in the company, its technology and long-term vision.

"As an early investor and partner, we continue to be impressed by the progress the company has made in scaling their solution to improve phosphorous efficiency, and we are looking forward to this next chapter in our relationship with the company," said Andy Spahr, SVP for Agribusiness at The Andersons. "As a result, growers throughout the U.S. will soon benefit from greater access to sustainable and high-efficiency phosphorus solutions for staple crops like corn and soybeans."

Tim Mahoney was recently appointed VP of business development at Phospholutions. He will play a key role in expanding partnerships and supporting international expansion, manufacturing and distribution of RhizoSorb®.

"This agreement with The Andersons is a pivotal moment for Phospholutions and for retailers seeking relief from a supply constrained market," said Mahoney. "We're committed to ensuring RhizoSorb® is readily available and well-supplied to our channel partners."

## TURKMENISTAN

### Casale awarded fertilizer plant PDP contract

Casale has signed a process design package (PDP) contract with Daewoo Engineering & Construction Co for two new fertilizer plants. These are being commissioned by Turkmenhimiya, Turkmenistan's state-owned chemical company, as part of a production complex in Turkmenaba, the country's second-largest city.

The two new fertilizer plants will manufacture granular ammonium sulphate (AS) and single superphosphate (SSP), respectively. Once completed, the Turkmenaba complex will produce:

- 350,000 t/a of granular SSP using CULTIVA-SPhos, Casale's proprietary technology for granular SSP production
- 100,000 t/a of AS using CULTIVA-PIPEX, a flexible and proven Casale process technology which is also used for NPK production.

*Envision green ammonia production plant, China.*

"This latest contract highlights once again the trust in Casale's process know-how and technology portfolio and confirms the value of our Phosphate and Nitrogen fertilizers portfolio in supporting large-scale fertilizer projects with high agronomic and operational performance," Casale said in a statement. "We thank Daewoo Engineering & Construction Co. for their confidence and look forward to building a strong and lasting partnership. This collaboration reflects Casale's commitment to driving sustainable agricultural development and delivering innovative solutions tailored to local market needs."

## CHINA

### Uralkali settles new potash contract

Uralkali has agreed to supply potash to a consortium of Chinese importers until the end of 2025 at a price of $346/t cfr, the major Russian potash producer has confirmed.

This new contract price is up $73/t from the 2024 contract of $273/t cfr, with local sources in China saying it includes rebates of $20/t. The volumes have not yet been disclosed.

### Mosaic Biosciences launches Neptunion in China

The Mosaic Company has announced the Chinese launch of Neptunion, its latest biostimulant product.

Neptunion is used to add valuable properties to water-soluble fertilizers and is designed to helps crops resist abiotic stresses such as drought, salinity and heat.

"The launch of Neptunion in China is a significant step in advancing our Mosaic Biosciences business," says Jenny Wang, EVP Commercial. "We remain committed to expanding our market access and maximizing ag productivity through biological products that enhance the value we provide to farmers and help the world grow the food it needs."

Mosaic is planning to improve the availability of Neptunion internationally and the product is undergoing registration in India and Brazil currently.

### Marubeni signs green ammonia offtake agreement

Japan's Marubeni Corporation has signed a long-term offtake agreement with Envision Energy for green ammonia produced from renewable energy in Inner Mongolia, China.

Envision began trial production of green ammonia from wind-generated electricity produced in Chifeng City, Inner Mongolia, in 2024. The company's commercial green ammonia plants are scheduled to start operating from late 2025 onwards. Marubeni describes the large-scale venture, which has a production capacity of 300,000 t/a, as the world's first large-scale green ammonia project.

Once operational, Marubeni will offtake an undisclosed volume of green ammonia produced at the Envision production plant to supply its clients.

This is Marubeni's first long-term offtake agreement for green ammonia. It is part of a strategy by the company to establish itself as a key supplier in the green ammonia market.

## BELARUS

### Government revives Slavkaliy project

The Belarusian government has nationalised and is fast-tracking the two million t/a capacity Slavkaliy project, according to local media reports on 23rd May, re-naming it Nedra Nezhin.

Having originally been due to enter production in July 2025, inaugural production from the project is now scheduled for 2026. Nedra Nezhin will then ramp up over the next few years.

During an inspection visit to the mining and processing complex (Nezhinsky GOK) in Lyubansky district, Belarusian leader Aleksandr Lukashenko personally backed the completion of construction by the end of this year.

"We will finish the construction this year, as the construction manager promises... in the spring, at such a time, next year, we will already, as he says, drink champagne here," said Lukashenko, the *Sputnik* news agency reported

"A private investor, investing his money, began construction. Then sanctions were imposed against him – Western sanctions – the Americans and Europeans. Then my decision was made: we will build ourselves," Lukashenko added.

The Belarusian president inspected the construction of the mining and processing plant on 23rd May. Two production lines with a potassium chloride (MOP) design capacity of one million t/a tons are being built, with one line said to be about 90% complete. The project has also already commenced potash ore mining. More than three dozen Belarusian organizations are said to be involved in the construction efforts.

During the visit, Lukashenko also claimed that Belarusian potash fertilizer sales had now returned to their pre-sanction levels.

"They have imposed sanctions against potash fertilizers and what happened? Today [Belaruskali Director General] Andrei Rybakov reports that the potash fertilizer sales have reached the sales the pre-sanction levels. It is impossible to restrain the development of any country, even a small one, by sanctions. It is simply impossible," Lukashenko said.

## POLAND

### Grupa Azoty ships fertilizer to South America

Grupa Azoty Police has successfully loaded a 36,640 tonne fertilizer consignment at its seaport for transport to South America. The historic shipment marks the first of its kind, in terms of its scale and the history of the company's Police production plant, Grupa Azoty said.

"The loading operation was carried out using the Group's port infrastructure and maritime logistics capabilities. This milestone confirms Grupa Azoty's ability to execute large-scale logistics operations at a top-tier level, opening new opportunities for exporting Polish chemical products to global markets," the company said in a statement.

Grupa Azoty says its sales efforts – combined with an expanded product portfolio – have already delivered tangible results in the first quarter of 2025. Total sales volumes for the period rose by 18% year-on-year, including a 22% increase in nitrogen fertilizer sales.

While ensuring a stable supply of fertilizers for Polish farmers remains its top priority, the company is simultaneously looking to improve its export performance currently.

# People

PHOTO: IFA


*Ken Seitz's tenure as IFA's new chair is welcomed by Alzbeta Klein. IFA's CEO and director general, at the Association's recent Annual Conference in Monaco.*

**Ken Seitz**, Nutrien's president and CEO, is the new chair of the International Fertilizer Association (IFA). He was elected during IFA's Annual General Meeting (AGM) on 14th May, held on the final day of its 2025 Annual Conference in Monaco. Mr Seitz succeeds **Tony Will**, President & CEO of CF Industries, following the end of his two-year tenure.

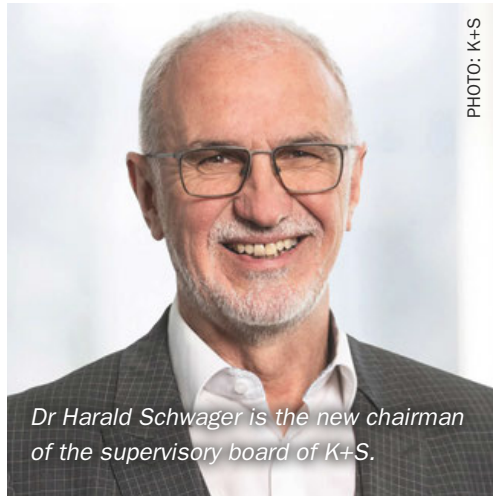
IFA also elected **Ahmed El-Hoshy**, CEO of Fertiglobe, as its new vice chair. He takes over from **Raviv Zoller**, ICL Group's President & CEO. IFA members also elected seven new board directors at this year's AGM.

- **Elad Aharonson**, ICL Group
- **Guangliang (Gordon) He**, Guizhou Phosphate Chemical Group
- **Nishant Kanodia**, Matix Fertilisers and Chemicals Ltd
- **Amit Lohia**, Indorama Corporation
- **Christian Meyer**, K+S Aktiengesellschaft
- **William (Tip) O'Neill**, International Raw Materials
- **Mikhail Rybnikov**, PJSC PhosAgro

"I am delighted to welcome our newly elected Board Directors, whose expertise and leadership will be invaluable as we continue to advance IFA's mission of helping to feed the world sustainably," said Alzbeta Klein, IFA's CEO & director general. "I look forward to working closely with them in the months and years ahead."

Ms Klein added: "I would also like to extend my warmest congratulations to Ken Seitz on being elected as IFA's new Chair, and express my gratitude to Tony Will for his support and guidance over the past two years. His commitment to IFA and the industry has been greatly appreciated by us all."

PHOTO: K+S



*Dr Harald Schwager is the new chairman of the supervisory board of K+S.*

**Dr Harald Schwager** (65) was appointed chairman of the supervisory board of K+S at the company's AGM on the 14th May. He succeeds **Dr Andreas Kreimeyer**. Dr Schwager and **Dr Tilman Krauch** (63) were both elected as new members of the supervisory board at the same AGM.

Dr Schwager has extensive board level experience at two global chemical companies. He is also a member of the German Federal Science and Humanities Council. Dr Tilman Krauch also has many years of experience as a board director of a global technology company.

To ensure continuity, the AGM extended the term of office of deputy supervisory board chairman **Thomas Kölbl** (62) until the 2029. **Dr Rainer van Roessel's** (67) term of office was similarly extended to 2029 by shareholders at the AGM.

The board thanked outgoing Chairman Dr Andreas Kreimeyer for his dedicated work. He had been a member of the supervisory board for ten years, including serving as its chairman since 2017.

"You have been an important advisor to me," said outgoing CEO Dr Burkhard Lohr. "The entire Board of Executive Directors has benefited from your many years of experience."

**Sailesh C Mehta**, managing director of Deepak Fertilizers, is the new chairman of the Fertiliser Association of India (FAI), succeeding **N Suresh Krishnan**, managing director of Paradeep Phosphates Ltd.

Mr Mehta brings over 40 years of industry experience to the role. He previously served as chairman of the western region of FAI for more than five years. Sailesh is also the chairman and managing director of Mahadhan AgriTech Ltd, a subsidiary of Deepak Fertilizers and Petrochemicals Corporation Ltd (DFPCL).

"I am truly privileged to serve as a bridge between government, industry, and farmers – acting as a catalyst to elevate Indian farmer and farm productivity on the world map," Mr Mehta said.

## Calendar 2025

### JULY

13-17

99th Annual Southwestern Fertilizer Conference, NASHVILLE, Tennessee, USA
Contact: Pat Miller
Tel: +1 (512) 259-2118
Email: swfc@swfertilizer.org

### SEPTEMBER

15-17

TFI World Fertilizer Conference, CHICAGO, USA
Contact: Valerie Sutton
Tel: +1 202-962-0490
Email: vsutton@tfi.org

16-18

37th AFA Technical Conference and Exhibition, BEN GUERIR, Morocco.
Contact: Arab Fertilizer Association
Tel: +202-23054464 – 67
Email: events@arabfertilizer.org

29 SEPTEMBER - 1 OCTOBER

15th GPCA Agri-Nutrients Conference, ABU DHABI, UAE
Contact: Faheem Chowdhury, Head of Events
Tel: +971 58 969 5448
Email: faheem@gpca.org.ae

### NOVEMBER

3-5

CRU Sulphur+Sulphuric Acid Expoconference, THE WOODLANDS, Texas, USA
Contact: Event Client Services
Tel: +44 (0)20 7903 2444
Email: conferences@crugroup.com

### DECEMBER

10-12

FAI Annual Seminar 2025, NEW DELHI, India
Contact: Secretary, The Fertiliser Association of India
Tel: +91-11- 46005204
Email: secy@faidelhi.org

# Resilient demand versus historically bad affordability

Affordability has rightly been a huge talking point over the past year. Yet CRU still expects overall global fertilizer demand to remain resilient in 2026, as the impacts of poor affordability should be largely isolated to regional markets such as the US. In this CRU Insight, **Anthony Rizzo** highlights regional variations and explains why market participants should expect an uneven global demand picture in 2026.

## Introduction

Fertilizer demand has remained strong in 2025, despite uncertainty in global markets, with global N, P & K consumption collectively set to reach 211 million nutrient tonnes this year, a 1.9% year-on-year rise, this being driven by higher agricultural growing area and greater fertilizer applications. While demand has held up this year, fertilizer affordability metrics have recently hit historically bad levels, bringing 2026 demand into question.

There is no need for market participants to panic, though, in CRU's view. Overall, global N, P and K consumption is expected to remain resilient in 2026, rising another 1% to 213.5 million nutrient tonnes. Regional consumption in key demand markets will be patchy, however, with Brazilian demand moving higher – in step with the global trend – while the US and China are both set to see their domestic demand contract next year.

## Global affordability worst since 2022

Fertilizer and crop prices have diverged over the past 12 months, with fertilizers moving higher and crops moving lower, the upshot being a steady deterioration in fertilizer affordability. CRU's Affordability Indicator has deteriorated by 35-points compared to one year ago, with the fertilizer price indicator 22 points higher and the crop price indicator 18 points lower.

The fertilizer price indicator currently sits at 128 – a level that has been reached only three times before, in 2008-09, 2011-12, and 2021-23. Even worse for affordability, the crop price indicator had an average value of 147 during those previous periods of elevated fertilizer pricing, compared to its current value of 108.

Historically, the only time fertilizer prices were this high, and crop prices conversely this low, was from late 2008 to early 2009. As a result, the CRU Affordability Indicator currently (mid-June 2025) is at 119, a level that has only been seen before in the global financial crisis of 2008/09 and in 2021/22 before and after the start of the Russia-Ukraine conflict.

Stark affordability differences between major commodities and nutrients are also notable (Figure 1). The phosphate affordability indicator now sits at 155, for example, the highest level since November 2008. Phosphate prices are back to 2022 levels, while crop prices have fallen significantly since then, worsening affordability. Urea affordability, meanwhile, hit its worst point since late 2022 in early May but has since improved, returning to

Fig. 1: **Phosphate affordability continues to erode while urea saw a turnaround during May**

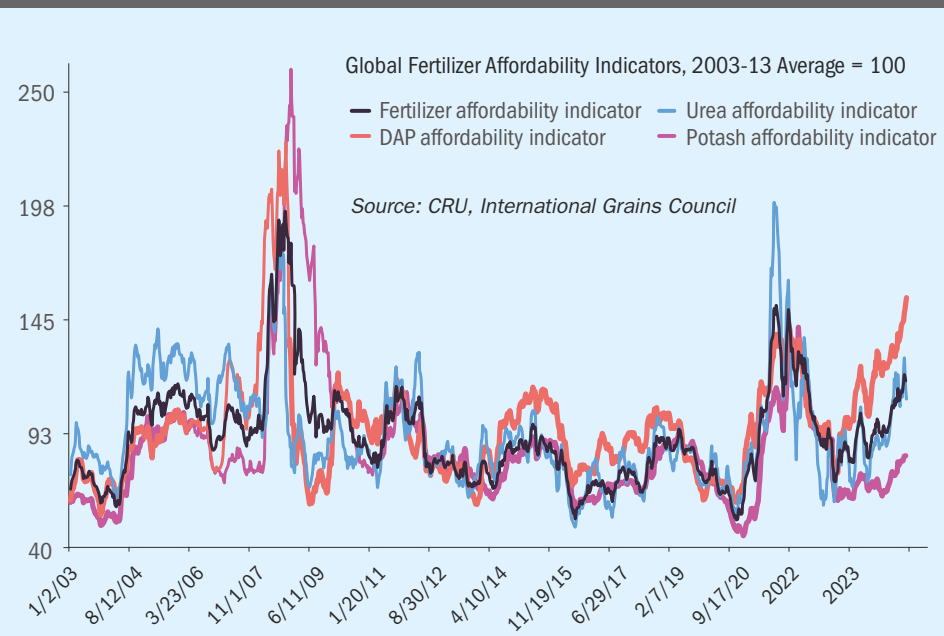
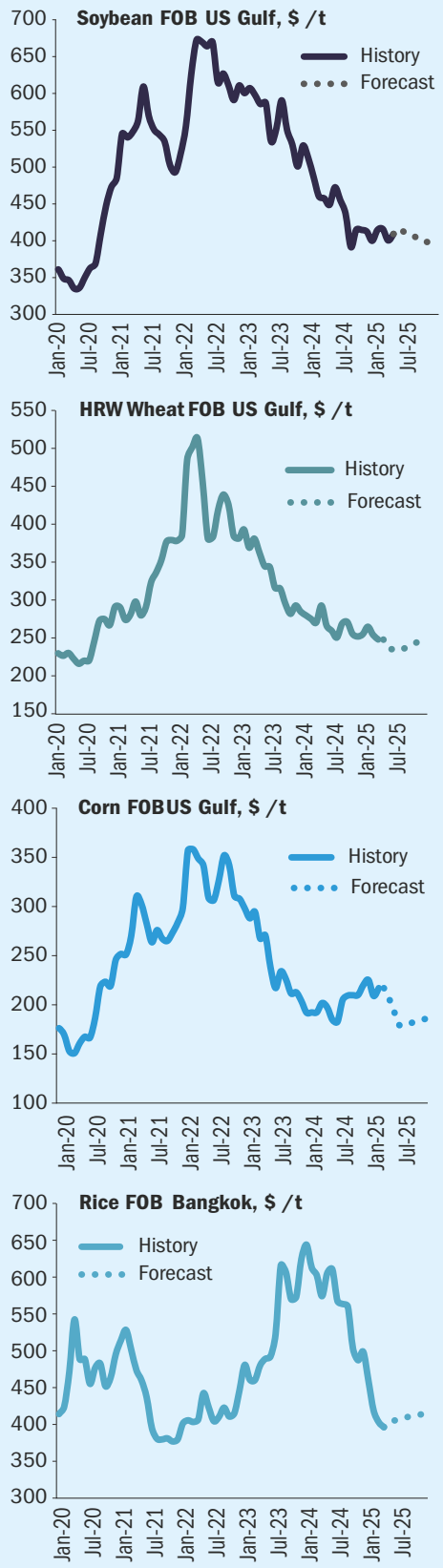
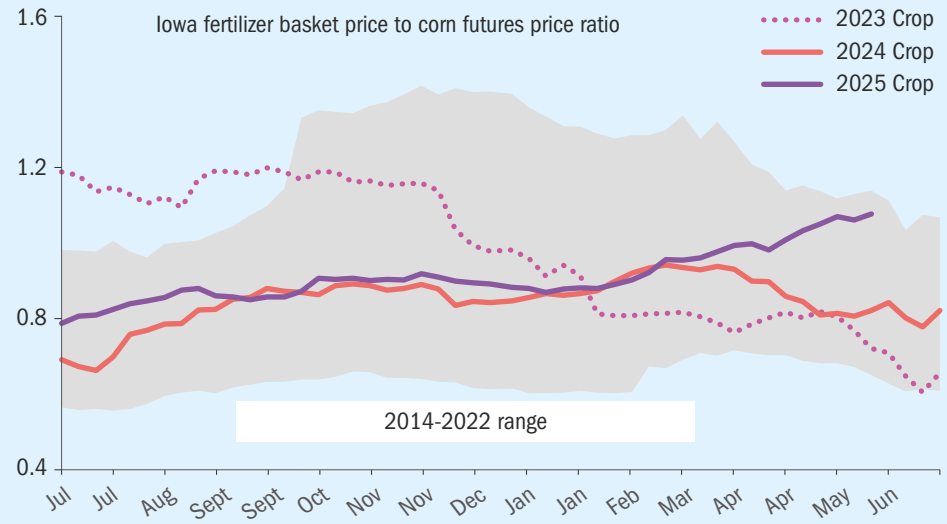


Fig. 2: **Grain prices are far removed from their 2022 peaks currently**




*Source: International Grains Council*

Fig. 3: **Historically bad affordability is causing concern in the US Midwest**




*Source: International Grains Council*

levels last seen at the start of this year following a recent price reset. While potash affordability is at its lowest level since mid-2023, with prices at their highest since late-2023, the indicator remains comfortably below its cycle average.

## Grains trending lower, offering little support for 2026

Grain prices are far removed from their 2022 peaks currently (Figure 2). This is important as crop prices are a key factor in the decision-making process for planting and therefore fertilizer buying. Corn prices, in particular, have cooled off in recent months, after a strong upward movement at the end of 2024 and the start of 2025, and now face multiple factors that could continue to push prices lower. Numerous negative price influences – a historically large US crop, another strong year of production from South America, and expectations of an inventory build in the US – are expected to take their toll during the remainder of 2025.

Soybean prices, in contrast, are set for a more modest decline, pressured by South American production, especially Brazil's record output. While the US soy crop is expected to be lower in 2025, its impact on pricing going forward will be less, as major customer China has taken a large majority of its business to South America where its 'Belt and Road' initiative continues to make strides.

## Historic corn crop boosts 2025 US demand

US fertilizer demand from 2025 crops has been strong, with nutrient consumption forecast to grow by 2.6% to 20.6 million tonnes. While total harvested acreage is forecast to decline 1.2% this year, a strong increase in the acreage of nutrient hungry corn should offset the declines expected for other grains and oilseeds. USDA's Prospective Plantings report sees corn acreage of 95.3 million acres this year, up from 90.5 million acres last year. CRU forecasts US 2025 corn acreage slightly lower than USDA at 94 million acres, leaving room for further upside this year, if acreage turns out to be closer to or above USDA's forecast.

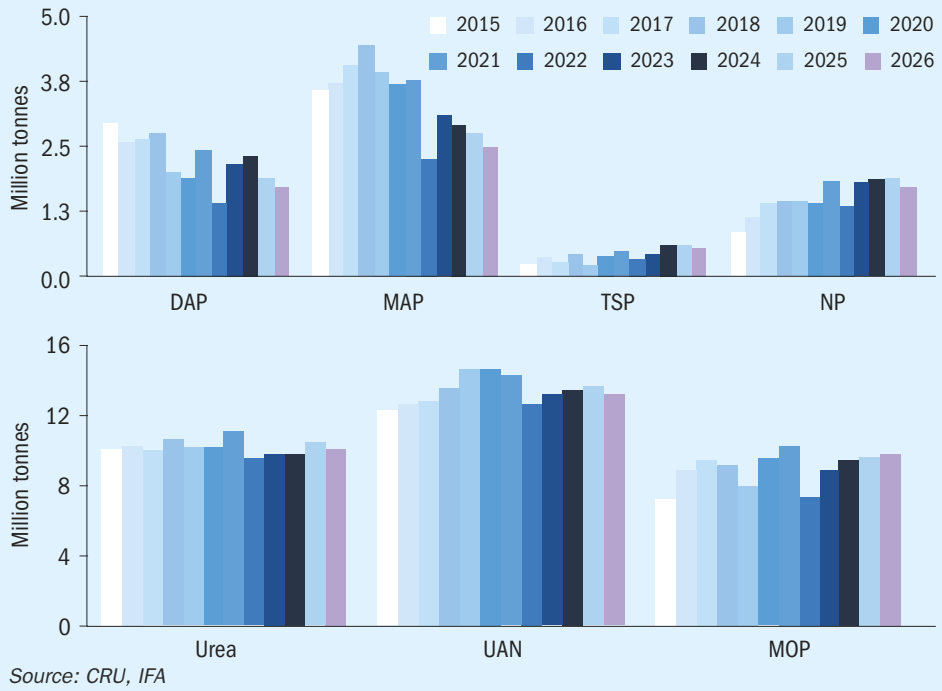
US application rates are all forecast to grow in 2025, due to strong fall and spring applications in anticipation of this historically large corn crop. Nitrogen and potash application rates are each expected to rise by 3 kg/ha, to 119 kg/ha and 51 kg/ha, respectively, while the phosphate application rate is forecast to rise by 2 kg/ha to 39 kg/ha.

## Lower 2026 US demand as poor affordability bites

The fertilizer demand outlook for the 2026 US growing season looks increasingly pessimistic, as affordability domestically continues to deteriorate to historically low levels. Going back to 2013, the ratio of the Iowa fertilizer basket price to the corn futures price – a reliable indicator of fertilizer affordability for Midwest growers (Figure 3) – currently ranks second worst for this point in the year, with only 2022 being higher.

Urea ammonium nitrate (UAN) affordability in the US Midwest is actually the worst on record for this point in the year, since tracking began in the 2004/05 season. Affordability of the other major fertilizer commodities is also poor: diammonium phosphate (DAP) has hit its worst level since 2008, while urea is at its worst since 2012. Potash affordability remains

Fig. 4: **2026 demand for US phosphate products is set show across the board declines, while urea falls back to its 10-year average. Muriate of potash (MOP) demand in the US, in contrast, is forecast to rise next year.**




*Source: CRU, IFA*

the lone bright spot, as its affordability in the Midwest is slightly better than the 15-year average.

In addition to affordability concerns, US growers will have to contend with increased corn carryout, with USDA's May WASDE estimate suggesting this year's harvest will rise 9.8 million year-on-year to 45.7 million tonnes for 2025. If realised, USDA's forecast would be 1.1 million tonnes above the 10-year average and the highest carryout since 2019/20. The US corn stocks-to-use ratio for 2025/26 is also forecast at 11.6 – this being above the 5-year average of 9.7 but below the 10-year average of 12.2.

Consequently, the size of the 2026 US corn crop is expected to decline year-on-year, based on the carry build from 2025 and lower US corn pricing.

Unsurprisingly, given the agricultural backdrop, overall US fertilizer demand is forecast to decline in 2026, with nitrogen and phosphate both seen lower, and potash higher (Figure 4).

Phosphate consumption is forecast to take a hit, declining to 6.5 million tonnes in 2026 versus 7.2 million tonnes this year, due to affordability and availability concerns. Within this nutrient group, alternative products like triple superphosphate (TSP) – which is unexposed to nitrogen pricing – and NP (which provides additional nutrients) will continue to gain market share, despite the overall year-on-year consumption decline.

Nitrogen demand, while less sensitive to affordability, is also seen lower, predominantly due to the expectation of lower corn and higher soybean acreage in 2026. Consumption is forecast at 10.4 million tonnes for urea and 13.5 million tonnes for UAN, both slightly below their long-term averages.

Potash demand, meanwhile, is expected to rise year-on-year from 9.7 million tonnes to 10 million tonnes in 2026, given that products remain relatively affordable and available, especially compared to phosphates. Additionally, an acreage switch from corn to soybeans in 2026 will still support demand, unlike the situation seen for nitrogen.

## Record 2025 soybean crop underpins Brazilian demand

Brazil is expected to produce a record soybean harvest of 168.3 million tonnes in 2025, according to the National Supply Company's latest grain harvest survey released on 15th May. Further support comes from the country's corn output, with cumulative production across all three corn crops forecast at 126.9 million tonnes.

Both corn and soybean are set to benefit from year-on-year increases in area and yield, per Conab's report. CRU anticipates a 3 kg/ha increase for the combined fertilizer nutrient application rate, which brings the rate to 211 kg/ha for 2025. As a result, total nutrient consumption is forecast to reach 20.8 million tonnes, an increase of 2.9% from 2024.

## Soil health, expanding production, outweigh 2026 affordability concerns

Brazil's fertilizer consumption is expected to remain robust IN 2026 (Figure 5), as demand for the country's grain exports continues to be strong and its agricultural growing area expands.

Barter ratios are a useful affordability metric for Brazil – being a comparison of fertilizer pricing to the price of the crop they are mainly applied to (Figure 6). Barter ratios for MOP and urea are middling, with both sitting just above their long-term averages. Monoammonium phosphate (MAP) affordability, in contrast, is historically bad as its barter ratio currently matches the level last seen in April 2022, the worst level since tracking began in 2010. While MAP affordability is a cause for concern, the country's soil deficiency requires P applications to remain heavy and an essential, particularly on newly cultivated land.

Brazil's harvested area is forecast to increase another 1.3% to 100.2 million

Fig. 5: **While Brazil's DAP+MAP consumption is set to increases in 2026, it remains below its long-term average, while the country's urea and MOP consumption are forecast to be well above their averages next year**

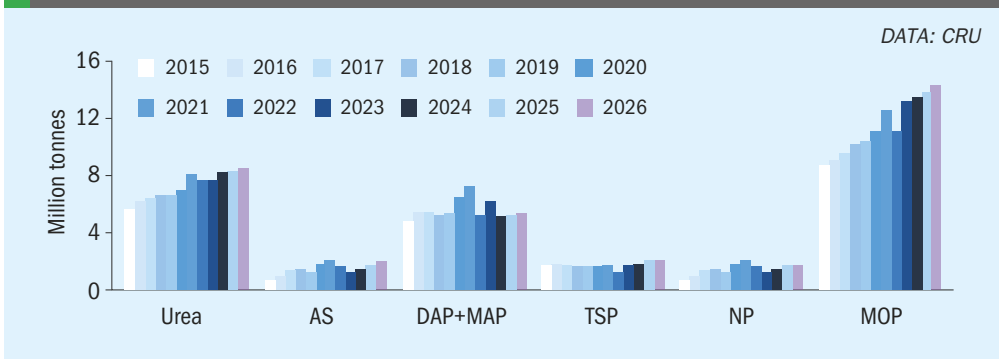
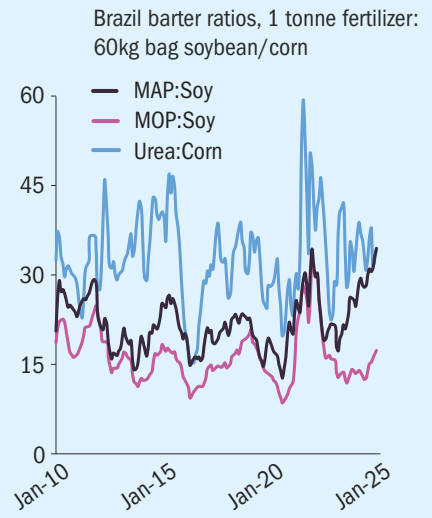


Fig. 6: **Brazil's MAP:Soy barter ratio matches its April 2022 level currently, the worst on record, while other barter ratios hover just above their long-term averages**




*Source: CRU, Agrolink*

hectares in 2026, which is expected to increase cumulative phosphate demand to 9.5 million tonnes, up from 9.3 million tonnes in 2025.

While DAP+MAP demand is seen 0.1 million tonnes higher year-on-year at 5.4 million tonnes, this is still below the 5.8 million tonne 10-year average for both. Brazilian growers are much more sensitive and reactive to prices than their North American counterparts, leading to product substitution. Consequently, the market share of TSP, ammonium sulphate (AS), and NP are all expected to continue increasing. TSP offers growers a phosphate source without the added nitrogen cost, while AS and NP bring additional nutrients to the table.

Brazil's TSP and NP consumption are forecast at 2.2 million tonnes and 1.8 million tonnes in 2026, respectively, while AS is seen at 2.1 million tonnes. Brazil's growing corn crop will help support continued growth in urea consumption, which is seen rising 0.3 million tonnes year-on-year to 8.6 million tonnes in 2026. Apparent potash consumption is forecast to grow from 13.7 million tonnes in 2025 to 14.5 million tonnes next year.

## China's 2025 demand declines as overapplication corrected

China has been attempting to correct fertilizer overapplication since introducing its 2015 'zero growth by 2020' plan – to little avail initially. Under recent food security initiatives, however, the country has ramped up efforts to limit overapplication by focusing on better growing practices. Consequently, China's total fertilizer application rate this year is forecast to decline by 1 kg/ha to 238 kg/ha. Nitrogen and phosphate applications are expected to fall by 2 kg/ha and 1 kg/ha year-on-year, respectively, with potash alone seeing an application rate gain of 2 kg/ha in 2025.

China's 2025 harvested area is forecast marginally higher at 185.9 million hectares compared to 185.7 million hectares last year. Overall fertilizer demand in China is therefore set to decline by 0.4% to 44.2 million tonnes – down from 44.4 million tonnes in 2024 – due to this minimal additional area and lower application levels.

The country's 2025 corn and soybean imports look like being flat and lower, respectively, compared to last year, according to the 12th May China Agricultural Supply and Demand Estimates report, pointing to less reliance on the global market. A slightly larger increase in the domestic harvested area is expected in 2026, with 0.6% growth to 186.9 million hectares forecast.

Attractive MOP prices have resulted in elevated deliveries to China, with these expected to rise from 18 million tonnes this year to 18.9 million tonnes in 2026. China doubled its strategic MOP reserve last year, as part of moves to keep domestic pricing down under the country's food security initiative. Urea demand is forecast at 67.3 million tonnes in 2026, almost 1% lower year-on-year, as applications get more efficient. China's DAP+MAP+TSP demand, meanwhile, is seen at 22.7 million tonne, 4% lower year on year.

## Key takeaways for 2026

Market participants should expect an uneven demand landscape in 2026 with regional forecasts at variance with the overall global picture.

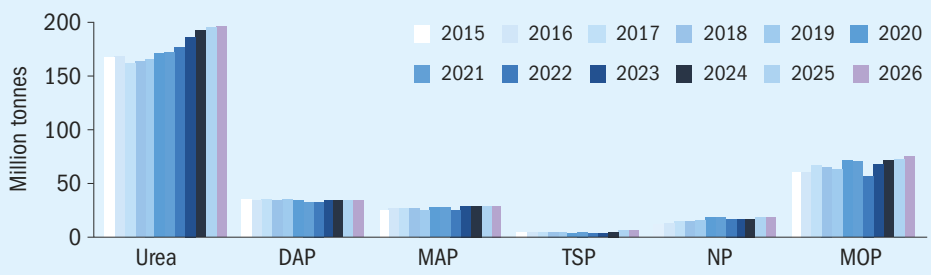
High phosphate prices look set to remain a fixture in the near-term, offsetting a global crop area increase, and leading to a global demand reduction for phosphate in 2026. While global phosphate fertilizer demand is seen marginally lower at 89.2 million tonnes next year, larger pullbacks are forecast in China and the US, where demand deferral is now expected to turn to destruction. While MAP, TSP, and NP consumption all remain well above their historical averages, DAP trails its average as this product continues losing market share to other phosphate product types.

Global potash deliveries are expected to grow 3.4% to 75.7 million tonnes next year, with product relatively affordable and available across key markets. Potash consumption should also continue to benefit from the spread between potash and phosphate affordability, as this still greatly favours the former.

Global nitrogen demand is seen 0.6% higher in 2026 due to increased crop area. Lower demand is forecast in both China and the US, however, as China continues to correct its application practices and the US plants a smaller corn crop in 2026.

Affordability has been a huge talking point over the past year, and rightfully so. Despite this, however, Global fertilizer demand (Figure 7) is expected to remain resilient in 2026, with the effects of poor affordability largely isolated to specific regional markets.

Fig. 7: **Global fertilizer demand is expected to remain resilient in 2026. On a commodity basis, potash is expected to see the strongest demand increase next year, while DAP demand lags its long-term average.**




*DATA: CRU*

## About the author

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Tel: +1 724 201 8877

# Crop nutrient product innovation

Fertiberia, OCP Nutricrops, GoudenKorrel and Omnia provide an update on the latest offerings in their product portfolios.

## FERTIBERIA

## Impact Zero – decarbonisation starts now

The agri-food industry stands at a pivotal moment, facing urgent challenges such as climate change and food security. In this context, Fertiberia has made a strong commitment to contribute to the decarbonisation of the sector through innovation. As a result of this commitment, Impact Zero was born – a lower-carbon solution to crop nutrition that, says the company, represents a paradigm shift in fertilizer production.

Impact Zero is the world's first fertilizer range to replace natural gas with green hydrogen in the ammonia synthesis process, while also incorporating cutting-edge technologies that enhance nutrient efficiency. The result is products that significantly reduce the greenhouse gas emissions from fertilizer use and also enrich the local soil microbiome. This dual breakthrough delivers a substantial reduction in crop carbon footprints combined with a simultaneous increase in agricultural productivity.

Impact Zero is a cornerstone of Fertiberia's sustainability strategy and has already been successfully implemented in collaboration with well-known agri-food brands, generating tangible progress in decarbonising their value chains.

The combination of state-of-the-art technology and a strong environmental commitment has made it possible to achieve a milestone for the sector: progressing toward more efficient, responsible agriculture that fully aligns with the UN Sustainable Development Goals – without compromising agronomic performance.

### Success Stories – brands driving change

Impact Zero is already transforming the agri-food value chain from the ground up, thanks to Fertiberia's collaboration with leading brands committed to a more sustainable agricultural model.

On an international level, Marks & Spencer has taken the bold step of incorporating Impact Zero in its UK dairy farms, fertilizing over 10,000 hectares of pastureland. Meanwhile, in France, the cooperative Vivescia has also begun applying the product range to its cereal crops.

PHOTO: BARTHOLOMEWS


*Unloading of Impact Zero fertilizers at Bartholomews' Southampton terminal in the UK for onward transport to Marks & Spencer's dairy farms.*

In Spain, Fertiberia has built a strategic network of partnerships with farmers, cooperatives, suppliers, and operators across various agricultural regions, enabling Impact Zero to make a real and measurable impact on sectoral decarbonisation.

One of the most noteworthy collaborations is with Heineken España, which is implementing smart farming practices in its malting barley crops in Andalusia. The results are clear: up to a 62% reduction in the carbon footprint of the crop and a significant increase in the average yield of participating plots.

Grupo Gallo has adopted the product range in the cultivation of durum wheat – its main raw material – working closely with leading farmers and cooperatives to reduce its greenhouse gas emissions.

In a large-scale initiative, PepsiCo has applied Impact Zero across more than 3,000 hectares of potato and corn crops in Spain and Portugal. As a result, the first Lay's and Ruffles potatoes grown with sustainable fertilization are now on the market, with emissions reductions of 15% for potatoes and 20% for corn.

Grupo IberoPistacho has incorporated Impact Zero as part of its decarbonisation strategy, as has Primaflor, an Almería-based company specialising in vegetables. Primaflor has introduced these products at its most advanced greenhouses, integrating their adoption with fertigation and water efficiency technologies.

Conesa Group, a European leader in tomato processing, has also started applying Impact Zero to its crops in Spain. The company aims to fertilize 250 hectares by 2025 and exceed 300 hectares by 2026, extending this practice to its associated producers.

## Real change underway

These collaborations show that, together, innovation and environmental commitment are not only compatible, they also generate real transformation. Impact Zero is mobilising key players in the agricultural sector toward production that is more efficient, low-emission, and focused on the future.

Fertiberia is committed to a responsible agricultural model that improves the chemical, physical, and biological quality of the soil – firm in the belief that the transformation of food production in future begins with changes to the present. ■

OCP NUTRICROPS

# OCP Nutricrops Green Solutions – sustainable solutions for green agriculture

PHOTO: OCP NUTRICROPS

*Ethiopian farmer inspects his crop. OCP Nutricrops is on a mission to help farmers restore their soils and build more sustainable, productive agricultural systems.*

Agriculture accounts for about 24% of global greenhouse gas (GHG) emissions, a level comparable to industry or transport. As global food demand grows, fertilizers remain essential for boosting yields, but also contribute significantly to emissions, particularly due to misuse or overapplication. To keep global warming below the 1.5°C limit set by the Paris Agreement and meet global food demand, agriculture must become a scalable lever for decarbonisation.

## Ambitious low-carbon solutions

As a leading global phosphate fertilizer producer, our mission is to help farmers restore their soils and build more sustainable, productive agricultural systems. Through our commitment to sustainability, we continuously improve our offerings to ensure the world's growing population can be fed nutritiously without impacting the planet.

OCP Nutricrops has launched its Green Solutions Business Unit – an initiative dedicated to shaping the future of sustainable farming. This new unit is focused on developing and deploying solutions addressing five key challenges: GHG emissions, water management, waste management, soil degradation, and deforestation.

The Green Solutions Business Unit complements OCP Nutricrops existing fertilizer offering by integrating carbon, water, and digital solutions to tackle sustainability challenges. These complementary solutions are designed to help stakeholders across the value chain. We work with farmer cooperatives and plan to engage with the wider agri-food sector to meet sustainability, traceability, and nutrition needs with tailored, responsible fertilization.

## Two flagship initiatives

The Green Solutions Business Unit is advancing two flagship low-carbon initiatives; responding to the EU's Carbon Border Adjustment Mechanism (CBAM), as well as supporting the goals of the Science Based Targets initiative (SBTi) being adopted by fertilizer users, from distributors and cooperatives to consumer goods companies.

- **Closing the loop.** This encompasses carbon capture from fertilizer production and waste valorisation. OCP Nutricrops aims to capture up to 80% of $CO_2$ emissions from its phosphoric acid units, repurposing the recovered carbon as feedstock for new products. This approach fully aligns with a circular economy approach, turning emissions into resources and closing the industrial loop.
- **Green fertilizers powered by green hydrogen:** By 2027, OCP Nutricrops aims to produce up to three million tonnes of green fertilizers, using green

hydrogen from electrolysis powered by Morocco's abundant solar and wind energy, positioning the company as a leader in green ammonia and fertilizers.

## Beyond carbon: circular and responsible operations

OCP Nutricrops is also transforming its operations by:

- Cutting Scope 1 and 2 emissions by 2030 and Scope 3 by 2040.
- At Group level, producing 1 million tonnes of green ammonia by 2027 and 3 million tonnes by 2032.
- Covering 100% of production water needs with non-conventional water by end-2025 – over 90% is already achieved at our Jorf and Safi plants.
- Aiming for 100% renewables by 2027 – over 80% of electricity today is generated in-house at our Jorf and Safi plants.

## Triple superphosphate – a proven solution for sustainable agriculture

Alongside new low-carbon products, OCP Nutricrops promotes triple superphosphate (TSP), a phosphate fertilizer with about 46% $P_2O_5$, as a proven sustainable solution. TSP has a lower carbon footprint and offers several agronomic and environmental benefits:

- **Soil health:** Balances phosphorus in deficient soils and supports soil carbon and microbes.
- **Water efficiency:** Boosts root growth and drought resilience for better water use.
- **Lower emissions:** As a pure phosphorus source, TSP does not generate direct on-farm GHG emissions.
- **Targeted delivery:** Supplies the right phosphorous at the right time for healthy early roots.
- **Environmental protection:** Improves nutrient efficiency and cuts runoff, protecting ecosystems.

These benefits make TSP a smart choice for precise, efficient, and sustainable fertilizer use.

## Committed to a sustainable future

Through the Green Solutions Business Unit, OCP Nutricrops is innovating in industrial processes and investing in circular, low-carbon technologies – delivering solutions that produce nutritious food, improve crop productivity, and strengthen climate resilience.

GOUDENKORREL

# Taking Polyhalite further

**Misael Machado, Export Sales Director**

## Going global in 20+ countries

GoudenKorrel S.A. is a Polish manufacturer specialising in multi-mineral compound fertilizers, with a strong focus on the innovative use of polyhalite as a core ingredient. The company is known for developing tailor-made, sustainable formulations that deliver immediate and measurable results – especially in vegetable and horticultural crops.

GoudenKorrel now has a presence in more than 20 international markets, with strong sales performance in countries like India, Brazil, China, Vietnam, Colombia, and Senegal. Its polyhalite-based fertilizers have been widely embraced by farmers and agri-businesses, says Misael Machado, the company's Export Sales Director, thanks to their proven effectiveness, sustainability, and crop-specific results.

## New and upgraded nutrient formulations

GoudenKorrel is transforming the performance of polyhalite fertilizer via upgraded formulations, comments Machado, including the addition of water-soluble nitrogen and phosphorus.

"Five years ago, we began this adventure in partnership with ICL, our trusted supplier of polyhalite," says Machado. "The idea was simple: take polyhalite further."

For GoudenKorrel, 'taking polyhalite further' has involved transforming the mined raw mineral into a portfolio of advanced, high-performance fertilizers – these being designed to meet the specific needs of a diverse range of crops and different soil conditions. Today, the company offers four unique formulations, with Polyhalite Complex emerging as its flagship product – a product that's proving particularly successful in key agricultural markets like India.

Polyhalite Complex is a polyhalite-based NPK compound fertilizer. It provides 11 crop nutrients in total – in contrast to standard granulated NPKs – containing additional Ca, Mg, Na and S alongside micronutrients (B, Fe, Mn and Zn), as well as being fully water-soluble and effectively chloride-free.

PHOTO: GOUDENKORREL

*GoudenKorrel's manufacturing plant in Poland.*

## New crop trial results

Recent trials with Polyhalite Complex have shown outstanding results in broccoli cultivation. In comparison to the control, its application pushed bud setting forward by 8–10 days and increased broccoli head weight by up to 59% (Figure 1).

The higher head weight shows that

SOURCE: GOUDENKORREL

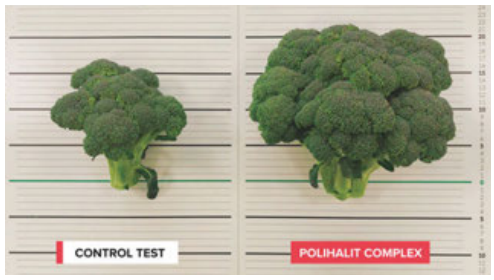



*Fig. 1: Comparison of broccoli head size for control (left) versus Polyhalite Complex (right) treatments.*

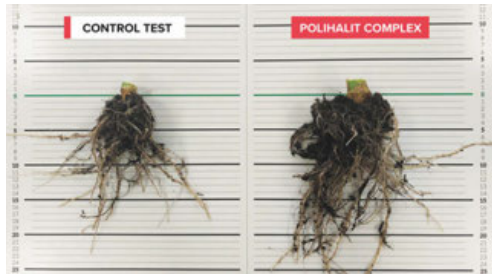



*Fig. 2: Comparison of the broccoli root system for control (left) versus Polyhalite Complex (right) treatments.*

Polyhalite Compex provided the crop with a timely supply of necessary mineral nutrients, contributing to better yields and increased farm productivity. By promoting the development of aboveground parts, this polyhalite-based fertilizer improved both broccoli yield and the quality of the main edible organs.

Plants exhibited healthier, darker green colouration, indicating higher chlorophyll levels and better overall plant vitality. These improvements translate into higher yields, stronger plant resilience, and faster harvests.

Measurements of the length and weight of the root system also confirmed the effectiveness of Polyhalite Complex in building stronger, more extensive roots (Figure 2). Root length increased by 36% and their weight increased by 43% compared to the control sample. These results testify to better uptake of water and nutrients, which is crucial for the stability and resistance of the plant to changing environmental conditions.

Another important effect of the polyhalite-based NPK fertilizer, versus the control, is the acceleration of the moment of setting of the broccoli heads. In the Polyhalite Complex treated crop, buds appeared 8-10 days earlier than in the control group, with broccoli plants showing a measurable improvement in their growth and development. The resulting faster maturity and earlier harvest makes the cultivation of broccoli more efficient.

Overall, Polyhalite Complex has proven to be an effective fertilizer for broccoli cultivation with significant positive impacts on crop development and quality. Higher head weight, a stronger root system, more intense colour and accelerated crop maturation are just some of the benefits of using this enhanced polyhalite-based fertiliser.

For GoudenKorrel, these results reaffirm our commitment to taking polyhalite further – by delivering tailor-made, sustainable formulations that boost crop performance while supporting more efficient, environmentally conscious agriculture. ■

OMNIA

# FertiCoat – a unique biostimulant coating product

In today's economic landscape, growers face constant pressure to optimise their inputs and maximise crop yields. Nutrient use efficiency in particular – by indicating how well inputs are delivered to the crop – plays a pivotal role in measuring and enhancing the performance of applied fertilizers.

To help answer these farm productivity concerns, Omnia has introduced FertiCoat, an effective biostimulant coating for fertilizers. Designed for ease of application, its primary goal is boosting crop yields, and therefore farm profits, by improving fertilizer efficiency.

The unique combination of biostimulants present in FertiCoat – including seaweed, humates, fulvates and amino acids – promotes plant growth and enhances crop resilience to both biotic and abiotic stresses. FertiCoat also acts to increase plant nutrient uptake through the root system.

FertiCoat serves as an excellent granular coating for NP, NPK and urea, and also functions as an effective additive for liquid fertilizers like urea ammonium nitrate (UAN). Crucially, when added to urea, FertiCoat ensures that nitrogen stays in the root zone, preventing wastage and nutrient loss through volatilisation and/or leaching.

## Preventing crop burn

When integrated with UAN, FertiCoat brings tangible advantages for both soil-applied or foliar applications. Moreover, its buffering effects on nitrogen content are conducive to microbial and mycorrhizal activity in soils.

PHOTO: KABOOMPICS

*In an Australian wheat trial, the application of FertiCoat to the fertilizer increased yield by 16.5%, versus the control, without compromising crop yield.*

For crops like wheat, UAN is commonly applied as a foliar solution. Under specific conditions, however, this may have a damaging effect on yield potential due to crop burn. Valuably, the addition of FertiCoat significantly reduces the likelihood of leaf burn or scorch by neutralising the harmful effects of biuret. The Humic and fulvic contents of FertiCoat also promote foliar uptake and minimise nitrogen volatilisation.

## Ease of application

FertiCoat can be applied to granules using various equipment, such as granulation drums, coolers, coating drums, blenders, screw augers, or conveyors. Independent trials conducted on crops worldwide, both in the field and greenhouses, have consistently demonstrated FertiCoat's superiority as a coating product, showcasing its ability to increase nutrient use efficiency and farm profitability.

Look out for a longer feature article on FertiCoat in the forthcoming September/October issue of *Fertilizer International*. ■

# Pioneering Pursell goes international

Pursell is a leading controlled-release fertilizer (CRF) manufacturer based in Sylacauga, Alabama. *Fertilizer International* sat down with **Joe Brady**, the company's Chief Financial Officer, ahead of the Southwestern Fertilizer Conference in Nashville in mid-July.


PHOTO: PURSELL

*Pursell is building a production plant with Wastech Group in Malaysia dedicated to the production of next generation controlled-release fertilizers (CRFs). From left to right: Tim Ferguson, Pursell CEO; Joe Brady, Pursell CFO; Simon Hii, Wastech Group, Managing Director; Nicholas Hii, Wastech Group Executive Director; Allen Sanders, Pursell COO; Mark Kwek, Huntsman Singapore, APAC Consumer Goods & Textile Marketing Manager; Benedikt Berberich, Eirich Machines Director of Operations.*

## The century old start up!

Joe, the roots of Pursell date back to 1904. Indeed, your founder Taylor Pursell described the company to me in 2018 as a 114-year-old start up. **Could you explain more about the history and origins of Pursell?**

"The Pursell family were pioneers in bringing controlled-release fertilizers into the mainstream over several decades. The Pursell name, like you say, was associated with innovation from the outset.

"Back in the day, Pursell's focus was on consumer, golf and T&O (turf and ornamental) markets with a spirit of both innovation and hospitality. They hosted thousands of golf superintendents and would bring them in for a week's training and entertainment at Pursell Farms, their golf resort and research facility. If you're going to have training, that's a great way to make it very accessible and enjoyable!

"They were building relationships; you had innovation on one hand and then meaningful interactions on the other. Those are the strengths we still have ourselves – that is an absolutely fantastic legacy to have and capitalise on.

"We still think there's incredible room for innovation within agriculture. Yet, unlike other markets where you can run solo, ag tech needs to work in partnership with the large established incumbent companies to leverage the infrastructure they have built.

"At the same time, Pursell has a lot of quality research and development in the pipeline, some of which we have already launched. We just need to execute now on the commercialisation of those technologies."

## Bringing CRFs to row crop farmers

**Pursell is specifically targeting controlled-release fertilizers at row crop agriculture – what's your strategy here?**

"There are actually a few different business models. [Yes,] we're still focused on building a strong broad acre controlled-release fertilizer offering in Canada and the US Midwest – primarily focused on corn –and then taking that same technology into other larger volume markets like palm oil in Southeast Asia. Those are some of our goals.

"[Also,] we'll continue to service the historical specialty market – that's turf & ornamental, specialty agriculture, consumer – from our existing Sylacauga and Savannah plants with the name recognition and the demand already in place for this. Those plants are highly dedicated and they also hold inventory and warehousing.

"That model is better suited to the specialty market – so we are servicing a lot of the specialty market across the US and internationally from Sylacauga and Savannah.

"We also established a joint venture with Sollio [the largest agri-food cooperative in Canada], which is about 90-95% broad acre, that is now doing magnificently. That's a totally different tolling model: Sollio brings in the fertiliser, the joint venture coats it and hands it back to them.

"That maintains very low expenses, low overheads. That's a model where we can put a smaller footprint plant right in the middle [of the market], at distribution level, with an established partner. It minimises expense, energy, carbon footprint, and logistics.

"So, we're looking at the JV model we have with Sollio as the model for further expansion in Canada and as we expand into the Midwestern United States.

"Then the third model is international. In Southeast Asia, it's a hot, wet climate with nutrient-poor, sandy soils and high value crops. It's an ideal location and part of the world for our technology. We are very optimistic about the new plant there [in Malaysia with Wastech Group] and future [regional] prospects because there's such growing demand [for CRFs] and it really connects well with the benefits of our technology.

"There are proven yield benefits [from CRFs] and a return on investment for farmers, without the need for subsidies. We make that the primary proposition to farmers and then the environmental benefits – important sustainability benefits – flow from those as secondary benefits.

"Having a standalone financial benefit for farmers is essential. But labour [savings of CRFs] is the one we help farmers realise every time [too] – as farm owners are consistently having difficulty sourcing labour [in agriculture]."

## Made to biodegrade

Pursell's low temperature coating process enables the production of polyurethane-coated fertilizer containing microbes that can reduce the coating shell to carbon dioxide, water and organic matter – once the product has delivered nutrients to the plants in a controlled manner. **How does this Pursell's patented biodegradable coating technology work, and can it actually benefit soil health?**

"In Canada and the US, we're performing field trials with a series of universities and partners – to see how the product performs – that we're excited about. Then we're doing biodegradation trials, working with other labs that are targeting EU regulations, in addition to the work we're doing with the IFDC (International Fertilizer Development Center).

"The EU regulations have expanded their slate of testing, and we're working with different labs and partners to address all of those. It does take time when accelerated tests to degrade the polymer run for 20 months and complete tests for 48 months. But we're moving down the road and testing biodegradation as well as the performance of our product.

"But what *has* happened, which is exciting to us, is that we've been presented with different biopolymers – by some of the other partners we work with – that, with some tweaking, will also work in our existing coating systems, so we don't have to rebuild our plants.

"The [biodegradable coatings] concept with the inclusion of microbes in the coating to degrade [the polymer] is still at the heart of what we're doing – because it's a lower temperature process. But the development and testing process does take a little bit of time.

"What we want to do is to keep people informed as move through the [regulatory] process, so that we can then [ultimately] build product lines, look at investments into certain areas that can really generate demand for these products, and do our best to keep the price point low by understanding what scale would look like.

"Development and testing is a multi-year exercise and we're in the middle of this overall process. But we're really excited and have a high level of confidence that we'll reach our goals."

## Going international

In a new partnership with Wastech Group, Pursell is building a fertilizer coating plant in Malaysia dedicated to advanced CRF production. **Is good progress being made on construction of the company's first CRF plant outside of North America – and what makes Southeast Asia a suitable site for this?**

"First, Southeast Asia – its wet climate, with nutrient-poor, sandy soils and a high acreage of high value crops – is an ideal place for our technology. Second, you have a concentration in the oil palm plantations and therefore the ability to get [a lot of] product into [a localised] market.

"Where you have captive customers, they can apply CRFs in large amounts, can achieve larger savings and can understand the labour benefits at a broader level than small holders. There are also other reasons that Malaysia, within Southeast Asia, works best for us.

"We're putting the plant right at Port Klang, which has amazing logistical benefits to receive and export product throughout the ASEAN region and further into Asia. Then there's [the region's current] void with controlled-release fertilizer production.

"Going back to old Pursell and Polyon, a lot of people have used this [CRF] product but imported it for years. [By producing in region,] we're going to save the full freight rate and there will be lower production costs.

"So, we feel we are going to be able to find the right price that offers farmers a really good return on their investment. It also makes sense economically to grow the [CRF production] volumes in a very aggressive manner – that's at the heart of it.

"Second, Wastech is a group that has strong agronomic expertise who are used to selling specialised products and understand controlled-release fertilizers and 'educational' sales. They can't be treated like any commodity product – you're not just selling urea, right?

"People really have to understand how to apply controlled-release fertilizers, how to blend [them] to get the full benefits. Yes, it's a straightforward proposition, but you do need to educate farmers in how to evolve their practises.

"We have always sold into Central America and South America some volumes [from the US], but now we're beginning to really explore South America, in particular, in more depth. Markets like Brazil are wonderful with great established companies there. So those will most likely be our next areas of focus for our international expansion.

"The progress we've made in Southeast Asia is a model of what we'd be doing with a joint venture partner and what we would pursue in other regions, such as South America.

"The Middle East is a different equation because you have production but no [in region] utilisation. So, there's a different element of partnering with a manufacturer who is then going to send that to markets abroad. [Yes,] we would always protect our different joint venture partners in their regions, but outside of that it becomes an open market."

# Stressing out with Indra

Levity Crop Science has made alleviation of crop stress the goal of its latest innovation. Its founder **Dr David Marks** talks to *Fertilizer International* about Levity's new product, Indra, and the company's innovative approach to crop stress, a major side effect of variable and extreme weather.

*With Indra, Levity has created a formulation that instructs the plant to produce polyamines. These can act as a substitute for calcium in the plant cell wall (in this instance, wheat).*

PHOTO: TANVIR SHAFI

## Crop stress – the next challenge?

"Has incidence of crop stress increased in recent years?" asks Dr David Marks, the managing director and founder of British functional fertilizer company Levity Crop Science. "Of course, we don't know, there are no reliable figures. But I think it's fair to say growers and agronomists have become more aware that crops can and do show signs of stress."

Dr Marks says the increase can be attributed to many factors. A change in weather patterns, such as the dry spring experienced by British cereal growers this year, is a prime cause. "It may also be the case that as agronomy advances and becomes more precise, growers know that they've solved other nutritional challenges – so 'stress' is the only option remaining."

In turn, that's given rise to a new sub-sector in crop protection: the anti-stress product. Seaweed, amino acids, yeast extract – all are finding increasing use as viable anti-stress products, often vindicated by results.

"One issue with these kinds of products," suggests Dr Marks, "is that while crops may show better growth following treatment, that doesn't necessarily mean that you've solved it. It's a bit hit-and-miss; these are complex products, with many different ingredients. You don't necessarily know what they are doing, how they're doing it, or why the plant is growing better."

## Building a different kind of product

Indra, the result of Levity's own long-term research, draws heavily on the science of stress, explains Dr Marks. "The best way to build a product is to understand the problem it needs to solve. If we can understand the science, then we can formulate a product. Any other approach is going to be trial and error."

While countless factors – heat, drought, saline – can induce stress, the result is always the same, notes Dr Marks. "Plants produce 'reactive oxygen species' (ROS) all the time, usually as a by-product of photosynthesis.

"Under normal conditions, the plant can absorb these small amounts, but when stressed, ROS levels can rise by several orders of magnitude – and this starts a whole chain of events."

*Dr David Marks, founder and managing director of Levity Crop Science.*

PHOTO: LEVITY CROP SCIENCE

Increased ROS stimulates production of the stress hormone ethylene, in turn prompting plant cells to move calcium from static sites in cell walls into the cell body itself where it acts as a signal molecule.

"It's this loss of calcium from cell walls that makes stressed crops so disease susceptible," Dr Marks points out, "and also helps to explain the link between stress, calcium and disease."

## Helping crops help themselves

Armed with this knowledge, Levity has performed its usual 'reverse engineering': finding substances that can, in Dr Marks' words, 'help the plant to help itself'.

"This is where Levity's development curve often diverges from the standard agrochemical practice. We're looking for products that mimic, enhance, or even short-cut the plant's own biochemical processes."

Behind Indra's development, then, were two goals: to help the plant strengthen its cell walls to provide immediate – if temporary – defence against disease; and to find a means of 'mopping up' the ROS and thus remove the factors causing the stress reaction.

For the cell wall solution, Levity created a formulation that would 'tell' the plant to produce polyamines. These can act as a substitute for calcium in the cell wall.

"By strengthening those cell walls, Indra 'puts the lid' on disease susceptibility," says Dr Marks, "but we still needed to deal with the ROS."

So, the Levity team looked to anthocyanins, a group of plant compounds usually better known for their vibrant pigmentation – they're what gives rise to the intense reds, blues and purples of fruits like blueberries and raspberries.

"Anthocyanins are what make blueberries a 'superfood'," Dr Marks explains. "They have powerful antioxidant properties: in


PHOTO: MACIEJ BONK/ADOBE

*Irregular weather patterns have become one of the prime causes of crop stress.*

humans, their proven effects extend to anti-inflammation, as well protection against heart disease and even cancer.

"And of course what they can do in animals is exactly why plants produce them for their own use – to absorb those ROS."

## Practical and pragmatic

Dr Marks acknowledges that while it's been a difficult technical accomplishment to combine these two substances into a commercial product – Indra is formulated with a variety of micronutrients, which act as co-factors in several processes – the product has performed ably in the field.

"We've seen it's effective in slowing the progress of a cereal disease like wheat powdery mildew, while in trials examining its performance on Ramularia, it allowed the complete removal – from a grower's standard fungicide programme – of folpet."

It's that type of result that really pleases Dr Marks. "We see ourselves as pragmatists at Levity. We're not advocates for an organic future – there's no way we can produce enough food without extra inputs – but we can produce food more efficiently, and with lower environmental impacts, than at present.

"An absence of harsh agrochemicals needn't mean the absence of science. It's just that our science is about more than simply getting a response. We want to be sure we're delivering on everything else: sustainability, lower levels of inputs, the right ethos, and of course responsibility." ■

## Acknowledgement

Reporting and interview by Adrian Bell, Agromavens.

# Reducing dust, enhancing safety: a coating-based approach

PHOTO: ISTOCK

Dust generation during the handling and storage of fertilizers poses ongoing challenges to operational efficiency, worker safety, and environmental compliance. In this article, **John Suldickas**, **Heather McKay** and **Juan Gonzalez Leon** explore Arkema's innovation in fertilizer dust control through its Dustrol® line of coating solutions, including new bio-based alternatives. These coatings significantly reduce dust by up to 95% while preserving the integrity and flowability of fertilizer granules. Laboratory testing methods and industrial application strategies are discussed, demonstrating how these coatings enhance product quality and sustainability in modern crop nutrient production.

## Introduction

The transport and handling of mineral fertilizers from production plants to agricultural fields present significant challenges, particularly concerning dust generation. Excessive dust not only diminishes product quality through material loss but also raises concerns related to worker health and environmental safety. Although they may appear uniform and intact, the physical degradation of fertilizer granules during handling and atmospheric exposure often releases fine dust particles into the surrounding environment.

This issue is especially pronounced in phosphate-based and compacted NPK fertilizers, as these fertilizer types tend to release more dust than ammonium nitrate and other granulated products. Mechanical abrasion, friable crystal breakage, and inconsistent bonding within granules all contribute to dust formation, particularly under variable humidity and temperature conditions. Even seemingly compact granules can release surface-bound micro-crystals upon impact.

The creation and loss of fertilizer dust during transit or storage poses serious health risks to workers and degrades the product. While manufacturing improvements and storage practices can help, applying dust control coatings during post-production remains one of the most effective mitigation methods. These coatings enhance storage, transport, and application performance by forming a protective layer that binds fine particles.

Arkema has developed a series of coatings tailored for a wide range of fertilizers under its Dustrol® brand. Coating selection is based on substrate characteristics and is typically determined through laboratory evaluations to identify the most effective formulation and dosage.

No universal standard currently exists for evaluating fertilizer dust generation or coating performance. Instead, Arkema compares the performance of different coatings using controlled laboratory simulations to apply coatings and mimic industrial conditions. Two methods in particular are favoured for the laboratory evaluation of dust control performance:

- Optical drop testing (Microtrac Dustmon)
- Modified IFDC dust tower.

PHOTO: ARKEMA

*Main image: The creation of fertilizer dust during handling, transit and storage poses serious health risks and degrades the product. This can be prevented using coatings that preserve the integrity of fertilizer granules. Above: Microscope image of a fertilizer granule at 50x (top) and 100x (bottom) magnification. Tiny particles and crystals on the surface can potentially turn into fine dust.*

Table 1: **Dust values of triple superphosphate – uncoated granules versus those coated with Dustrol® A and Dustrol® B**

| | Dust value (a.u.) | Dust control protection (%) |
|---|---|---|
| Un-coated TSP | 156.4 | 0 |
| Dustrol® A | 12.1 | 92 |
| Dustrol® B | 14.8 | 91 |

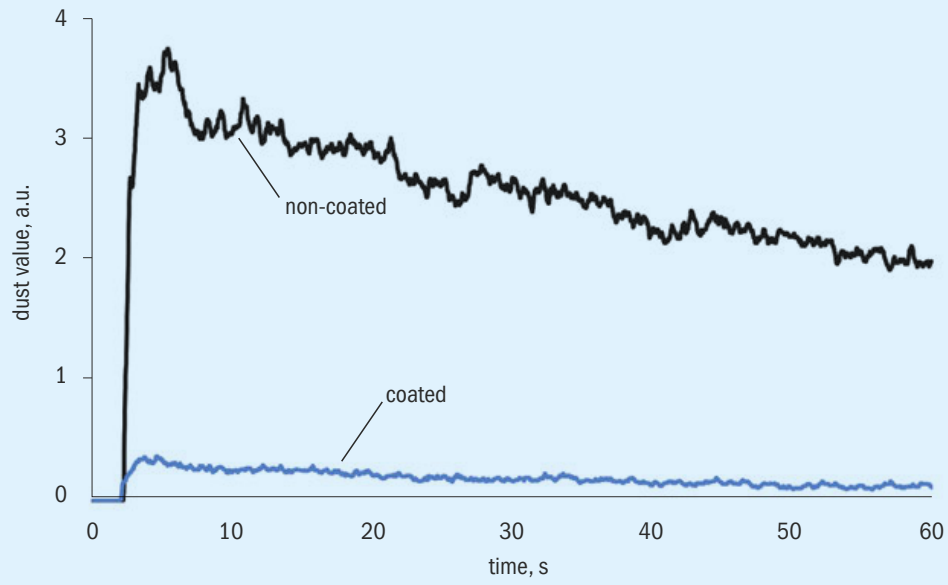
*Source: CRU*

Table 2: **Modified IFDC dust tower test showing improved dust control behaviour of Dustrol® coated monoammonium phosphate (MAP) fertilizer granules**

| | Dust Collected (ppm) | |
|---|---|---|
| **Treatment** | **Initial** | **Cumulative After 6 weeks aging** |
| Non-coated | 507 | 853 |
| Dustrol® C | 27 | 397 |
| Dustrol® D | 52 | 328 |

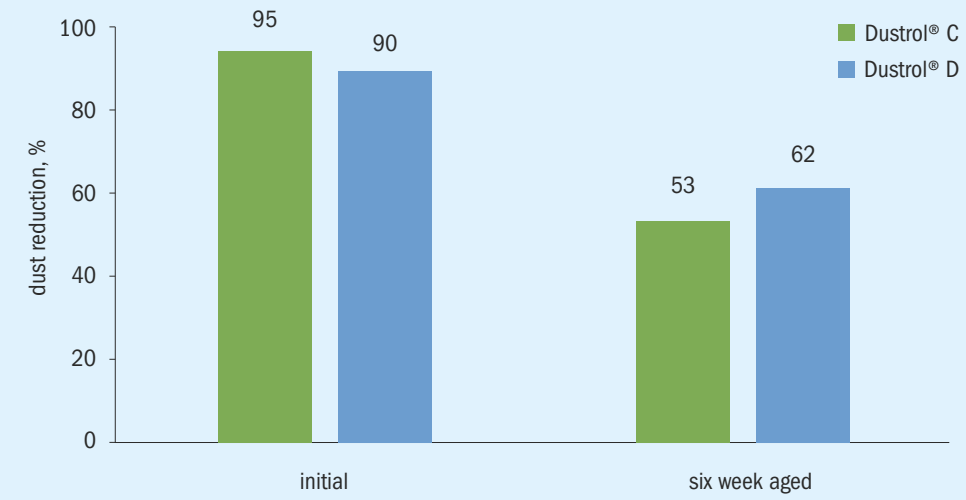
*Source: CRU*

Fig. 1: **Dust values obtained from optical drop testing for both uncoated (black) and coated (blue) triple superphosphate (TSP) granules**




*Source: Arkema*

Fig. 2: **Modified IFDC dust tower test showing improved dust control behaviour of Dustrol® coated monoammonium phosphate (MAP) fertilizer granules**




*Source: Arkema*

## Optical drop testing (Microtrac Dustmon)

This method evaluates airborne dust released from fertilizer samples dropped into a sealed chamber. A laser-based sensor measures light transmission changes caused by suspended dust. Lower light transmission equates to higher dust levels. This approach provides real-time, quantitative dust values (Figure 1). In one test, triple superphosphate (TSP) treated with Dustrol® A and Dustrol® B reduced dust levels by over 90% compared to untreated samples (Table 1).

## Modified IFDC dust tower

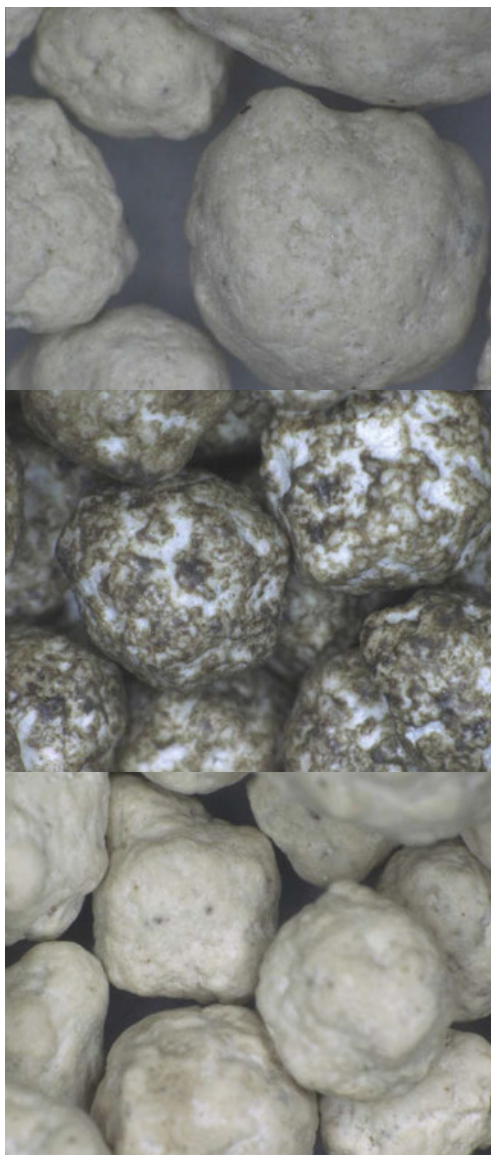
This method uses a vertical vacuum dust extractor to quantify free dust in fertilizer samples. Dust values are reported in ppm and as a percentage of total sample weight. Monoammonium phosphate (MAP) granules coated with Dustrol® C (petroleum-based) and Dustrol® D (bio-based) both showed over 85% dust reduction initially. Coating performance was also prolonged with dust reduction remaining above 50% after six weeks of ageing (Figure 2 and Table 2).

## Consistent coating application for optimal performance

The uniformity and durability of coatings significantly affects dust suppression. Even coverage is paramount, as it ensures improved granule flowability, consistent nutrient release, and resistance to clumping or breakdown during handling. Darker coatings are easier to assess visually, while clear coatings are more challenging, often requiring UV or fluorescent lighting or extraction testing to verify coating coverage.

Achieving the consistent application of a coating to fertilizer granules depends on proper spray techniques, precise dosing, and efficient mixing systems. Hydraulic or pneumatic spray systems are used initially to evenly coatings the surface of granules. Then, following initial spraying, the granules enter mechanical mixers – such as ribbon, paddle, or pugmill designs – to ensure coatings are thoroughly distributed over their entire surface.

PHOTO: ARKEMA



*Uncoated MAP (top), petroleum coated MAP (middle) and bio-based coated MAP (bottom).*

## Industrial application best practices

The industrial-scale application of dust control coatings involves specialised storage, heating, and application infrastructure. Coating tanks must accommodate bulk deliveries and maintain the correct temperature for flowability, often through insulated, heat-controlled systems. Automated Vendor Managed Inventory (VMI) platforms can also enhance operational efficiency by enabling remote monitoring and ordering.

Key components of industrial coating systems (see schematic in Figure 3) include:

- Circulating loops with backpressure regulators for temperature and flow consistency
- Weigh belt scales linked to automated dosing control systems
- Coriolis-effect mass flow meters for accurate coating delivery
- Spray systems integrated with actuated valves to prevent unintended discharge.

Machine learning and imaging technologies are also emerging as tools for real-time coating quality control, providing manufacturers with continuous performance data and early issue detection.

## Conclusion

Fertilizer dust control is vital for ensuring product quality, operational efficiency, and workplace safety. Arkema's Dustrol® coatings, available in both petroleum- and bio-based versions, deliver proven performance validated through laboratory testing and field application. With the right combination of formulation, application technique, and infrastructure, producers can achieve significant reductions in dust emissions, contributing to cleaner, safer, and more sustainable fertilizer production. ■

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## Acknowledgements

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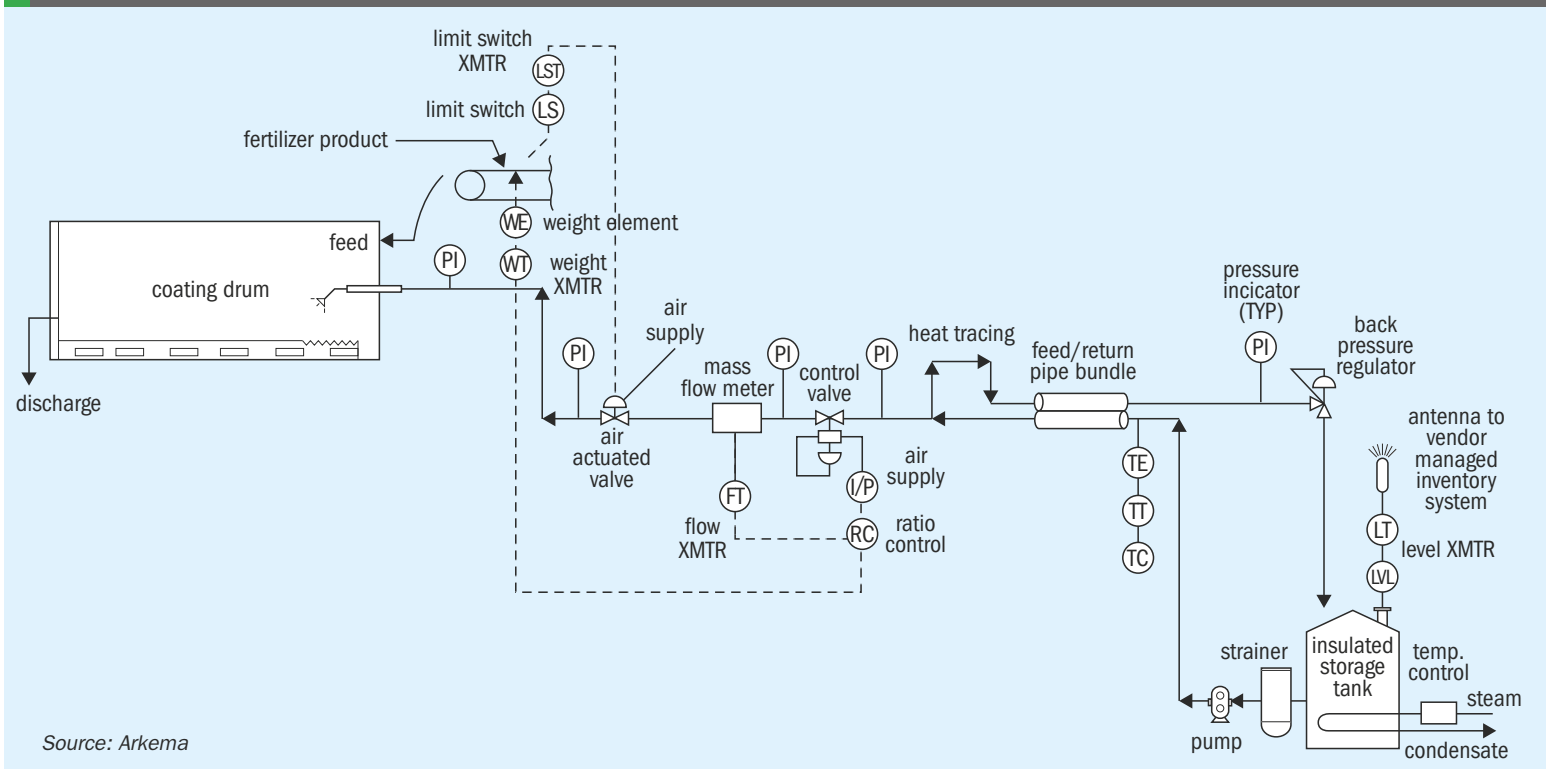
## Authors' note

Dustrol is a registered trademark of the Arkema Group of Companies.



Fig. 3: **Piping & Instrumentation Diagram (P&ID) of an industrial coating application system**




*Source: Arkema*

# Bio-based fertilizer materials: benefits and challenges

The B-FERST project has proven the feasibility of manufacturing a family of innovative bio-based fertilizers. These mineral and organo-mineral fertilizers contain nutrients recovered from selected waste sources and also incorporate biodegradable coatings and biostimulants. Fertiberia's **Cinta Cazador Ruiz** outlines the project's aims and highlights its major successes.

## Biobased materials: benefits and challenges

Sustainable agriculture aims to meet the current food needs of society without compromising farming for future generations. To help meet this sustainability challenge, the European Union (EU) is improving cooperation between farmers and bio-based industries through its Circular Economy Package.

In particular, the EU faces several great challenges:

- Firstly, large nutrient-rich flows are being dispersed into the environment as both mineral (e.g. phosphorus) and organic waste streams.
- Secondly, the EU is strongly dependent on external non-renewable resources for the supply of key fertilizers used in agriculture.
- Thirdly, securing the availability of crop nutrients at affordable prices is necessary to safeguard European food supply.

To answer these challenges in a sustainable way, the farming sector will also need to increase its productivity and use nutrients more efficiently. However, the EU's high external dependency for phosphorus (P), for example, illustrates a lack of a circular approach currently.

The recovery of P from urban and industrial flows is a matter of growing urgency in EU countries, due to both limited regional reserves and concerns about the rate of consumption. Thermal treatments (e.g. incineration or sludge pyrolysis) offer one of the most promising recovery strategies, followed by leaching, precipitation and chemical adsorption[1].


PHOTO: FERTIBERIA

*Fertiberia nutrient recovery demo plant in Spain.*

## Turning waste into resources

Increasing waste generation and resource scarcity are entwined worldwide problems, with the European Union alone producing over 2.5 billion tonnes of waste per year. This is a discouraging situation for a society facing a future of water, food, and resource scarcity, as the global population continues to increase.

Turning waste into resources is central to the shift to a circular economy. The recovery of bio-waste, for example, offers many possibilities for generating chemicals, fuels and other valuable products.

Current phosphorus recovery processes are typically based on the crystallisation or precipitation of struvite from a supernatant liquid. This is separated from solid sludge by digesters at wastewater treatment plants (WWTPs).

However, the recovery rate of phosphorus from the liquid phase generally ranges from 10-60% of the WWTP influent. This compares to 35-70% P recovery possible

from sewage sludge and the significantly higher 70-98% recovery from sewage sludge ash[2]. Other potentially suitable recovery processes include the capture of phosphorus from incinerated municipal solid waste (MSW) ash, using methods such as acidic leaching-precipitation or acidic-alkaline leaching[3].

Despite the wide range of process options, significant technological and market barriers to large-scale commercialisation of nutrient recovery and the development of marketable products remain. Addressing these is a matter of urgency due to impending legislation – with several European countries making P recovery from sewage sludge mandatory, including Switzerland by 2026, Germany by 2029 and Austria by 2033.

## B-FERST – a fertilizer industry paradigm shift

The B-FERST project was created to overcome these barriers. Its overall approach has been to a build a new value chain by developing a novel bio-based process for nutrient recovery from waste – a new concept for the fertilizer industry. This innovative approach involves introducing bio-based materials into existing industrial fertilizer production lines to partly replace conventional mined raw materials.

The project's full title is *Bio-Based fertilizing products as the best practice for agricultural management sustainability*. The project was designed to:

- **Valorise bio-wastes** and integrate these in agriculture management plans.
- **Create new circular** and bio-based fertilizer value chains by bringing together municipal waste management, the agri-food industries and fertilizer producers.
- Encourage **bilateral cooperation between the farming and fertilizer sectors**.
- Create a **paradigm shift** in the fertilizer value chain **by formulating eight specialised fertilizers**.

B-FERST has proven the feasibility of manufacturing the following innovative bio-based fertilizers:

1. Bio-based mineral fertilizer
2. Bio-based mineral fertilizer enhanced with a microbial plant biostimulant (MPB)
3. Bio-based mineral fertilizer enhanced with a non-microbial plant biostimulant (NMPB)
4. Organo-mineral fertilizer enhanced with MPB
5. Organo-mineral fertilizer enhanced with NMPB
6. Bio-based organo-mineral fertilizer enhanced with MPB
7. Bio-based organo-mineral fertilizer enhanced with NMPB
8. NMPB based on bio-waste by-products from dry industrial oil crops or compost extracts.

These eight fertilizer products were manufactured in two demonstration plants via a three-stage process:

- Nutrient recovery
- Granulation
- Bio-based conditioning (addition of NMPB or MPB, and biodegradable coatings).

As well as achieving more sustainable resource management, these specialised formulations offer tailor-made nutrient dosing for farming systems.

The B-FERST project, led by Fertiberia, comprised a balanced consortium of 10 partners covering the entire value chain, including bio-based industries, SMEs, research and technology organisations, and academic institutions. Project activities were divided between nine work packages.

## From biowaste to potential raw materials

The project mapped biowastes from different sectors in European countries to find materials suitable for fertilizer production.

A comprehensive list of requirements was then drawn up to ensure the success and viability of these new bio-based raw materials. The list was based on EU Regulation 2019/1009[4] and the specific needs of the fertilizer industry. The following requirements were identified as the most critical factors influencing the use of these novel bio-wastes:

**Quality**. Nutrient concentration and solubility are paramount and the main quality factors for a potential bio-based material. Nutrient concentration should be high enough to allow the incorporation of at least 1-2% of N, $P_2O_5$ or $K_2O$ within NPK fertilizers. Crucially, to guarantee the final quality of new bio-based NPK formulations, these nutrients must be plant-available and therefore water soluble and/or soluble in ammonium citrate, citric acid, etc.

**Regulatory**. Any selected bio-waste must comply with the requirements of the new fertilising product regulation (FPR) 2019/1009, including its stipulations for Component Material Categories (CMC) or Product Function Categories (PCF). National regulatory requirements must also be considered.

**Security**. The absence of pathogens and a low heavy metal concentration are of critical importance, based on current regulations, as is compliance with product safety requirements.

**Processing feasibility**. The main process considerations include how to handle and introduce bio-based materials as feed into the fertilizer granulation process and how to maintain or increase nutrient availability. Physical properties and chemical composition are also highly significant. In particular, parameters such as moisture content, granulometry and density of the new raw material need to be assessed, as they directly affect successful incorporation in the process.

**Availability**. A continuous supply of potential new raw materials is necessary. Sufficient volumes of the bio-based waste source therefore need to be available throughout the year. Availability needs to be reviewed and updated frequently in response to the changing market and international situation.

**Logistics**. Transportation to the fertilizer production plant can be a challenge. Transportation distance is a key parameter as it directly influences overall economics, the carbon footprint, transport costs and environmental impacts etc.

**Stability**. Linked with security and availability, the composition, biological activity and supply of the bio-based material all need to be stable. Stability is a challenge – as the fertilizer industry requires raw materials with homogeneous physical properties and chemical composition – and therefore must be assessed from the very beginning. It is particularly important to ensure the absence of pathogens within the whole fertilizer value chain.

**Economic feasibility**. All the above factors influence the costs of bio-based materials. These costs are critical as, to ensure viability, they need to be below the current market prices of standard crop nutrient products. Economic feasibility therefore involves comparing the unit cost of conventional fertilizer raw materials with the unit cost of bio-based materials (nutrient per tonne basis). In some cases, the waste management costs avoided by nutrient recovery make bio-based materials highly affordable from an economic point of view.

**Carbon footprint**. Targets to cut the environmental impacts and carbon footprint of fertilizer manufacturing are widespread nowadays. Helping achieve these targets by substituting biowastes for conventional raw materials is therefore helpful when it comes to the final decision-making.

While more than 150 bio-based materials (see example photo of agrifood industry ash) were identified across Europe, only 5% of these met all of these requirements.


PHOTO: B-FERST

*Ashes from agrifood industry.*

## Fertilizer industry implementation

The quality of nutrients – particularly plant availability – was identified as one of the main factors determining successful adoption of bio-based materials in fertilizer manufacturing. The incorporation of soluble nutrients is crucial for final acceptance by the fertilizer end-user.

Ashes produced by the incineration of sludges from WWTP, manure or slaughterhouse are abundant in Europe. While many of these contain $P_2O_5$ at high concentrations, the P present is insoluble in water and therefore requires extraction using strong acid solutions.


PHOTO: B-FERST

*Coating demo plant.*

A first-of-its-kind demo plant for P extraction from ashes (based on acid leaching in a thermally coupled reactor) has been developed, built and validated at Fertiberia's operations in Spain (see main photo). The plant can extract up to 93% of the $P_2O_5$ from sludge ash and produce 500 kg/h of dicalcium phosphate (DCP, see photo), an ideal source of plant-available phosphorus.

The project has also shown that incorporating bio-based additives can enhance nutrient use efficiency. A first-of-its-kind fertilizer coating demo plant was built at one of Fertiberia's production sites in Spain (see photo). This 2 t/h capacity plant applies biostimulants (microbial and non-microbial) and biodegradable coatings to fertilizer granules (see photo).

## Improving fertilizer performance

The project carried out 16 field trials across four field campaigns in Spain, Italy, Portugal and Poland. These were designed to test bio-based fertilizers in different soils and climate conditions. Crop trials were carried out on bio-based mineral and organo-mineral fertilizers from selected sources (ashes from olive oil industry, chicken litter ash and composts) as well as on biodegradable coatings and microbial/non-microbial biostimulants. Nutrients present in these biowastes, while not water soluble, were soluble in neutral ammonium citrate. These crop trials and the use of bio-based materials in agriculture are fully supported by the goals of Fertiberia's sustainability strategy and the EU's Green Deal and Farm to Fork Strategy.

The main lessons and conclusion from the crop trials (Figures 1 and 2) are that:

- Bio-based fertilizers can perform equally well as conventional fertilizers
- Bio-based fertilizers need to incorporate other components such as biostimulants to outperform conventional fertilizers.

Soil biological properties and biodiversity were also assessed as part of the field trials[5] with the following results:

- There was no significant change to soil biological properties as a result of using either conventional or bio-based fertilizers.
- Similarly, metagenomic analysis showed there were no big differences in biodiversity between the treatments, except for the enhancement to the

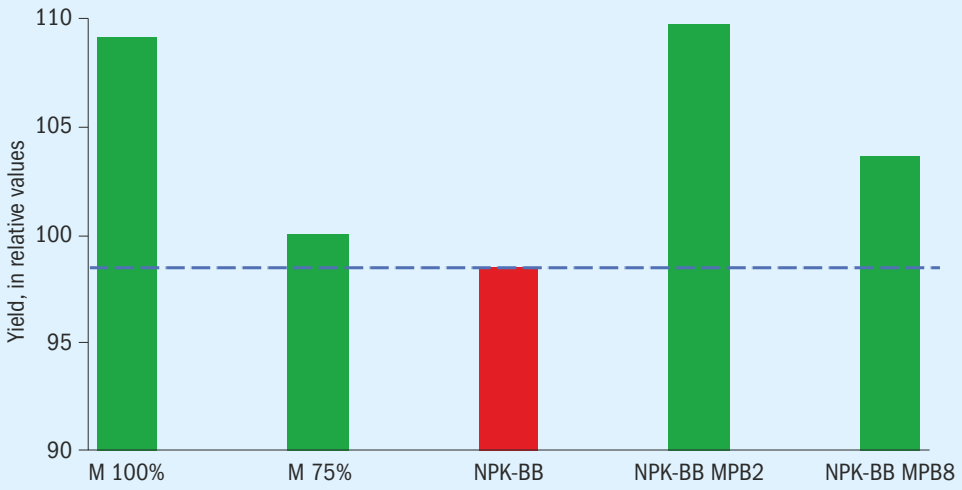

PHOTO: B-FERST

*Dicalcium phosphate cake in a press filter.*


PHOTO: B-FERST

*Coating unit with bio-based additives equipment.*

Fig. 1: **Bio-based fertilizers performance in a 2023 maize trial in Spain**




Key:

M 100%: mineral conventional fertilizer at usual dosage (100%)

M 75%: mineral conventional fertilizer at 75% dosage

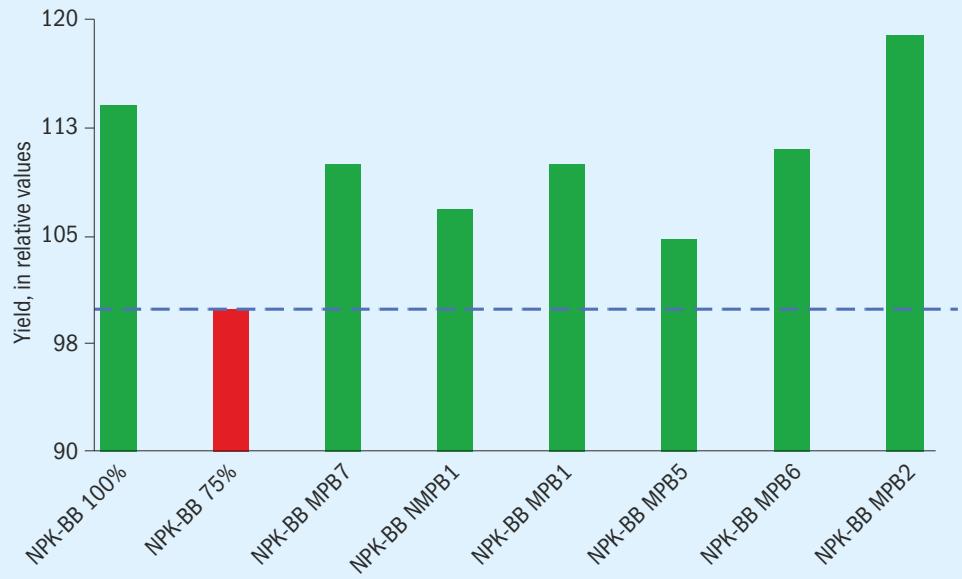
NPK-BB: bio-based NPK fertilizer at 75% dosage

NPK-BB MPB2: bio-based NPK fertilizer at 75% dosage with microbial plant biostimulant number 2

NPK-BB MPB8: bio-based NPK fertilizer at 75% dosage with microbial plant biostimulant number 8

*Source: B-FERST*

Fig.2: **Bio-based fertilizers performance in a 2024 wheat trial in Italy**




Key:

NPK-BB-100%: bio-based NPK fertilizer at usual dosage (100%)

NPK-BB-75%: bio-based NPK fertilizer at 75% dosage

NPK-BB MPB7: bio-based NPK fertilizer at 75% dosage with microbial plant biostimulant number 7

NPK-BB NMPB1: bio-based NPK fertilizer at 75% dosage with nonmicrobial plant biostimulant number 1

NPK-BB MPB1: bio-based NPK fertilizer at 75% dosage with microbial plant biostimulant number 1

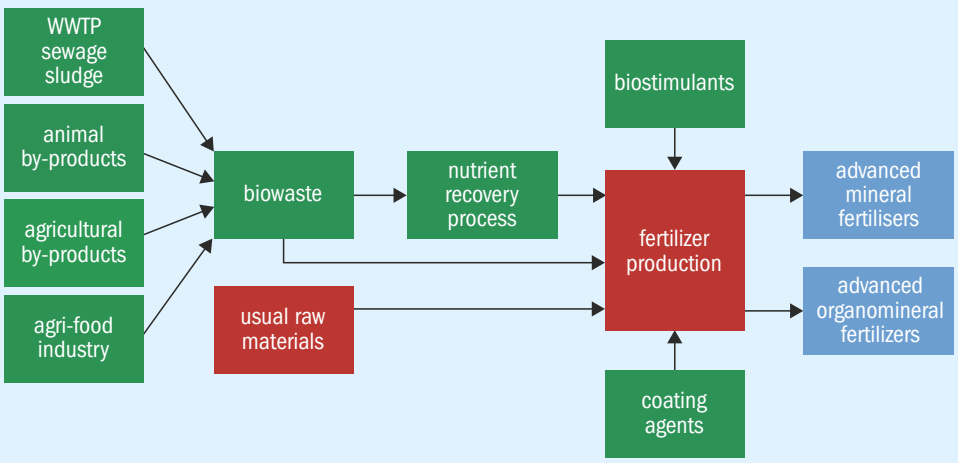
NPK-BB MPB5: bio-based NPK fertilizer at 75% dosage with microbial plant biostimulant number 5

NPK-BB MPB6: bio-based NPK fertilizer at 75% dosage with microbial plant biostimulant number 6

NPK-BB NMPB2: bio-based NPK fertilizer at 75% dosage with nonmicrobial plant biostimulant number 2

*Source: B-FERST*

Fig.3: **Bio-based fertilizer industry value chain (Fertiberia)**




*Source: B-FERST*

biodiversity of bacterial communities by the addition of non-microbial plant biostimulants.

- DNA analysis did not reveal any adverse effects on soil biodiversity. The highly variable responses suggest that soil background conditions were determining the ultimate effect of treatments on soil diversity.

## New enhanced bio-based fertilizer family

The most promising bio-based materials were incorporated into the fertilizer production value chain (Figure 3). These new bio-based fertilizers have the following properties:

- Contain up to 42% bio-based materials
- Up to 16% of the nutrients (N, $P_2O_5$, $K_2O$, $N+P_2O_5$, $N+K_2O$, $P_2O_5+K_2O$) derived from bio-based sources
- Up to 8% organic carbon content
- 100% of nutrients plant-available
- More than 80% of nutrients water-soluble
- Biodegradable coatings
- Incorporate microbial or non-microbial plant biostimulants. ■

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PHOTO: B-FERST

*Example of an organic organo-mineral fertilizer coated with a microbial plant biostimulant.*


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## About the project


B-FERST consortium was led by Fertiberia and composed of 10 other partners: University of Leon (Spain), FCC Aqualia (Spain), Agrisat Iberica SL (Spain), Novamont (Italy), Fundazione ICONS (Italy), FKuR Kunststoff GmbH (Germany), Vlaamse Instelling Voor Technologisch Onderzoek N.V. (Belgium), Arcadia International (Belgium), AgFutura Technologies DOOEL (North Macedonia) and Instytut Uprawy Nawozenia I Gleboznawstwa Panstwowy Institut Badawczy (Poland).

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# Vanguard views on future farming

Farming technology is moving on apace – even 50 years ago who could have predicted the widespread use of ultra precise, automated machinery in field crops and controlled environments? So, looking ahead, what might the next 50 years bring us? Three vanguard companies, ICL Growing Solutions, John Deere and BigSis, share their thoughts.

PHOTO: JOHN DEERE

*John Deere's See & Spray technology can reduce chemical usage by up to 80%.*

PHOTO: ICL

*Dr Elinor Erez, vice president of research and development at ICL Growing Solutions.*

Farming is facing a huge technological revolution – so what might the future look like? Will it be one dominated by vertical, soil-less farming, or will autonomous vehicles and artificial intelligence (AI) replace the need for people?

## Crop resilience in a changing climate

Climate change is driving many of the latest developments and investments, according to Dr Elinor Erez, vice president of research and development at ICL Growing Solutions. "In the past three years we've invested a lot in next generation products – dealing with resilience to stress," she says.

"Our climate is changing, with more extremes – areas in Brazil that were considered tropical with heavy rain events are now considered dry. Plants have to deal with different stresses, and we're developing products to improve their resilience, whether that's to high UV radiation, drought, or salinity, for example."

Sustainability is being seen as absolutely critical too, and that involves creating healthy soils to support growing plants. It's also about understanding the whole microbiome and plant-soil interactions and developing biological products to optimise that relationship.

"Today we understand that bacteria have a huge effect on our health and it's the same with plants," explains Dr Erez. "There is a tight synergy between microorganisms and plant health, and we can use that to help them cope with heavy metals or salinity, or to sequester carbon dioxide or fix nitrogen, for example."

*ICL's Dr Erez sees the progress of a corn crop in response to inputs.*

## The biologicals era?

Plant nutrition has evolved over the years, through the eras of applying physics (mechanisation), then chemistry (mineral fertilizers), and more recently biology (biostimulants/biofertilizers) to farming systems, adds Dr Erez. "Looking ahead it's about bringing them all together, and developing new molecules to benefit plant physiology, which is essential to improve crop productivity."

The agricultural sector is borrowing heavily from developments in the pharmaceutical industry and is adopting cutting-edge technology to speed up product development. "We now use artificial intelligence (AI) to screen bacteria or metabolites for particular phenotypes that we're looking for, so we can select those most likely to deliver what we need," says Dr Erez.

This massively speeds up the research process – so, for example, the AI finds bacteria that are most likely to cope in drought conditions, the laboratory grows them under extreme conditions, and then tests the genetic phenotype of the next generation to see what has changed. "Nature does what it does and we cherry pick those that survive."

But it's not just about bacteria. "We have an unlimited number of molecules that exist in nature, and we need to discover their potential in agricultural practice." ICL has access to a massive, and growing, library of molecules and metabolites, which can be quickly screened using AI and then developed.

"We can grow plants with less water to see what kinds of molecules they secrete, and then use them to help other plants to deal with drought," notes Dr Erez. "The AI models predict the efficacy in the field, giving us a much higher success rate more quickly – it really shortens the whole process to field trials."

So, will biologicals replace fertilizers in future? Dr Erez doesn't think so. "We will need to have fertilizer forever – nutrients are the building blocks for plants to grow." However, science will increase the efficiency of nutrient use, with biologicals providing extra support and resistance to various stress-related conditions.

"We will be able to use less fertilizer, with less damage to the environment, and fewer emissions. Also, smarter solutions mean we might not need to create nitrogen fertilizer with its associated high energy requirements and emissions. There are commercially available bacteria that can fix nitrogen from the air, and in the future farmers will potentially add proteins to prevent the formation of nitrous oxide, for example."

Foliar applications – which are highly efficient – will become more commonly used and can be combined with biological products. But plants also need nutrition to germinate and grow, so controlled-release fertilizer (CRF) can be used at drilling to meet these needs without losses to the environment. "We're developing a CRF product with live micro-organisms now, too."

## Soil-less systems and circular solutions

The rise of vertical farming, greenhouses and soil-less systems will continue, predicts Dr Erez. "But we will always have soils as the staple system to grow plants – energy won't be able to replace the sun, from a cost perspective."

And healthy soil is essential to the planet. "More sustainable solutions are our focus. Soil health is a key element for sustainable farming, and the regenerative farming trend is important. We will see more products focusing on sequestering carbon and creating a healthy rhizosphere," she says. "With carbon credits food companies can incentivise practices to boost soil carbon – and the economics of the food system might change."

Circular systems will evolve, so that nutrients are reused rather than having to be mined, but the changing climate will also see crop choices evolve. "We expect to see a movement of farmers from area to area – similar to the movement of tomato growing from California to Florida."

And what about the emergence of lab-grown meat? Will that replace the need for real farms in future? "The chances for cultured crops are a lot higher than those for cultured meat," says Dr Erez. "Cultured meat uses animal cells, which are very difficult and expensive to grow."

Plant cells, in contrast, are generally cheaper and easier to grow – so new techniques could see, for example, tomato ketchup, produced entirely from lab-grown molecules. "But that won't replace the need for fresh food, grown naturally," concludes Dr Erez.

## The view from Brazil

Eduardo Lopes Cancellier, the Brazil-based agronomist for the global biostimulant portfolio at ICL Growing Solutions, points out that autonomous machines are already on the market. And that will change the role that farmers play. "The professional working in agriculture will have to be more trained in programming electronics and all types of computer skills," he predicts.

Farmers often don't like such developments until they see the benefits – and then they truly embrace them. "Combine harvesters already self-regulate their settings based on photos of the grain, GPS and autosteer, for example. And AI is going to improve the decision-making of these machines."

AI will also improve decision-making when it comes to crop management, with more accurate diagnostics improving the choice and timing of treatments – while biological products will also play a far greater role, says Eduardo. "Today, biostimulants are quite generic, but they will become more specific and targeted. The future is specialisation."


PHOTO: JOHN DEERE

*Variable rate application distributes the right amount of nutrients to exactly where they're needed, allowing commercial growers to 'farm smarter'.*

For example, certain strains of nitrogen-fixing bacteria might be used in UK wheat crops, with different strains chosen for barley in Spain. And the next generation of biostimulants, using secondary metabolites, will have more consistent and specific effects, making them more competitive.

"Even with this technology, fertilizers will never be eliminated," Cancellier says. "But they will be used more efficiently and therefore reduced. And crop protection products will be tools for emergency use. We will manage quite well with biological products, but chemical products will be a backup, for example, if diseases mutate into new strains. We are fine tuning and perfecting the technologies, and the future is extremely exciting."

## Farming smarter with John Deere

Innovation in agricultural machinery is evolving as rapidly as developments in crop inputs, with technology playing a central role in shaping how farms operate now and in the future.

For John Deere, the world's largest manufacturer of agricultural machinery, the mission is clear: To support more profitable, sustainable, and efficient farming practices through each new advancement. A clear example of this progress can be found in intelligent spraying systems that use advanced imaging and artificial intelligence (AI) to distinguish weeds from crops, applying herbicide only where needed.

"There are a few brands that have spent many years working on technology to spray green weeds growing on a brown, soil background, and indeed unwanted weeds in a growing, green crop," says Chris Wiltshire, tactical marketing manager at John Deere.

"Our technology, called See & Spray, can result in up to 80% less chemical usage – good news for both farmers and the environment. These systems rely on sophisticated algorithms that recognise crop rows and focus attention on the inter-row space, where weeds typically thrive, using cutting-edge digital and mechanical tools."

But the power of today's machinery doesn't stop at what happens in the field – it extends into how information is collected, analysed, and acted upon. With connected platforms and digital dashboards, farmers now have access to field-by-field performance data that helps them make timely, informed decisions.

From identifying yield differences to tracking the effects of variety choice, seed rate, or input strategy, the goal is to farm smarter. That includes the variable rate application of fertilizers. "All of this information is captured automatically as the machine works, building a real-time picture of the farm's performance," Mr Wiltshire adds. "By the time the next season rolls around, you're better equipped to refine and improve your approach."

Recent moves in aerial imaging hint at where things are heading – towards rapid, high-resolution field analysis that can seamlessly inform what happens on the ground. Drone-based crop insights, processed through intelligent software platforms, are already making it easier to detect plant health issues, identify weed pressure, and create targeted application plans.

"You can now imagine a future where drones scan the field from above, machines adjust their actions below, and the farmer oversees it all from their phone," says Mr Wiltshire. "It's a fast-moving, exciting space."

## Back to the future for plant protection

Biostimulants and biologicals may be shaking up crop nutrition, yet progress on bio-based plant protection, like bio-herbicides or bio-insecticides, has been less clear-cut. However, BigSis, a British start-up, hopes farmers won't need to turn to insecticides to tackle pests in future, for the company has reinvigorated the sterile insect technique (SIT), a decades-old concept that until now has proven uneconomical in commercial situations.

"With artificial intelligence and better robotics, we reinvented SIT," says Glen Slade, the company's founder and CEO. "SIT outperforms chemical insecticides and comes with the unbeatable advantage of lower regulatory hurdles."

Its premise is simple: Release sterile male insects into a crop, where they mate with wild females – stopping a pest population like spotted-wing drosophila (SWD) from ever reaching a level high enough to cause damage in the high-value soft fruit crops it targets.

The BigSis production facility rears each insect individually, with minimal operator input, before artificial intelligence (AI) selects the males for a burst of X-rays, rendering them sterile. "SIT tears up the biologicals rule book. Traditionally we leveraged the 'three Ps': Predators, parasites, or pathogens," Mr Slade explains. "Now we use the pest against itself. Sterile males will always find wild females and mate. When they do, the job is done. Any eggs laid will never hatch. There will be no population explosion."

Contrast this certainty with the efficacy of other biologicals, constrained or limited by factors beyond grower control: Pest population, crop type, soil, environment, weather, and regulations. "SIT has no such restrictions. We can even use SIT against one pest then deploy much-reduced insecticide doses for other pests. Nor does its effectiveness rely on protected environments, like a glasshouse or polytunnel. It works in open fields."

The company's trials have proven season-long control of SWD using SIT in outdoor commercial strawberries, with a reduction of up to 91% in female SWD numbers. A further trial cut female SWD numbers in commercial raspberries by up to 88%, compared to controls given one insecticide application.

"Perhaps the biggest advantage is that we're using locally captured native insects, so we achieve a zero-regulatory approach," Mr Slade notes. "And with a production facility that's replicable and scalable, we can always produce locally using local insects.

"Being non-toxic, species specific and non-GMO, this approach provides highly effective insect control that fits seamlessly into existing crop protection programmes and integrated pest management protocols." ■

## Acknowledgement

Reporting by Olivia Cooper, Ben Pike and Adrian Bell of Agri-hub.

PHOTO: KINWUN/ISTOCKPHOTO.COM

# Measuring innovation

How do you gather reliable intelligence and accurately track the global value-added fertilizer market? **Vatren Jurin** of DunhamTrimmer proposes a sophisticated methodology that encompasses definitions, market segmentation, intelligence sources, quality control and modeling.

*Foliar application of fertilizers to a green teas field using drones. The introduction of new agricultural technologies globally is influencing the adoption of value-added fertilizers.*

## The measurement challenge

Unlike traditional commodity fertilizers with transparent pricing and standardised products, the value-added fertilizer (VAF) market represents one of agriculture's most sophisticated yet poorly understood segments. VAFs inhabit a complex intersection of crop nutrition, biostimulant technology, and chemical enhancement – creating a measurement challenge that has long been a source of frustration for industry analysts and investment decision-makers alike.

Consider the fundamental problem: How do you track a $20 billion global market that spans everything from chelated micronutrients to seaweed extract blends, where 75% of biostimulants are sold in combination with nutrients, and where product definitions vary not just by region but by application method and crop type? Traditional market research approaches, designed for discrete product categories, simply cannot capture the nuanced reality of these hybrid formulations.

This measurement challenge extends beyond what can be solved with panel or lab data. In an industry where major agricultural companies like Corteva, Mosaic, and Yara are making billion-dollar strategic pivots toward specialty fertilizers and biologicals, the quality of market intelligence directly affects investment allocation, acquisition strategies, and competitive positioning. The difference between rough market estimates and rigorous tracking methodology can determine whether a company captures growth opportunities or misallocates resources in what has become agriculture's fastest-growing input segment.

## Defining value-added fertilizers

The first step toward building reliable VAF market intelligence begins with establishing definitional boundaries that reflect both product reality and commercial utility. The challenge lies in creating categories that are at once scientifically accurate, commercially relevant, and globally applicable across diverse agricultural systems.

A three-component VAF framework, developed through DunhamTrimmer's extensive product label analysis and industry consultation, provides this foundation. When breaking down the global VAF market, one can segregate:

- **Foundational components** (comprising 5-98% of end-use product formulations) which include the macro and micronutrients that provide essential plant nutrition
- **Functional components** (0.5-25%) which encompass primarily biostimulants – seaweed extracts, amino acids, humic substances – that enhance plant physiological processes, and
- **Enhancement components** (0.2-12%) that consist of chemical additives including chelators, surfactants, and compatibility agents that improve nutrient stability and delivery.

This three-component framework accomplishes several critical objectives:

- First, it acknowledges that VAFs exist on a spectrum rather than as discrete categories, accommodating everything from lightly enhanced fertilizer blends to sophisticated multi-component formulations.
- Second, it provides quantitative boundaries that enable consistent product classification across different markets and applications.
- Third – and this is critical – **it recognises that the value proposition lies not in individual components but in their synergistic combination – a crucial distinction for market valuation purposes**.

The geographic adaptation of VAF formulations is equally important. A calcium-amino acid blend optimised for Mediterranean tree fruit production differs fundamentally from a micronutrient-biostimulant combination designed for Brazilian soybean systems, yet both qualify as VAFs under this framework. The methodology must therefore accommodate these variations while maintaining analytical consistency.

## Market segmentation strategy

Effective VAF tracking requires segmentation along three primary dimensions: crop type, application method, and geography. This three-dimensional modeling approach reflects the reality that

VAF adoption patterns vary dramatically based on the following intersecting factors.

**Crop type segmentation**. This recognises distinct nutritional and stress management needs across agricultural systems. Row crops with relatively straightforward nutritional requirements average one VAF application per season, reflecting their commodity nature and cost-sensitivity. Tree fruits, perennial crops, and tubers, meanwhile, receive an average of three applications, acknowledging their extended growth cycles and higher value per acre. Finally, annual vegetable crops and berries average four applications per season, driven by intensive management practices and premium quality requirements.

**Application method analysis**. This reveals adoption patterns and market development trends. Fertigation systems, while representing the highest rate per hectare and most premium fertilizer usage, still account for a relatively small percentage of total VAF volumes. Soil application, primarily through liquid or dry blends used at planting, represents a significant volume driver. Foliar application, however, leads in adoption rates, particularly in specialty crops, with growing penetration in row crop systems.

**Geographic modeling**. This incorporates regional differences in soil types, climate conditions, and management practices. Growers participating in high-value export markets typically invest in higher input levels to achieve quality premiums. These variations must be captured in regional coefficients that adjust global models for local conditions.

## Integrating data sources

Building comprehensive VAF market intelligence requires integrating multiple data streams, each with distinct strengths and limitations. The methodology employs both bottom-up and top-down approaches to ensure accuracy and completeness.

**Bottom-up data collection** involves systematic interviews with distributors and fertilizer producers, analysis of trading statistics, and compilation of company financial reports. This approach captures ground-level market dynamics and provides insights into adoption patterns, pricing trends, and regional variations. Distributor interviews prove particularly valuable for understanding application methods, seasonal patterns, and grower decision-making processes.

**Top-down validation** incorporates published industry analysis, governmental agricultural statistics, and corporate financial disclosures. This approach provides market-level validation of bottom-up findings and helps identify discrepancies or gaps in primary data collection.

The most critical component remains proprietary database development. This involves continuous data compilation from multiple sources, systematic organisation of market information, and regular updating to reflect market changes. The database serves as both a validation tool and a foundation for longitudinal analysis of market trends.

## Quality control

Data quality becomes paramount when dealing with fragmented markets dominated by privately-held companies. Multiple validation mechanisms are therefore necessary to ensure reliability and accuracy.

**Cross-referencing protocols** involve comparing data points across multiple sources to identify outliers or inconsistencies. When distributor reports suggest rapid growth in a particular region, this must be validated against production statistics, import/export data, and company financial reports.

**Regional validation** through in-country networks provides local expertise and market knowledge that external analysis cannot capture. Understanding whether reported growth reflects genuine market expansion or temporary market disruptions requires local intelligence.

**Transparency indicators** acknowledge varying data quality across different markets. China's combination of market size, fragmentation, and limited transparency, for example, results in lower data accuracy compared to developed markets with more open information flows. These limitations must be explicitly acknowledged and factored into confidence intervals.

## Quantitative modeling

Converting raw data into actionable market intelligence requires sophisticated modeling that captures the complex interactions between crop types, application methods, and regional factors. For the *2024 DunhamTrimmer Global Value-Added Fertilizer Market Report*, the algorithm centres on the following variables derived from extensive market analysis:

**Harvested area** provides the foundation, drawn from FAO agricultural census data and adjusted for regional variations. **Treated hectares** represent the percentage of harvested area receiving VAF treatments, a metric that varies dramatically by crop type and region. **Application frequency** reflects the average number of applications per season, based on agronomic requirements and economic factors.

**Level of penetration** measures the degree of VAF adoption within each crop-region combination, expressed as the percentage of planted area receiving at least one application meeting VAF definitions. This metric proves particularly valuable for identifying growth opportunities and market maturation patterns.

**Cost per application** and **rate per hectare** provide the economic foundation for market valuation. These metrics can vary significantly within regions, requiring sophisticated extrapolation methods to generate meaningful averages.

**Estimated growth in penetration level** projects future adoption rates based on historical trends, regulatory changes, and technology developments. This forward-looking metric enables strategic planning and investment decision-making.

## Specificity – regional modeling

Regional modeling incorporates multiple factors that influence VAF adoption and market development. Soil type and climate conditions affect both the need for and effectiveness of different VAF formulations. Mediterranean climates may favour different biostimulant combinations compared to continental or tropical systems.

Export market participation significantly influences input investment levels. Growers producing for premium export markets typically invest more heavily in quality-enhancing inputs, creating higher VAF adoption rates and willingness to pay premium prices.

**Data accuracy varies between countries** and needs to be managed. This requires acknowledging and adjusting for different levels of market transparency. Developed markets with extensive agricultural statistics and corporate disclosure requirements provide higher data confidence than emerging markets with limited transparency. China represents a particular challenge, combining enormous market size with a fragmented structure and limited data availability.

## Overcoming methodological challenges

The VAF market's fragmented nature, dominated by privately held companies, creates unique tracking challenges that require specialised approaches.

**Private company analysis** involves piecing together market intelligence from multiple indirect sources. When traditional financial disclosure is unavailable, market intelligence must be constructed from distributor relationships, trade show participation, regulatory filings, and industry networking.

**Extrapolation techniques** for minor markets balance analytical rigour with practical resource constraints. For smaller markets where detailed primary research is not economically feasible, careful extrapolation from similar markets provides reasonable estimates while acknowledging higher uncertainty levels.

**Market coverage decisions** require balancing comprehensive analysis with diminishing returns. While major markets deserve detailed analysis, attempting to achieve the same level of precision in every market would be neither practical nor cost-effective.

PHOTO: TESSENDERLO

*Plantation crops such as coffee are part of the success story for value-added fertilizers in Latin America.*

## Adapting to changing technology

VAF market tracking must accommodate rapid technological change and product innovation. The approach to this is threefold:

**New product category integration** requires flexible definitional frameworks that can incorporate novel formulations without losing analytical consistency. As companies develop new combinations of nutrients, biostimulants, and enhancement technologies, the tracking methodology must evolve accordingly.

**Precision agriculture integration** increasingly affects VAF application methods and effectiveness. Variable rate application, sensor-guided timing, and GPS-guided placement change both adoption patterns and market dynamics.

**Future-proofing tracking systems** involves designing methodologies that can accommodate anticipated technological developments without requiring complete reconstruction of historical data sets.

## Market intelligence products

Intelligence outputs are valuable if they can turn data into actionable Insights. In practice, effective VAF market intelligence generates multiple analytical products that serve different strategic purposes.

**Treated hectares** has emerged as a key performance metric that often proves more valuable than simple market value measurements. This metric captures market penetration trends and adoption patterns that pure financial measures might miss. A market showing rapid growth in treated hectares but stable total value might indicate price compression, while the reverse pattern suggests a trend in 'premiumisation' – a shift from commodities to VAFs.

**Application type analysis** reveals market development patterns and technology adoption trends. Markets with high foliar application rates, for example, typically indicate more sophisticated grower adoption, while the dominance of soil application might suggest earlier-stage market development or different crop system requirements.

**Crop group performance tracking** enables strategic positioning and resource allocation decisions. Understanding which crop segments drive growth helps companies focus on product development and marketing efforts.

## Validation and accuracy

**Multi-source validation protocols** ensure that market intelligence reflects genuine market conditions rather than statistical artefacts. When multiple independent data sources confirm similar trends, confidence in the analysis increases significantly.

**Network-based accuracy checking** leverages industry relationships and regional expertise to validate analytical conclusions. Ground-truth verification through distributor networks and industry contacts provides reality checks on model outputs.

**Confidence intervals and data quality indicators** provide users with explicit information about analytical certainty. Markets with extensive data sources receive higher confidence ratings than those requiring significant extrapolation.

## The competitive advantage

A rigorous VAF tracking methodology offers competitive advantages and a strategic market understanding that extends beyond simple market sizing.

**Investment decision support** becomes particularly valuable in merger and acquisition activities. Understanding market development trajectories, competitive positioning, and growth opportunities requires sophisticated market intelligence that goes beyond basic market research.

**Competitive landscape mapping** through systematic tracking reveals market share trends, competitive positioning changes, and strategic opportunity identification. Companies can identify markets

where competitors are gaining or losing ground and adjust strategies accordingly.

**Market development pattern recognition** across regions enables strategic planning and resource allocation. Understanding how VAF markets develop in different agricultural systems helps predict future opportunities and challenges.

## Building an industry-wide intelligence capability

**Standardised tracking approaches** benefit the entire industry by establishing common metrics and definitions. When multiple organisations use consistent methodologies, market intelligence becomes more reliable and actionable across the industry.

**Collaborative intelligence approaches** can reduce individual research costs while improving overall data quality. Industry associations and trade organizations can play valuable roles in coordinating market intelligence efforts.

**Establishing benchmarks**, using a rigorous methodology that creates industry standards, helps to improve decision-making across the value chain.

## Conclusions

The value-added fertilizer market has reached a scale and sophistication that demands equally sophisticated market intelligence capabilities. VAFs represent one of agriculture's most dynamic segments, being valued at $20 billion globally and growing at 5.5% annually, with more than 1.7 billion applications per season. Yet this growth potential can only be captured effectively with robust market intelligence that goes beyond traditional market research approaches.

The methodological framework outlined here – combining definitional precision, multi-dimensional segmentation, sophisticated data integration, and rigorous validation – provides the foundation for strategic decision-making in this complex market. From investment allocation to competitive positioning, from product development to market entry strategies, the quality of market intelligence directly affects business outcomes.

Looking forward, VAF market intelligence must evolve alongside technological developments in precision agriculture, genetic engineering, and formulation science. The integration of sensor technologies, predictive analytics, and AI-driven insights will create new opportunities for market intelligence while requiring continuous methodological refinement.

The companies and organisations that invest in building robust VAF market intelligence capabilities today will be best positioned to capture the growth opportunities that will undoubtedly emerge as this market continues its rapid evolution. In an industry where the difference between success and failure often comes down to being in the right place at the right time with the right products, superior market intelligence becomes the foundation for sustained competitive advantage.

The path forward requires not just better data collection, but the development of market intelligence as infrastructure – systematic, rigorous, and continuously refined to serve an industry in rapid transition. The value-added fertilizer market deserves nothing less than market intelligence that matches its sophistication and potential. ■

### About the author

Vatren Jurin is Chief Technology Officer and Partner at DunhamTrimmer.

# Tailored fertilizer blending – from inline coating to full plant solutions

As the global demand for high-performance fertilizer blending systems continues to grow, Dutch manufacturer EMT remains a key player in delivering custom-engineered solutions. With over 35 years of experience and installations in more than 80 countries, EMT focuses on practical, modular systems that integrate seamlessly into diverse operational environments. **Zico Zeeman**, EMT's Commercial Director, highlights two notable recent projects.

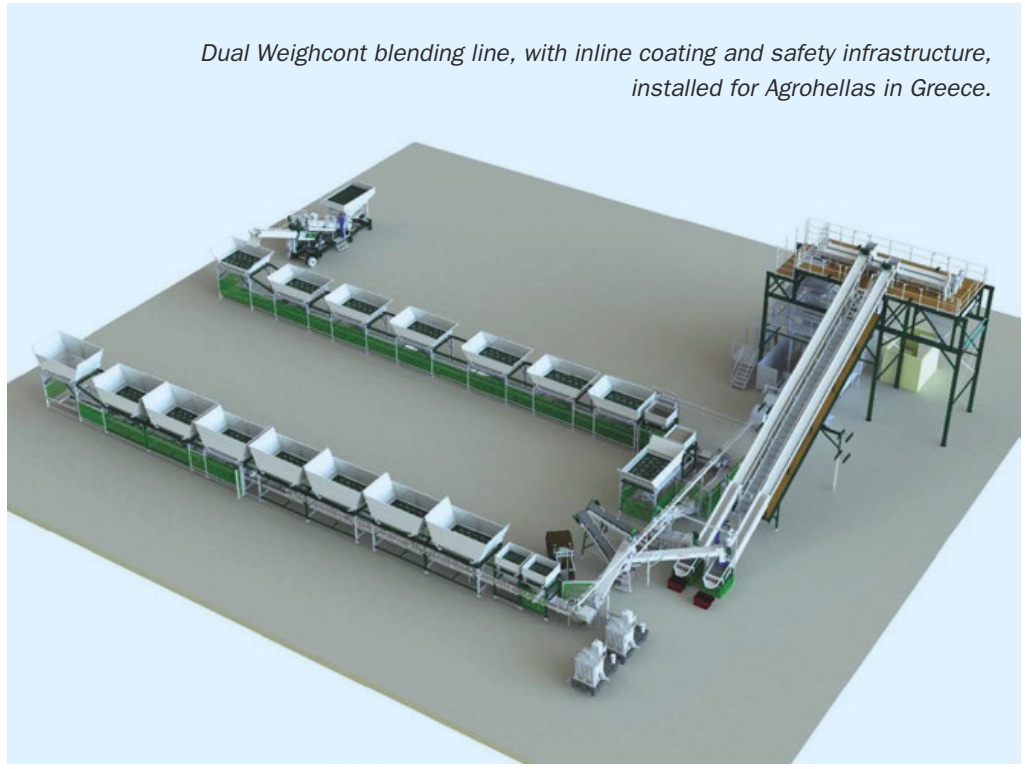
The following two recent projects – for Agrohellas in Greece and Thomas Bell in the UK – demonstrate EMT's strength in building versatile, high-output blending lines with integrated liquid coating and dosing technology.

## Dual-line continuous blending system for Agrohellas in Greece

For Greek fertilizer blender Agrohellas, EMT delivered one of its most comprehensive installations to date: two parallel Weighcont continuous blending lines, each equipped with 10 dosing hoppers, multiple liquid adding units, inclined blending screws and coarse screens.

To handle a wide range of raw materials, both lines were fitted with custom hopper configurations – including 9m³ and 12m³ extensions – and pre-cabled weighing units for fully automated dosing. Stainless steel support frames, access platforms, and conveyor safety features were integrated throughout the layout to meet both performance and operator safety requirements.

A key component of the line is EMT's liquid coating unit, which includes a continuous weighing scale, pump, stainless steel piping or special hoses, and distribution system. This configuration allows Agrohellas to apply liquids in the blend with high dosing accuracy, without interrupting the blending process.



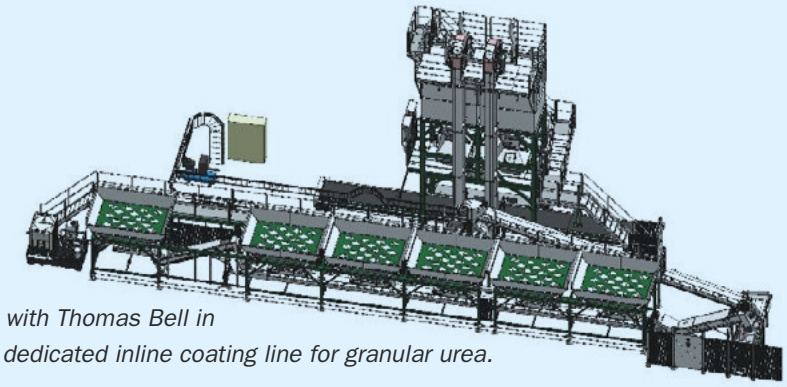
*Dual Weighcont blending line, with inline coating and safety infrastructure, installed for Agrohellas in Greece.*

PHOTO: EMT

Following blending, material is screened using a 120 m³/h fertilizer vibrating screen before being transported to the bagging equipment. The complete plant is designed for reliable, high-capacity operation with central control and real-time feedback.

The installation of this ultramodern production line in Anchialos, Thessaloniki, represents a major investment in capacity by Agrohellas and demonstrates the company's commitment to supplying the domestic agricultural market, now and into the future.

PHOTO: EMT



*EMT partnered with Thomas Bell in the UK on this dedicated inline coating line for granular urea.*

## Inline coating and high-speed twin big bagging for Thomas Bell

In the UK, fertilizer distributor Thomas Bell partnered with EMT to design and fabricate a blender with a dedicated inline coating line for granular urea. This compact system applies liquid treatments directly into the material flow, using weigh-controlled dosing to ensure consistent coverage. After treatment, the urea is directly added to the blend.

To support the higher output from this blender process, EMT also supplied a Twin Big Bag High Speed filling unit, capable of filling two flexible intermediate bulk containers (FIBCs) simultaneously at rates up to 120 bags/hour. The system provides fast, clean, and automated handling – ensuring high throughput without sacrificing accuracy.

A special feature of this system is the twin elevator principle. To prevent incompatible products being transported in the same elevator, the customer has two elevators, both being able to fill either hopper of the twin bagging unit.

This equipment combination allows Thomas Bell to coat and bag efficiently within a limited footprint, delivering flexibility in product handling and seasonal product demands. Investment in the new system will help the company maintain its status as the UK's largest privately-owned fertilizer importer offering a wide range of high-quality products – backed up by state-of-the-art blending plants, 150,000 sq ft of undercover storage and its own fleet of lorries.

## Modular thinking, global results

Whether it's a greenfield installation or a retrofit in an existing warehouse, EMT designs its systems with modular logic. From small and big bagging lines to batch blending, coating, and screening equipment, each part is built to match the customer's process and raw materials.

With its in-house team of mechanical, electrical and software engineers, EMT continues to support producers worldwide with machines that combine reliability with flexibility. All systems are assembled and tested in the Netherlands, with international installation and remote service provided by the company's own technicians.

# IFA's Sustainable Fertilizer Academy – transforming the fertilizer industry

By investing in education today, the International Fertilizer Association (IFA) – through its Sustainable Fertilizer Academy (SFA) – is cultivating a technically proficient workforce that is environmentally conscious and socially engaged. In doing so, the academy is helping to implement a more sustainable future for agriculture and the fertilizer industry. The SFA's **Alexandra Dorison** highlights its success and rapid progress to date.

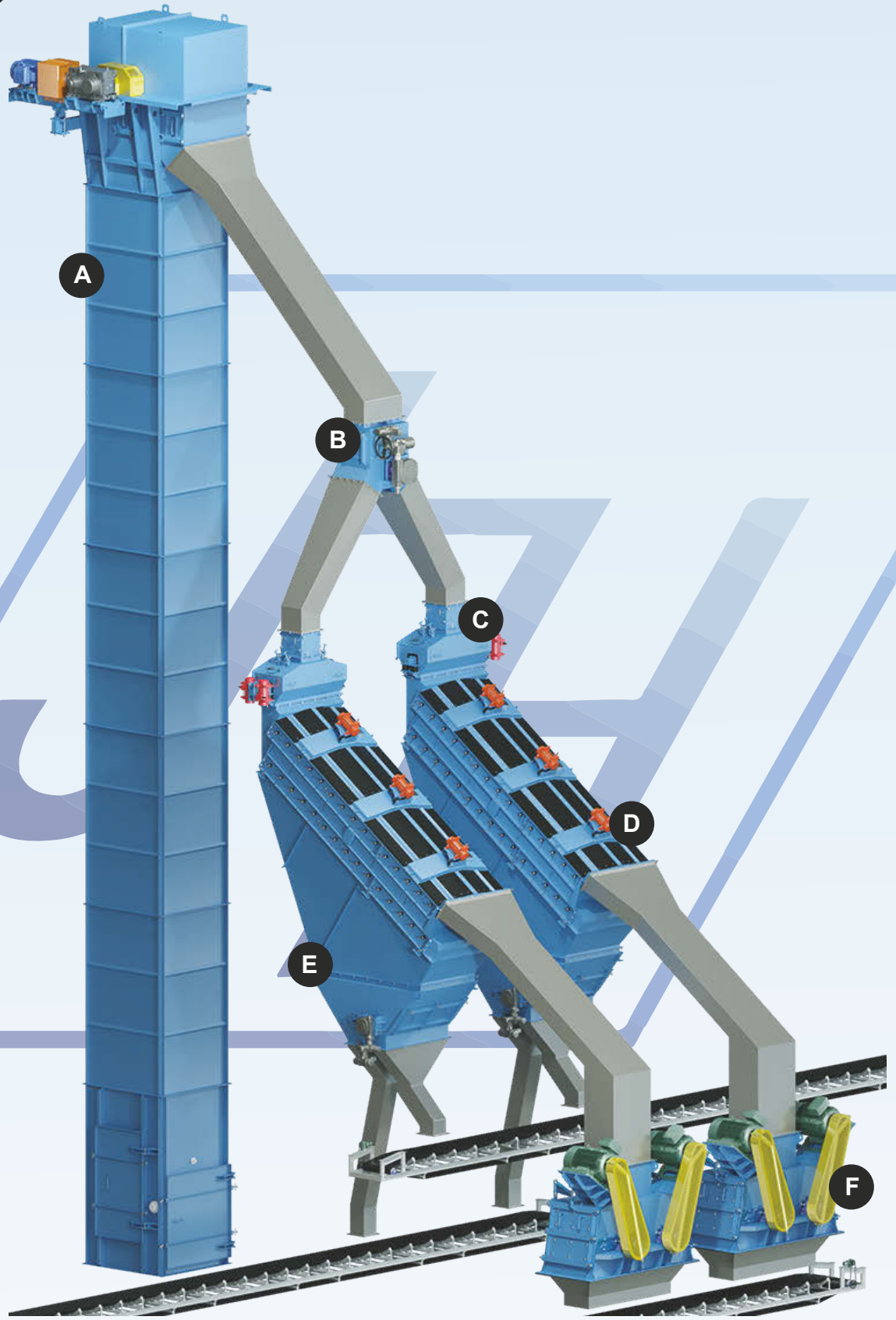
## An academy open to all

As the fertilizer industry faces increasing sustainability expectations, the need for knowledgeable, forward-thinking professionals has never been greater. Addressing climate change, enhancing nutrient stewardship, and reducing environmental impact all hinge on the skills and commitment of the people driving the sector forward.

The International Fertilizer Association (IFA) and its Sustainable Fertilizer Academy (SFA) – a virtual education platform dedicated to equipping current and future professionals – provides the tools and insights needed to lead the industry's sustainability transformation.

Founded in September 2022 (*Fertilizer International* 514, p17) and now in its third year, the SFA has become a pillar of IFA's strategy to build sustainability competencies across the global fertilizer industry. Through its e-learning platform, the Academy provides structured, multilingual training on topics ranging from fertilizer fundamentals to advanced sustainability practices. It supports workforce development in companies while also extending its reach to young professionals and students through university partnerships. The SFA is open

*Alexandra Dorison, IFA's Sustainability Education Coordinator at the Association's recent Annual Conference in Monaco.*




## Fertilizer Process & Recycle System

- **A** Severe Duty, Continuous Discharge Bucket Elevator
- **B** Modulating Material Stream Splitter
- **C** Static Body, Vibrating Pan Screen Feeder
- **D** Static Body, Vibrating Wire Screen Machine
- **E** Recycle Control Splitter
- **F** Oversize Crusher

to all learners, not only IFA members – inviting anyone interested in sustainability in the fertilizer sector to participate.

## Tailored learning

The SFA offers two distinct learning levels, tailored to meet the diverse needs of learners within and beyond the industry. Level 1 introduces foundational concepts such as the basics of fertilizers and sustainability frameworks. Level 2 delves deeper into more specialised areas, including emissions reduction, circular economy principles, biodiversity impact, and nutrient stewardship.

Classes are delivered through an engaging e-learning platform, and subtitles are available in Arabic, English, Portuguese, Spanish, and Turkish, making the content accessible to a broad audience. The use of a 'Company Access' model also enables IFA's member organisations to integrate SFA learning into their internal training systems, helping build sustainability competencies across teams.

## Truly global

What distinguishes the SFA is its commitment to reaching learners not just in corporate offices, but also in classrooms and rural training centres around the world. In Brazil, for example, the Academy has partnered with the Federal University of Mato Grosso (UFMT), and in its second year has enrolled over 1,600 learners in their collaborative programme. This partnership model exemplifies the SFA's goal of expanding its reach both geographically and demographically, while working alongside local universities and government institutions to integrate sustainability into their education.

In West Africa, through a partnership with the West African Fertilizer Association (WAFA), the SFA has educated over 1,000 agronomy students across nine universities in Nigeria, Liberia, and the Ivory Coast. Using a hybrid approach, students participate in workshops led by trained WAFA facilitators who present SFA content in on-site sessions. This approach not only accommodates areas with limited internet connectivity but also fosters discussion, mentorship, and peer-to-peer learning – critical components for building a community of practice around sustainable fertilizer use.

In China, the Academy has reached an astonishing 1.32 million agriculture professionals for the third year running through its collaboration with IFA member Sino-Agri. By dubbing SFA courses in Mandarin and broadcasting these through Sino Agri's live-streaming platform, IFA has made its sustainability training accessible to a vast network of agronomists throughout the country.

PHOTO: IFA/WAFA

*Sustainable Fertilizer Academy 2024 workshop at the Ahmadu Bello University in Zaria, Nigeria, in collaboration with the West African Fertilizer Association (WAFA).*

## Training the industry's next generation

By equipping students with essential knowledge early in their careers, the Academy ensures that the next generation of agronomists and industry professionals enter the workforce with a deep understanding of the environmental and social dimensions of fertilizer use and production.

Moreover, these efforts help address a pressing concern across the fertilizer industry, such as talent attraction and retention. Young professionals today are driven not only by career opportunities, but also by values. They seek employers whose missions align with their own commitment to sustainability. By engaging with students through the SFA, IFA is positioning the fertilizer industry as a pathway to an exciting, purposeful career.

## Upgraded access

A major redesign of the Academy's website is currently underway to improve the user experience, with a special emphasis on mobile-friendly, micro-learning formats. This will allow audiences, especially those in low-bandwidth or remote areas, to access key insights without needing a desktop computer or high-speed internet.

Additionally, the Academy is preparing to launch a new initiative of executive training modules designed for senior leaders within the fertilizer industry. These in-person sessions will tackle complex strategic issues such as climate transition planning and sustainability reporting, topics that are increasingly shaping corporate decision-making.

## More to come...

The SFA's next steps are to continue expanding its impact by developing educational content specifically for farmers, further extending its reach and relevance to those working directly on the ground.

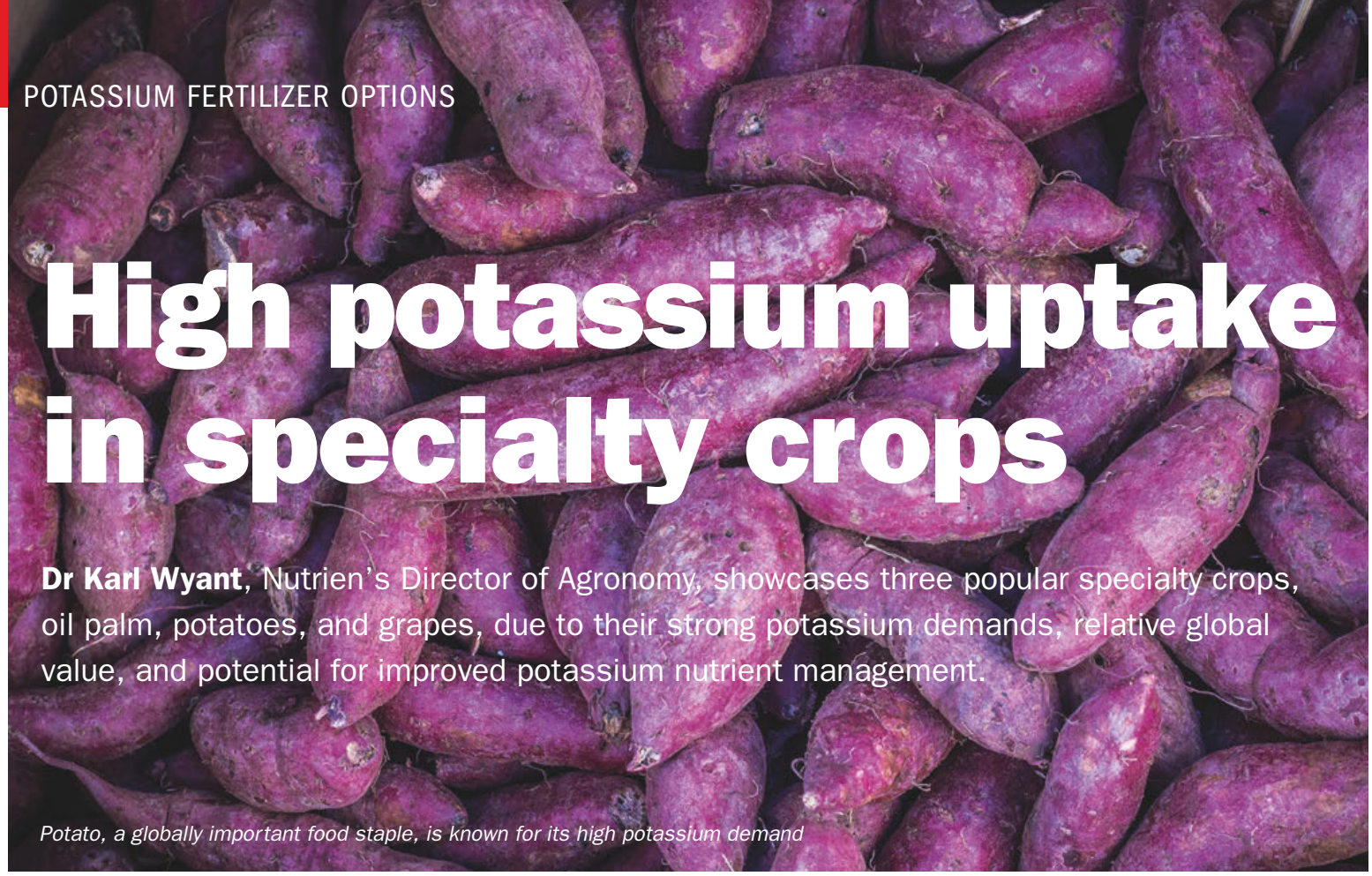
The impact of the SFA is rooted in its existing and upcoming collaborations. Whether with universities, regional associations like WAFA, or digital innovators such as Sino-Agri, the Academy thrives on these partnerships. The Academy's mission to empower the people who will drive the fertilizer industry's transformation toward sustainability remains steadfast.

By investing in education today, IFA, its members, and universities are cultivating a workforce that is not only technically proficient but also environmentally conscious and socially engaged. In doing so, the SFA is helping to implement a more sustainable future, for agriculture, for the fertilizer industry, and for the planet. ■

July-August 2025

# phosphates & potash INSIGHT





# High potassium uptake in specialty crops

**Dr Karl Wyant**, Nutrien's Director of Agronomy, showcases three popular specialty crops, oil palm, potatoes, and grapes, due to their strong potassium demands, relative global value, and potential for improved potassium nutrient management.

*Potato, a globally important food staple, is known for its high potassium demand*

PHOTO: RUNGSURIYA CHAREESRI/SHUTTERSTOCK.COM

## A vital nutrient with knowledge gaps

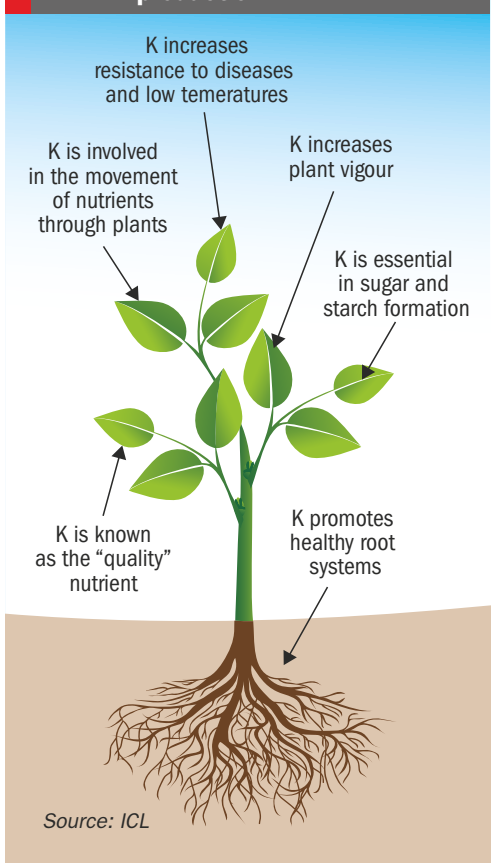
The potassium (K) nutrition of crops is vital (Figure 1) and has received more attention in recent years due to global reports of increased soil deficiency and associated yield losses.

Short-term potassium deficiencies occur when the supplying power of both the soil and fertilizer cannot keep up with the daily uptake by the crop during the active growing season. Long-term potassium deficiency in soils can also be created when potassium inputs to the system (e.g., K supply from fertilizers and manures) do not match potassium offtake from the field at harvest (e.g., K removal by potato tubers).

The resulting imbalance in the potassium 'budget' (i.e., where nutrient removals exceed nutrient inputs) can result in the gradual drawdown of the soil's K reserves, leading to deficiency occurring with increasing frequency over time[1]. In many areas of the globe, K inputs from fertilizer – such as muriate of potash (MOP 0-0-60 or 0-0-62) – and manures have not kept pace with increasing yields, leading to consistent patterns of reccurring K deficiency.

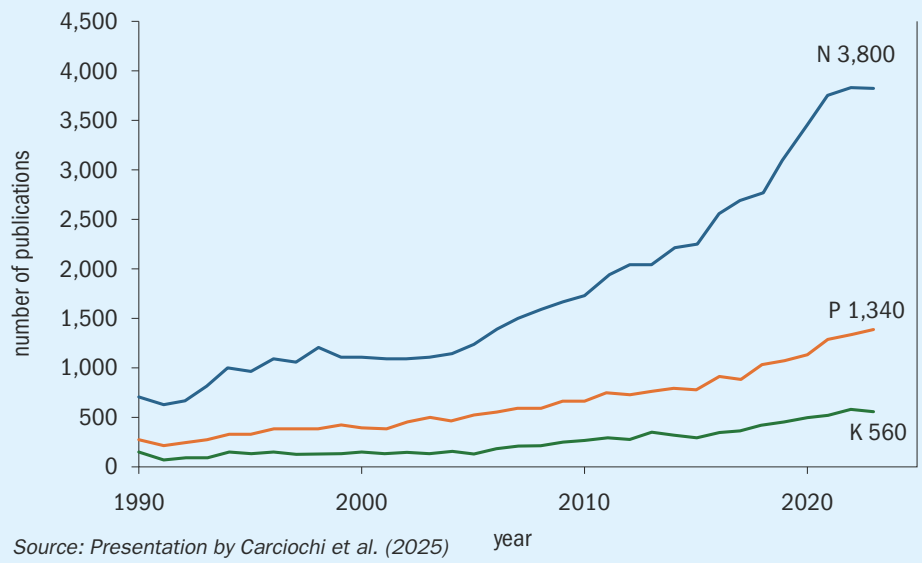
Another complication to the potassium story is the relative lack of published agronomic trial data, compared to nitrogen and phosphate (N & P), the more popular of the 'Big 3' plant nutrients. In a recent presentation, Walter Carciochi of the University of Nebraska and fellow researchers estimated there was one potassium study for every seven nitrogen studies and 2.5 phosphate studies, based on the number of papers published in the final year of their literature analysis (Figure 2).

Fig. 1: **The role of potassium in crop production**




*Source: ICL*

Fig. 2: **Published crop studies on nitrogen (N) and phosphate (P) are far more numerous than those for potassium (K)**




*Source: Presentation by Carciochi et al. (2025)*

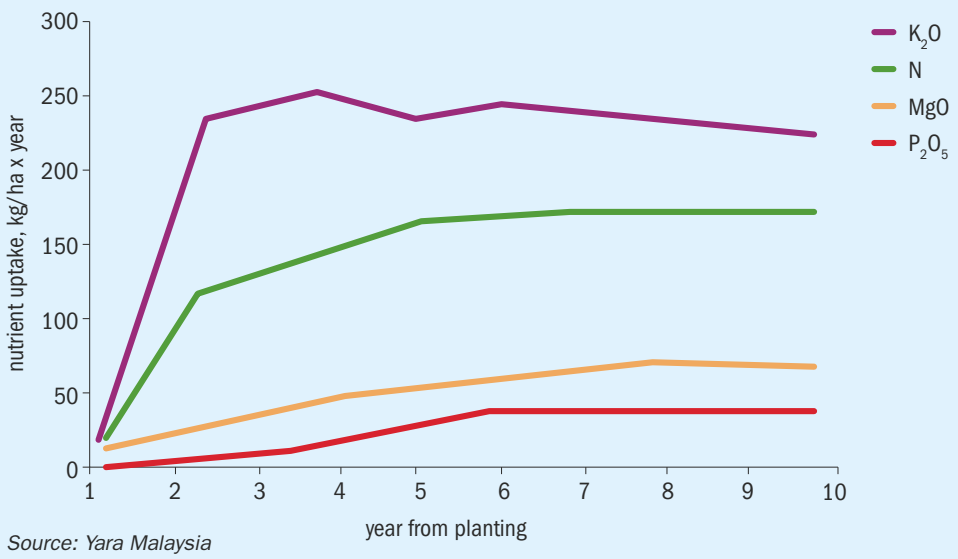
Table 1: **2016 harvest: value, production, and potassium uptake and removal for palm oil, potato and grapes**

| Crop type | Global value (billions USD) | Tonnes produced | Potassium uptake ($K_2O$ kg/ha) required for 1 t/ha yield | Potassium removed ($K_2O$ kg/ha) at harvest for 1 t/ha yield |
|---|---|---|---|---|
| Palm oil + fruit | 69.7 | 313,724,107 | 13.0 | 5.0 |
| Potatoes | 92.7 | 356,952,488 | 12.0 | 6.5 |
| Grapes | 67.8 | 74,089,693 | 6.0 | 2.0 |

*Source: FAO 2016, IPNI 2014 and www.nutrien-eKnomics.com*

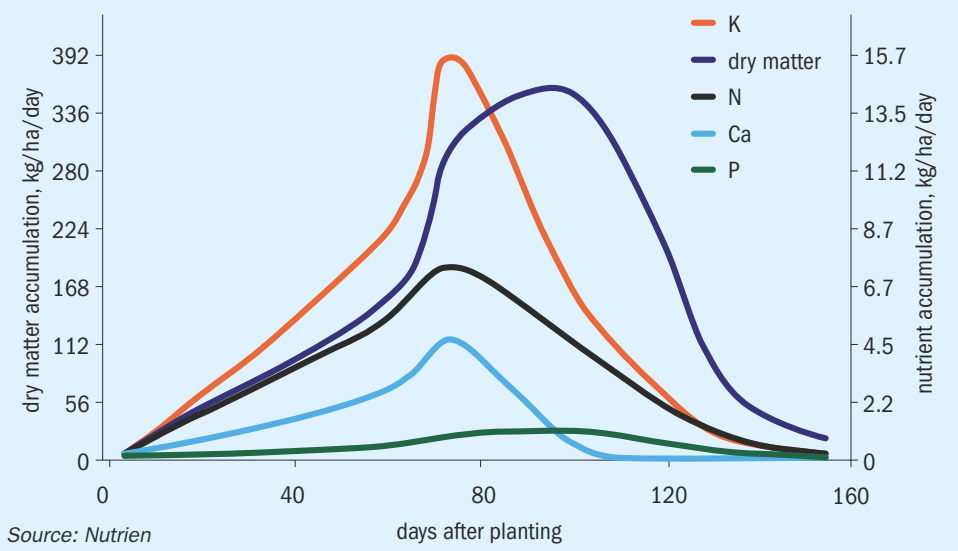
This relative absence of evidence is exacerbated by the fact that many published K studies concentrate solely on potassium uptake and its impact on yields for the 'Big 4' row crops, maize, soya, wheat, and rice. This leaves a crucial knowledge gap about the potassium fertilization of important specialty and horticulture crops, these being popular options for growers located in suitable climates.

Fig. 3: **Yearly total nutrient uptake by oil palm. Top line shows the crop's large potassium demand, relative to nitrogen, phosphorus, and magnesium**




*Source: Yara Malaysia*

Fig. 4: **Daily dry matter accumulation (left axis) and nutrient uptake (right axis) for potatoes. This chart shows the crop's strong potassium uptake, relative to nitrogen, calcium and phosphorus for potatoes.**




*Source: Nutrien*

In this article, I will highlight potassium use by three popular specialty crops – oil palm, potatoes and grapes – due to their global value, strong K demands, and the potential for improved management of this major nutrient.

## Crop value and crop potassium demand

Oil Palm, potatoes, and grapes can be used to showcase potassium dynamics in this article because of the availability of crop uptake and removal data for potassium and published nutrient uptake graphs. Similar uptake estimates and charts exist for other specialty crops (citrus, sugar cane, almonds, etc.) and it is therefore likely that a local crop expert can readily produce these for growers should they be needed

Table 1 shows key 2016 global agricultural metrics for oil palm, potatoes, and grapes, in terms of the crop value and metric tonnages produced. Of relevance to this article are both total crop requirement for potassium and potassium removal by the crop at harvest (kg $K_2O$/ha basis). These are shown for each tonne per hectare of crop yield (1 t/ha).

Farm-level potassium uptake and removal can be calculated simply by multiplying the numbers listed on the right side of the Table 1 by the farm yield (t/ha). In general, these data highlight the large quantities of potassium needed for growing crops of marketable quality at high yields.

Examples of K allocation in specialty crops are shown below.

## Oil palm

Oil palm fruit can be processed to generate an important vegetable oil – palm oil – at high yields, making it an important crop for hot, humid regions.

Palm oil and palm kernel oil held a 35 percent share of total global vegetable oil production in 2020/21, according to

USDA, with 73.8 million tonnes of palm oil produced that year. Southeast Asia (mainly Indonesia and Malaysia) contributed 84 percent to this production total with the rest produced in Africa and Latin America.

The yield per hectare from oil palm plantations is considerably higher than for other oilseed crops (rapeseed, soybean, sunflower, etc.) and a developed field can produce for several years before being replanted. Consequently, oil palm remains an attractive and profitable crop choice in suitable growing regions.

Oil palm has a particularly high potassium demand – showing a staggering requirement of around 250 kg $K_2O$/ha/yr (!) during peak production between years two and eight. Furthermore, there is a direct connection between potassium uptake and crop performance and oil yield (Figure 3).

Due to the high potassium demand of oil palm, growers routinely apply potassium fertilizers to help support high yields over the lifetime of the crop. Indeed, potassium fertilizers are often the largest nutrient input for the grower and much attention is paid to proper K management.

## Potatoes

Potatoes are a starchy crop and carbohydrate staple in many parts of the world. Prized for its versatility, harvested tubers can be peeled and cooked fresh or frozen, fried into chips (crisps), or even fermented to produce alcoholic drinks. Unsurprisingly, given the wide variety of ways potatoes are consumed, this crop is top of mind for growers and consumers alike across the globe.

What is less well known is the strong potassium demand required by high yielding, high quality potato crops during the growing season (Figure 4). At its peak, roughly 80 days after planting, the daily potassium demand (elemental K) of potato is more than double that of nitrogen. The peak in dry matter accumulation (the portion harvested for food production) also occurs shortly after N and K uptake reach their maximum.

Field observations and research have shown that potassium plays an outsized role in influencing potato crop yield and quality. Figure 4 helps illustrate exactly why this is the case.

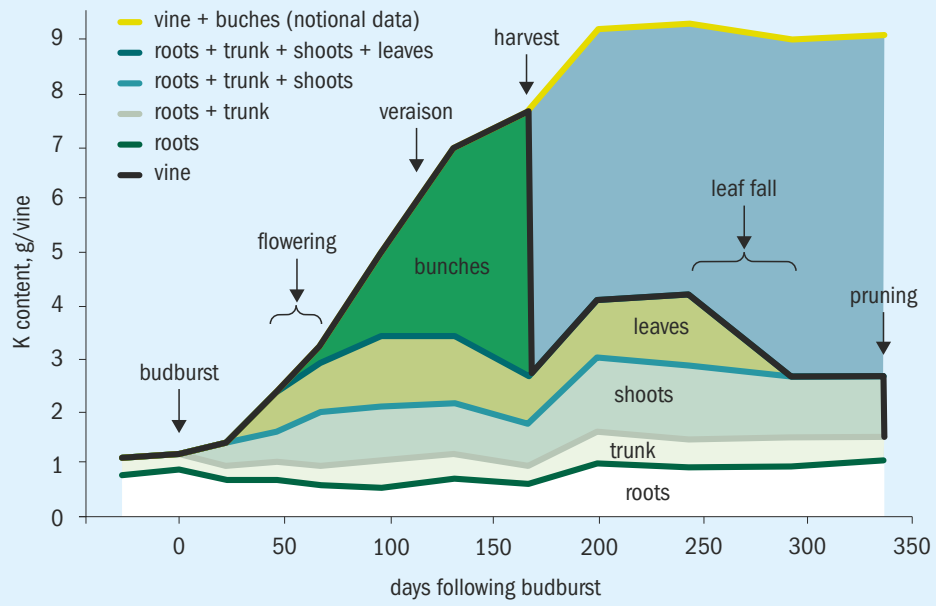
## Grapes

Similar to potatoes, grapes are common in many diets around the world. Their popularity is due primarily to the versatility of the harvested fruit and the tolerance of grapevines to a wide variety of growing conditions.

Grapes are harvested and then served fresh as table grapes, processed into juice, dried into raisins, and famously fermented to produce wine. Potassium plays a key role in supporting grape yield and quality with this crop having a relatively high K demand as a result.

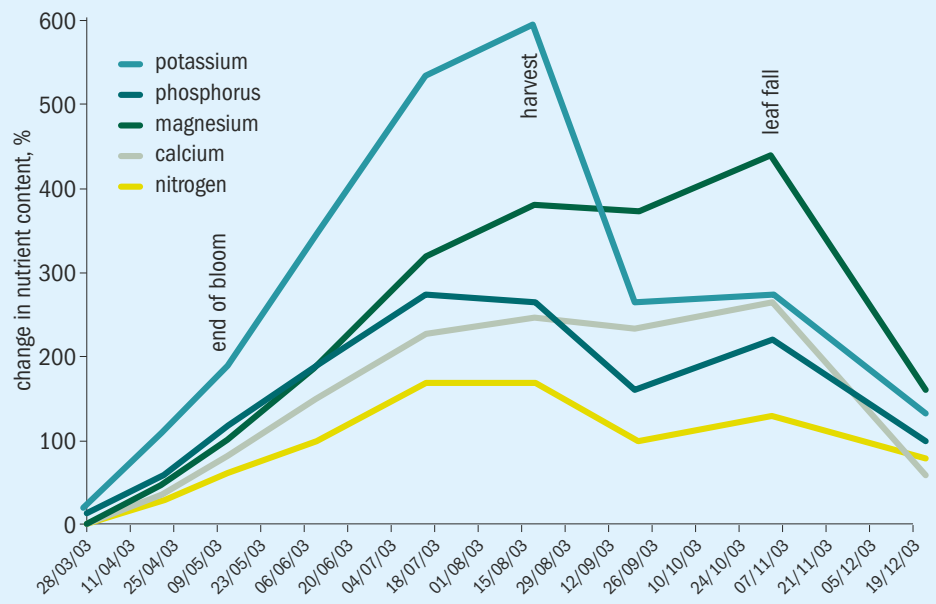
Figure 5 shows the accumulation of potassium (elemental K basis) in various plant parts (roots, shoots, trunk, vine, and grape bunches) over the growing season. Note the strong sink for potassium in the bunches starting 50 days after budburst and continuing into harvest (green section, Figure 5). Potassium demand peaks while the grape bunches are actively growing – and it should be no surprise that potassium uptake exceeds that of nitrogen and phosphate during this period (Figure 6).

Fig. 5: **Accumulation of K in different parts of the grapevine following budburst**




*Source: Mpelasoka (2003)*

Fig. 6: **Grapevine demand for nitrogen, phosphorus, potassium, magnesium and calcium over the growing season**




*Source: Conradie (1980) and Conradie (1981)*

## Crop management considerations

Potassium nutrition in specialty crops requires careful management to balance fertilizer input costs, crop performance, and grower profitability. Potassium deficiencies can be addressed using soil tests and the adjustment of nutrient application rates in response.

In-season demand for K can be met through the top dressing of dry granular fertilizers – such as potassium chloride (MOP) or potassium sulphate (SOP) – or via the fertigation or foliar application of water-soluble/liquid potassium fertilizers.

Tissue and soil sampling can help estimate crop nutrient demand through the growing season and are therefore key for informing local nutrient management plans. Moreover, knowing the timings of high K uptake demand (see Figures 3-6) are crucial for understanding when potassium applications should be prioritised.

In general, a strong agronomic understanding of K needs is critical for managing the impact of potassium fertilizer inputs on specialty crops, which often have a higher elevated uptake rate when compared to nitrogen and phosphate. Recognising that plant-available potassium is quite scarce in arable soils helps to focus nutrient management priorities (Figure 7).

Overall, an improved understanding of K nutrition in specialty crops can result in a refined nutrient management plan that optimises crop yield and quality and helps prevent environmental issues.

## Conclusions

Specialty and horticultural crops are important components of the global agricultural system. These crops are crucial for regional and local food security as harvested products can often be eaten fresh or processed further into familiar food products and beverages (see above sections on potatoes and grapes).

Despite the importance of specialty crops in our daily life, this diverse set of plants are relatively understudied when compared to the 'Big 4' row crops – maize, soya, wheat, and rice – that are planted to much higher total hectares each season.

In contrast, studies of the potassium nutrition of specialty crops are relatively rare, although this is understandable given the smaller planted expanse, the niche climate zones needed to grow these crops, and their smaller economic impact globally. Nonetheless, to address existing knowledge gaps, efforts should be made by local university and agricultural professionals to prioritise potassium studies. This is especially vital given the important influence of this nutrient on the yield and quality of specialty crops – and the primacy of potassium uptake by these crop types compared to nitrogen and phosphorus, which still get the lion's share of research attention currently. ■

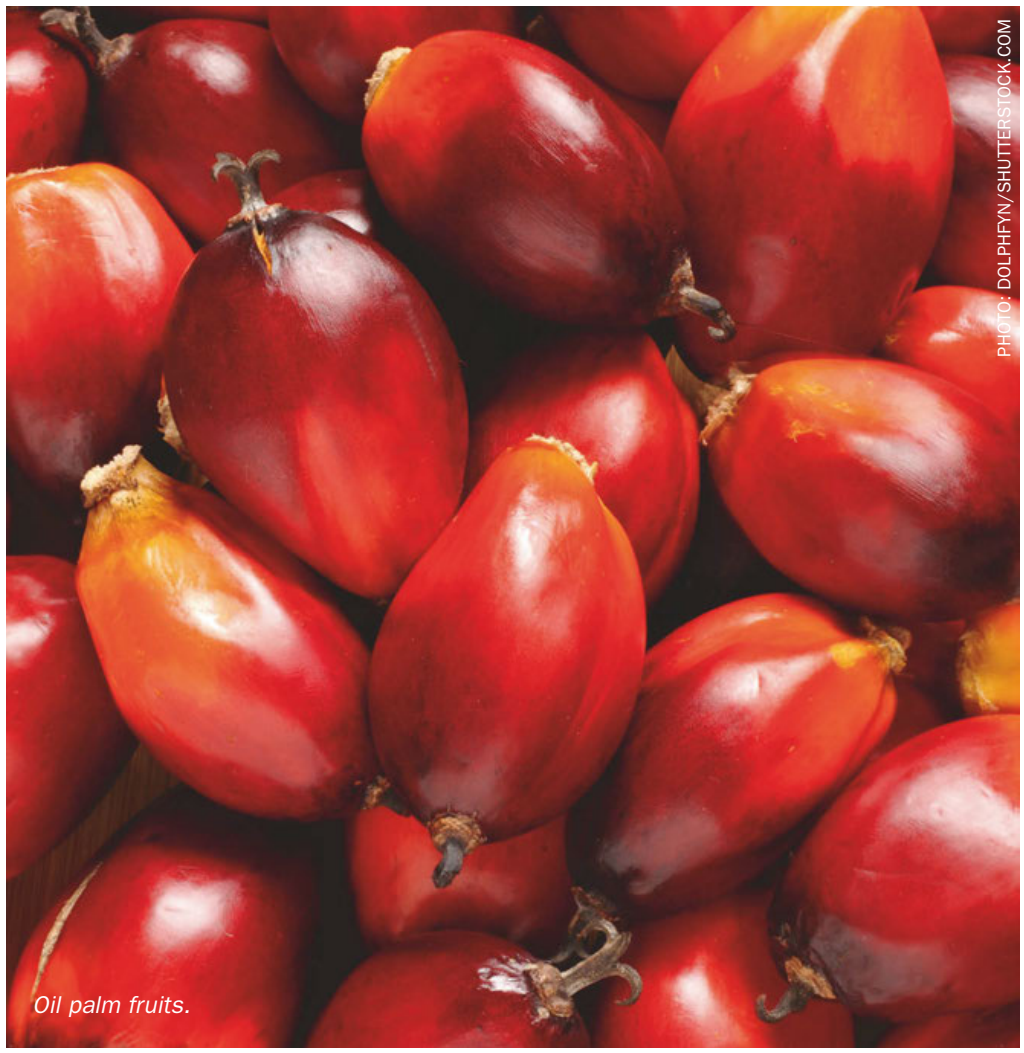
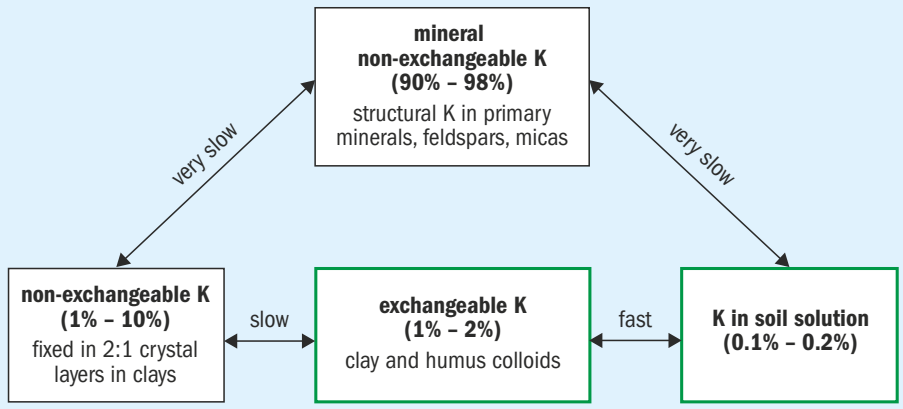


PHOTO: DOLPHFYN/SHUTTERSTOCK.COM

*Oil palm fruits.*

Fig. 7: **Soils contain four general pools of potassium, with these often being held in large amounts in minerals, clays, organic matter and the soil solution, respectively. Plant available potassium (exchangeable K or K in soil solution) is typically low, however, representing only 1-2% of total soil K**




*Source: Better Crops (2011)*

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# The long-term SOP outlook – a hot topic

PHOTO: CINIS FERTILIZER

In this CRU Insight, **Wahome Muya** and **Willis Thomas** of CRU Consulting take a deep dive into the long-term prospects for the potassium sulphate (SOP) market. In particular, they ask what impact could export controls in China have on SOP market dynamics over the next 25 years?

*Sweden's Cinis Fertilizer is a new market entrant that began supplying SOP to the market in 2024.*

## Introduction

In CRU's recently produced *Potassium Sulphates Long Term Special Report*, we show global potassium sulphate (SOP) supply/demand balances under two scenarios – both with and without Chinese capacity and demand being accounted for in the global picture.

This includes analysis of the specific years in which the global SOP market is set to balance, with and without Chinese participation, and the accompanying long-term price forecasts associated with each scenario. Our analysis is underpinned by an overview of long-term demand drivers, key demand-related risk factors, and an evaluation of regional SOP demand dynamics.

CRU Consulting's special report answers the following key questions:

- What are the key drivers underlying long-term growth in SOP demand, and in what regions are they most prevalent?
- What are the key agricultural, policy, and tech-related risks to long-term SOP demand growth?
- At what point in time do we expect a capacity requirement to emerge in the global SOP industry, and how does Chinese export policy affect that timeline?
- What is the long-term outlook for SOP market prices, and how are they determined?

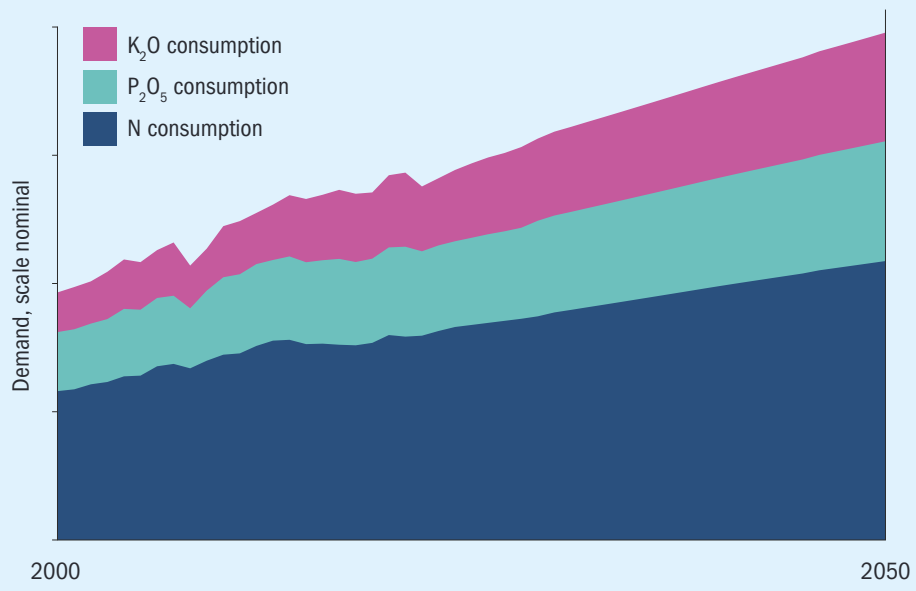
Being comprehensive in scope, the report provides:

1. An overview of long-term drivers behind fertilizer demand, and contrasts these with short- and medium-term drivers.
2. Analysis of key long-term demand risks, including resource constraints, climate change, and policy.
3. Long-term global $K_2O$ nutrient and SOP demand forecasts.
4. Overview of regional SOP demand dynamics, and underlying SOP demand drivers.
5. Global SOP supply/demand balances for two different China-based scenarios.
6. Long-term SOP price forecasts to 2045.

## SOP – a popular alternative

Although potassium chloride (MOP) will remain the primary source of $K_2O$ for nutrient consumption over the long term, SOP is the principal alternative potassium-based fertilizer consumed by farmers today. The popularity of SOP is mainly due to its low chloride levels – versus high chloride MOP – combined with its ability to provide sulphur as a crop nutrient, plus the ample availability of the product in water-soluble form.

Fig. 1: **Long-term forecast for global nutrient demand**




*Source: CRU*

Most crops have some degree of sensitivity to chloride, which can have detrimental effects on the quality (size, weight, colour, shape, taste, etc.) of some 'premium' crop categories, such as fruits, vegetables, tree nuts and tobacco, these being highly chloride sensitive. Approximately 20% of the world's harvested area is used to cultivate such chloride-intolerant crops, and chloride sensitivity can be a particular issue in regions with little rainfall and/or poor drainage, as chloride can accumulate in the soil.

Additionally, although sulphur has historically had little value as a crop nutrient, demand for sulphur-containing fertilizers has risen notably over the last 20 years. This has been necessary in response to a decline in atmospheric deposition of sulphur to soils (via industrial $SO_2$ emissions), as well as increasing levels of agronomic education and soil testing in the emerging agricultural economies.

With global agricultural demand for potassium set to increase (forecast at 1.8% CAGR from 2023-50) – driven by a rebalancing of nutrient consumption ratios away from nitrogen in key fertilizer-consuming countries such as China – we expect the share of $K_2O$ consumption accounted for by SOP to at least maintain its historical average of 8-9%.

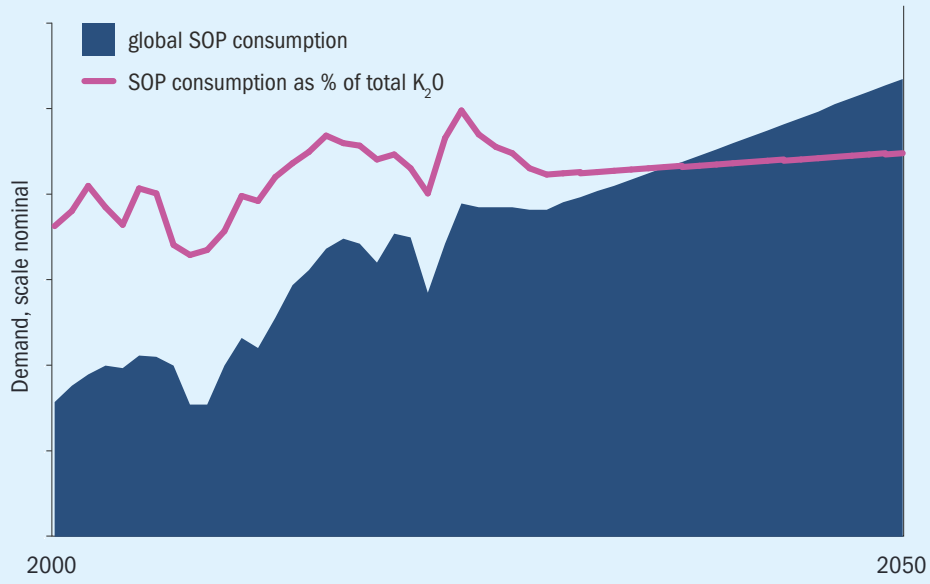
High analysis MOP will remain the agricultural mainstay for potassium fertilization of crops. Although the relative abundance and lower cost of MOP supply will support its growing consumption over the long term (Figure 1), the expansion of fruit and vegetable crop areas in key markets such as China – together with improved farmer agronomic knowledge in emerging agricultural centres such as Africa – should enable SOP to maintain its share of potassium nutrient demand (Figure 2).

## Future SOP capacity – when and how much?

CRU uses supply gap analysis to forecast the long-term global capacity requirement in the SOP industry. This is defined as the gap between our long-term global SOP demand forecast, and global SOP capacity at the end of the medium-term forecast in 2029. We are able to predict – up until this point – the timings and production volumes associated with individual projects in our pipeline.

A key area of uncertainty over the long term is the extent to which Chinese SOP supply should be considered in a global market balance. On the one hand, Chinese SOP exports peaked at nearly 400,000 tonnes in 2020 – at the time, making China the joint second largest SOP exporter in the world. Since mid-2021, however, China has put in place SOP export controls due to concerns about food security and high domestic prices. These controls were then intensified, firstly in October 2021 and again in January this year. Consequently, Chinese SOP exports for 2025 are expected to total only ~75,000 tonnes.

Fig. 2: **Long-term forecast for SOP demand**



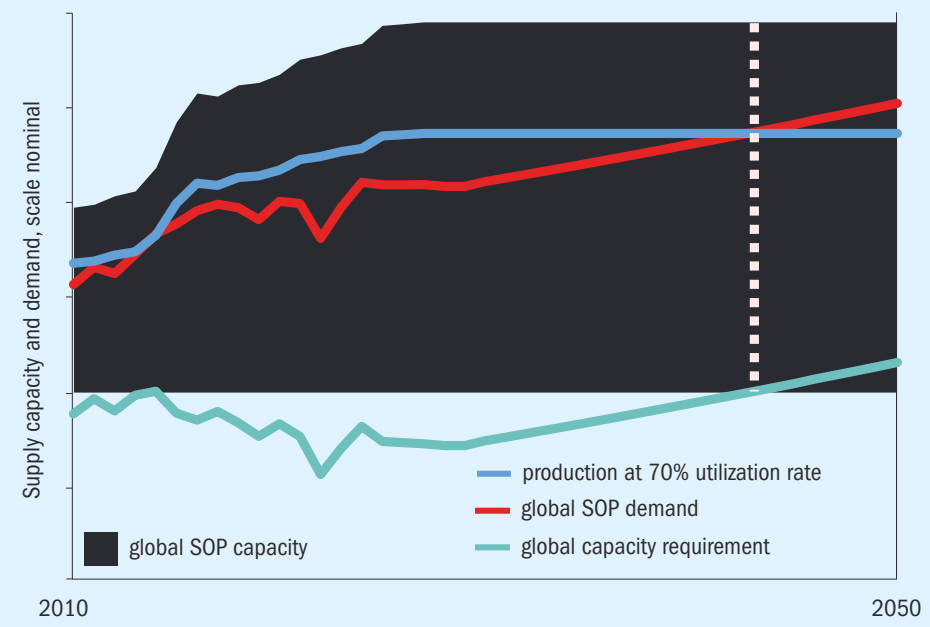

*Source: CRU*

## Chinese participation holds the key

Essentially, there is significant uncertainty surrounding the long-term future of Chinese SOP export restrictions, in terms of both their duration and severity. Although Chinese export restrictions seem unlikely to be lifted in the short-medium term, for a 25-year forecast horizon this becomes impossible to predict.

As a result, our long-term view of the SOP industry needs to take into account both scenarios – one with Chinese participation in

Fig. 3: **Long-term global SOP supply/demand balance, million t SOP. Scenario with Chinese participation in the global traded market**




*Source: CRU*

PHOTO: SALT LAKE POTASH

*Installation of the SOP crystallisation plant at Lake Way, Western Australia. It is curently owned by Sev.en Global Investments.*

the global traded market and the increased SOP supply availability that results from this (Figure 3), and another where the duration and severity of SOP export controls in China do not subside, and the country virtually functions as a separate, self-contained market (Figure 4).

In the report, we show the specific years in which the global market is set to balance, with and without Chinese participation, and the accompanying long-term price forecasts associated with both scenarios.

## The long-term SOP outlook – a hot topic

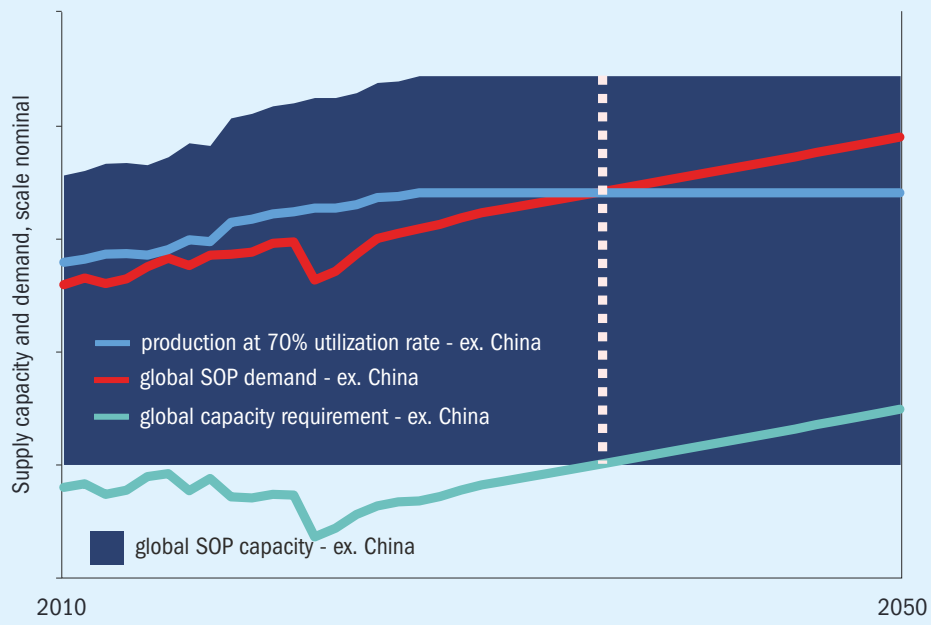
The outlook for SOP over the longer term has become something of an industry hot topic for several reasons:

Firstly, Chinese participation in the global traded market is a major point of uncertainty. One of the key questions explored in the report is the potential impact that Chinese export restrictions may have on long-term supply/demand balances in the SOP industry. The maintenance of export restrictions into the long-term could significantly tighten the global market balance, but a resumption of Chinese seaborne supply would exacerbate global oversupply.

Secondly, the demand potential associated with chloride-sensitive crops in key markets. The long-term growth prospects associated with SOP are linked to its use in the application of chloride-sensitive crops such as fruits, vegetables, tree nuts, and tobacco, where use of SOP is much more suitable than application of MOP. While SOP demand stemming from these crop categories is significant in markets such as China, other major producers of these crops such as India have a very nascent SOP market currently.

Thirdly, questions remain in relation to the long-term industry marginal producers. Over the past 10-15 years, we have seen significant efforts by project developers in regions such as Western Australia and Eastern Africa to advance primary SOP projects. However, these nascent industries have hit problems since 2021 in raising capital and navigating political instability. Meanwhile, established secondary SOP producers in regions such as NW Europe and East Asia continue to represent relatively stable, important sources of supply to the global traded market, and will likely continue to do so in the long term. The choice of long-run industry marginal producers forms the basis of our long-term price forecasts.

Fig. 4: **Long-term global SOP supply/demand balance, million t SOP. Scenario with export controls that exclude China from the global traded market (ex. China)**




*Source: CRU*

## Find out more

We look forward to exploring how CRU Consulting can help you deepen your understanding of SOP industry dynamics, supply/demand balances under different China-related scenarios, and implications for long-term pricing.

You can find out more about CRU's long-term outlook for the SOP industry in the CRU *Potassium Sulphates Long Term Special Report*. If you are interested in this report, please reach out and contact us below. ■

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# Phosphorus recovery tech emerging at scale

EasyMining's Ash2™Phos technology recovers phosphorus from incinerated sewage sludge ash and manufactures a safe, high-grade calcium phosphate product (RevoCaP™) by eliminating contaminants. EasyMining's **Christian Kabbe** provides an update on the company's first full-scale Ash2™Phos plant in Germany.

PHOTO: GELSENWASSER

*Official ground breaking ceremony in May at Schkopau, Saxony-Anhalt, Germany, the home of the world`s first full-scale Ash2™Phos plant.*

## Breaking new ground

On 26th May, a sunny day in Eastern Germany and in the presence of Prof Dr Armin Willingmann, Minister for Science, Energy, Climate Protection and the Environment in Saxony-Anhalt, the ground was officially broken at the chemical industry park in Schkopau, a site set to become home to the world`s first full-scale Ash2™Phos plant.

"The innovative phosphorus recovery plant will be an example of how environmental protection and resource conservation also pay off economically," says Willingmann. "I am delighted that Gelsenwasser and EasyMining are investing in this sustainable technology here in Saxony-Anhalt. Saxony-Anhalt can thus once again distinguish itself as an attractive business location and as a state of future technologies. As a state with a strong agricultural sector, Saxony-Anhalt will also benefit from having to import less phosphorus from abroad in the future thanks to its own recycling capacities."

Over the next two years, Phosphorgewinnung Schkopau (PGS) GmbH is building the recovery plant, with a capacity to process 30,000 tonnes of sewage sludge ash, at the DOW ValueParks site. The plant is scheduled to become operative in 2027.

PGS is a joint venture between EasyMining, part of the Swedish environmental company Ragn-Sells, and the German infrastructure and utility company Gelsenwasser. It was founded in 2021 with the specific aim of building and commissioning the Schkopau phosphorus recovery plant. Using EasyMining's Ash2™Phos technology, Schkopau will recover more than 90 per cent of the phosphorus from its sewage sludge ash feedstock.

The European Commission recently formally approved calcium phosphate extracted from sewage sludge ash for use in organic farming. Consequently, the main product of the Ash2™Phos plant, RevoCaP™, will help boost organic food production as well as contributing to food security in general. Even use as animal feed phosphate is possible, given the quality of the RevoCaP™, although EU legislation to allow this is still pending. Current EU regulations still focus too much on the origin of materials currently, comments EasyMining, instead of their quality.

## High quality end-product and marketable co-products

The Ash2™Phos process also recovers other marketable co-products, such as iron and aluminium coagulant chemicals for reuse at wastewater treatment plants, as well as building sand. The process is also highly efficient at extracting and removing pollutants from end-products, not simply diluting or immobilising them, a fact that the process developers EasyMining are keen to emphasise.

"If we are serious about creating a sustainable society, we need to reuse the resources we have already extracted out of the Earth`s crust over and over again. This is especially true for critical raw materials, such as phosphorus," says Lars Lindén, Managing Director of Ragn-Sells, the parent company of EasyMining.

## Secure circular phosphorus supply

Phosphorus is essential for agriculture, yet Europe is almost entirely dependent on imports. In 2024, the European Union imported phosphate fertilizer and phosphate raw materials worth around 4 billion euros from non-EU countries. By recovering phosphorus from sewage sludge ash, the Schkopau plant will contribute to a circular economy and greater self-sufficiency in the EU.

## INTERVIEW


PHOTO: EASYMINING

*Digital image of the full-scale Ash2Phos plant in Schkopau, Germany.*

*Fertilizer International* talks to Christian Kabbe, managing director of EasyMining Germany, about the company's ambitions and achievements to date.

### Regulatory push

German regulations mandating phosphorus recovery from sludge have been a key enabler, says Kabbe: "Without regulation, utilities wouldn't prioritise this – there are too many competing investment demands. But once you show that plants like ours work and have a viable business case, it becomes a no-brainer."

Phosphorus recovery goes beyond just compliance, according to Kabbe, who sees it as a resource sovereignty issue too. With phosphate rock controlled largely by a few exporting nations – and with additional pressure from its use in lithium iron phosphate (LFP) batteries – the strategic need for European phosphorus sources is becoming urgent, in his view.

"We don't just need this for food security," says Kabbe. "We need it for industrial independence. Without access to our own materials, we risk becoming dependent and economically vulnerable."

### Scaling up: quality, volume and reliability

A critical strength of the Ash2™Phos process, according to EasyMining, is its ability to decouple feedstock variability from product quality. Sewage sludge ash is highly heterogeneous, yet the company's proprietary chemical separation process yields consistent, high-grade products – something that other processes and the direct application of ash have struggled to cope with due to quality fluctuations.

"We're not just producing something that works," says Kabbe. "We're producing something that's industrially relevant – at scale, with consistent specs, and aligned with existing supply chains."

Kabbe is crystal clear about what it will take for the circular economy in phosphorus to succeed: "Quality matters. Volume matters. Reliability matters." Without all three, resource recovery will remain a boutique solution, he suggests. Interesting, maybe, but simply not impactful enough.

### Going global?

Europe remains the epicentre of phosphorus recovery, this being largely driven by conducive policy, the concentrated supply of waste streams and technical leadership. Yet Kabbe sees global potential for the technology as urbanisation intensifies and nutrient pressures mount. "As cities grow, the mismatch between nutrient production and land availability for reuse becomes more acute," he says. "In the end, the global market will move in this direction – policy can accelerate it, but the drivers are already there."

EasyMining's vision for the Ash2™Phos process is more than just a clever technology, suggests Kabbe – it's a blueprint for how resource recovery can integrate different industrial ecosystems, close critical nutrient loops, and secure Europe's place in a materials-hungry future. For utilities, investors, and regulators, it potentially offers a triple win, in his view, by combining environmental compliance, economic value and resource security.

"We're not trying to make a niche green product," Kabbe concludes. "We're trying to build a real industry." ■

Germany was the first country in EU to regulate phosphorus recovery by law. From 2029, most of the country's sewage treatment plants must recover phosphorus from sewage sludge. The plant in Schkopau will help to fulfil this legal requirement and serves as a model for large-scale nutrient recovery throughout the EU.

Henning Deters, Chairman of the Management Board of GELSENWASSER AG, says: "The establishment of clean phosphorus recycling promotes Germany's independence from a vital raw material and leads to a high reduction of pollutants in the material cycle. By mono-incinerating sewage sludge and recovering phosphorus from the ash, we process waste from municipal wastewater treatment and strengthen water and soil protection in Germany."

### Unique technology

As highlighted in previous articles (*Fertilizer International* 509, p58; *Fertilizer International* 519, p47), Ash2™Phos technology recovers phosphorus from sewage sludge ash and manufactures a safe, high-grade calcium phosphate product (RevoCaP™) with defined quality criteria by eliminating deleterious contaminants.

EasyMining`s business ethos and model is to create value by keeping materials previously thrown away by society in circulation and reusing these as often as possible – without compromising public health or the environment. This follows the guiding vision of the Swedish parent company Ragn-Sells: "We want to be living proof, that caring for the earth and good business go hand in hand."

For the company, it is not just about cherry picking small fractions from bigger material flows. Sewage sludge ash contains more than just P, for example, and Ash2™Phos therefore recovers the other valuable elements present by extraction and detoxification. The process, says EasyMining, closes many loops – not just one – and consequently is very effective at generating commercial-grade homogeneous products from heterogeneous, variable quality ash.

## Securing critical materials

As global demand for critical raw materials intensifies, Europe faces a resource reality check. Phosphorus – an essential nutrient for agriculture and an emerging ingredient in electric battery technology – is one such material. Almost entirely imported, its supply chain is vulnerable, fragmented, and increasingly unsustainable. But buried in the ash of incinerated sewage sludge, says EasyMining, lies a domestic source of phosphorus, long overlooked and now increasingly being reclaimed.

But recovery alone is not enough, says Christian Kabbe, managing director of EasyMining Germany: "There's no point in recovering material and ending up in a market that doesn't exist. Volume, quality and reliability are everything."

This principle has shaped EasyMining's strategy from the ground up. The Schkopau plant in Germany is designed as a volume hub: sourcing sewage sludge ash from across the country during its demonstration phase, and later from regional sources as additional Ash2™Phos plants come online.

The ultimate ambition of EasyMining and Gelsenwasser is to build up total sewage sludge ash processing capacity to 300,000 t/a at Ash2™Phos plants strategically placed across Germany, these being capable of yielding about 150,000 tonnes of the main RevoCaP™ product annually. There should be a plentiful supply of raw materials available, with Germany alone predicted to generate more than 600,000 t/a of sewage sludge ash in future.

## A sustainable and circular pathway

Already today, more and more European countries, especially those with large populations and high livestock densities, are pursuing the pathway of large-scale phosphorus recovery from sewage sludge ash. This should allow high volume and efficient phosphorus recovery from waste streams, which have been discarded previously or only partially recovered. Neglected until now, these secondary resources represent a valuable economic base for those countries and regions where primary phosphate resources are scarce or absent.

"For Europe – given its high dependence on mineral resources beyond its borders – there is only one economic future for survival and that is circular!," sums up Christian Kabbe. ■

# Phosphorus recycling: the granulation opportunity

Granulation, backed by testing, can play a pivotal role in providing a scalable and reliable way to turn recovered nutrients into valuable inputs for agriculture, as **Nick Reckinger** of FEECO International explains.


PHOTO: FEECO

*On-farm manure granulation plant.*

Phosphorus is one of life's most essential elements. The nutrient underpins global food security by fuelling the biological processes that enable plant growth and animal development. Without it, crops wouldn't grow, livestock wouldn't thrive, and ecosystems would collapse. Yet, as a non-renewable resource for which demand continues to rise, phosphorus is increasingly at the heart of a global sustainability challenge.

Neither is today's conversation around phosphorus sustainability just about optimising the mining and mineral processing stages of the fertilizer production process; it's also about ensuring the future of this finite resource through recovery and reuse. That future increasingly points to phosphorus recycling – a field of research and innovation that has the potential to rewrite how we capture nutrients and feed the world.

## Higher demand versus security of supply

Most of the world's accessible phosphate reserves are concentrated in just a handful of countries, making global agriculture vulnerable to geopolitical and economic instabilities[1]. The 800% phosphate rock price spike in 2008 – part of a general fertilizer affordability crisis which caused social unrest in several nations – serves as a stark reminder of both the importance of phosphorus and its vulnerability to supply disruption[2].

Agricultural demand, meanwhile, continues to grow. With the global population projected to surpass 9.7 billion by 2050[3], the pressure on phosphorus resources has never been greater.

But it's not just supply availability and risks that are driving urgency. Poor phosphorus management has led to excessive nutrient runoff into waterways, contributing to algal blooms, dead zones, and long-term ecological damage. The solution, increasingly, lies not in digging ever deeper for phosphate rock – but in closing the nutrient loop.

## Turning waste into a resource

Human and animal waste streams represent a vast, underutilised reservoir of phosphorus. While municipal wastewater and livestock manure, for example, are enriched with this critical nutrient – much of the phosphorus present ends up in landfill or waterways, with waste management costs or undesirable environmental consequences.

Encouragingly, however, today's researchers are exploring how these waste streams can be transformed into renewable phosphorus sources. A 2016 study found that just 37% of the phosphorus contained in domestic waste streams (including human food waste, human excreta, and animal manure) could supply the annual phosphorus demand for US corn production[4].

Countries like Switzerland have already taken legislative action. In 2016, the country mandated phosphorus recovery from sewage sludge, with a full rollout expected by 2026[5]. The European Union and Canada, meanwhile, have declared phosphorus a critical raw material. These developments are signalling a broader regulatory shift – one that forward-looking companies would do well to anticipate.

## A business opportunity in waiting

Beyond meeting regulatory requirements, there is also a compelling business case for phosphorus recycling. Nutrient recovery at wastewater treatment plants, farms, and processing factories offers a way to reverse the costs and liabilities associated with waste streams and turn these into revenue-generating assets instead. These municipal and commercial operations – by transforming waste into standardised, market-ready fertilizers – can reduce their disposal costs and enter the emerging market for sustainable agricultural inputs.

As consumer and corporate demand for environmentally responsible products grows, recycled fertilizers offer companies an opportunity to align their businesses with sustainability goals while enhancing their resilience to fluctuating raw material prices.

## Granulation: the bridge to market

While phosphorus can be recovered in liquid or solid forms, turning it into a usable, transportable, and market-ready fertilizer requires additional processing. This is where granulation – a well-established fertilizer industry technique – comes into play.

Granulation converts fine powders or sludges into uniform, dry granules. In the case of manure or biosolids, wet granulation is used to pelletise nutrient-rich solids which are then dried – creating a product that is easier to handle, store and apply to soils. A well-designed granulation system can produce a low-odour, pathogen-free fertilizer that meets or exceeds the Class A biosolid standards set by the US Environmental Protection Agency (EPA).

In a recent project, FEECO worked with a large-scale dairy farm to convert their manure digestate, previously a waste management challenge, into a premium granular fertilizer that could be sold on the market at a profit. The subsequent installation of an on-site granulation plant at the farm demonstrates the pivotal role granulation can play in transforming difficult-to-handle wastes into products that comply with market criteria – often a key barrier when closing the nutrient loop.

But granulation offers more than just convenience. It's also a tool for improving nutrient use efficiency (NUE) as well. Nutrients not taken up by crops during the growing season can remain fixed in soil or be lost to the environment through runoff. This makes raising NUE particularly important for phosphorus, a nutrient where efficient delivery from fertilizer to crop has been low historically.


PHOTO: FEECO

*Granular manure-based fertilizer.*

Granular fertilizers can improve phosphorus NUE in several key ways:

- **Controlled nutrient release**. Locking nutrients within granules helps to regulate phosphorus availability and supply and align this with crop requirements and uptake.
- **Application in the right place**. The uniformity of granules enables consistent and predictable spreading of fertilizers and their accurate placement in fields.
- **Reducing leaching and runoff**. Unlike livestock manure, dry and stable granules can be safely stored away from the environment until they are ready to be used.
- **Precision nutrient blends**. Coatings or micronutrients can be added during granulation to create specific nutrient formulations and improve crop fertilization performance.

Overall, by enhancing NUE, granulated products allow farmers to achieve the same or better crop yields using less fertilizer product – producing more from less – an outcome that benefits both the environment and the bottom line.


PHOTO: FEECO

*Manure granulation testing in progress at FEECO's Innovation Center.*

## Testing critical for closing the loop

FEECO International has long been a partner to those industries working at the intersection of waste generation and disposal with the regeneration and reuse of resources. With its decades of experience designing custom granulation systems, FEECO has helped municipalities, farms, and food processors transform their waste materials into viable, market-ready fertilizer products.

FEECO's state-of-the-art Innovation Center plays a key role here, providing the batch- and pilot-scale testing needed to develop bespoke granulation systems designed around unique source materials. Given that material characteristics vary from one source to the next, testing facilities like this allow waste recovery projects to derisk their investments, refine product formulations, and validate process performance before committing to full-scale operations.

With growing interest in sustainable phosphorus management, in our experience, testing capabilities are proving more critical than ever.

## Looking ahead: a circular phosphorus economy

Phosphorus recovery and recycling is no longer a fringe concept – it is fast becoming a core pillar of global food security and environmental stewardship. The case for phosphorus recycling will only strengthen, in our view, as governments implement stricter nutrient discharge regulations, and as the fertilizer industry seeks to buffer itself from price volatility and security of supply risks.

Innovations in nutrient recovery, precision agriculture, and regenerative farming are converging to create a future in which phosphorus use is not only more efficient, but also circular. Granulation, backed by testing, will play a pivotal role in making this transition possible, providing a scalable and reliable way to turn recovered nutrients into valuable inputs for agriculture.

FEECO is proud to be on the front line of this transformation, providing the technology, testing, and expertise needed to close the phosphorus loop – one granule at a time. ■

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