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JANUARY-FEBRUARY 2026

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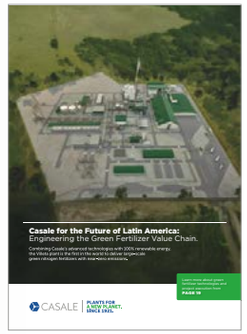

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CRU Fertilizers – top calls for 2026

> "CRU expects China's urea exports to increase to 5.9 million tonnes in 2026, with the export window possibly opening as early as May."

European affordability pressures will persist – *leading to lower fertilizer import duties and CBAM carve outs.*

Fertilizer affordability remains challenging for European farmers, with crop price indices flat and fertilizer price indices up 25% relative to pre-2023 averages. An additional tariff of €40/t was added to imports of Russian nitrogen fertilizers from July 2025, which will increase to €60/t from July 2026. From 1st January 2026, the EU's carbon border adjustment mechanism (CBAM) will also impose extra costs on the import of all nitrogen-containing fertilizers, with urea expected to see an annual average CBAM cost of ~$52/t.

Indian urea and DAP imports to remain high – *with domestic production facing limitations.*

Sulphur prices to remain above historical norms in the first half of 2026 – *but the year's second half will see price relief as supply tightness eases.*

The current sulphur price surge has pushed affordability beyond prior peaks. The combination of returning supply and a demand slowdown will, however, see the sulphur market return to balance in 2026.

China NP exports to slow on a shift back to DAP/MAP – *while OCP continues to pivot towards TSP.*

We believe China's NP exports will face tighter scrutiny in 2026, most likely in the form of a P_2O_5-based export quota, making a shift back towards higher value products like diammonium phosphate (DAP) and monoammonium phosphate (MAP) likely. Combined with the announcement that exports will be banned until August, this means overall exported volumes from China will be significantly weaker. OCP, meanwhile, has been significantly increasing its triple superphosphate (TSP) capacity and production – expanding in established markets like Brazil and developing new market destinations for TSP such as India.

China urea exports will start earlier and be more substantial – *CRU forecasts almost 6 million tonnes.*

China's urea production is expected to reach a record 72 million tonnes in 2025, far exceeding domestic demand. With the government more confident about supply security and keeping prices affordable for local farmers, CRU expects China's urea exports to increase to 5.9 million tonnes in 2026 – with the export window possibly opening as early as May.

European nitrogen majors to invest in US ammonia capacity and offtakes – *pivoting away from their existing high emissions sources.*

Europe's 'grey' ammonia production and imports will come under increasing pressure as the EU phases out emissions trading system (ETS) free allowances and phases in CBAM. To avoid cost escalation, EU nitrogen producers will act to secure strategic, long-term sources of low emissions ammonia in 2026, either through investment in capacity or offtake agreements. The US, in contrast to Europe, benefits from low-priced natural gas, advanced carbon capture and storage (CCS) infrastructure and generous 45Q tax credits for CCS operations. These factors, along with relative proximity, make the US a natural partner for EU nitrogen producers seeking low-carbon ammonia volumes to hedge against increasing carbon costs.

Phosphate investment builds momentum – *with capital from less traditional sources for projects in riskier jurisdictions.*

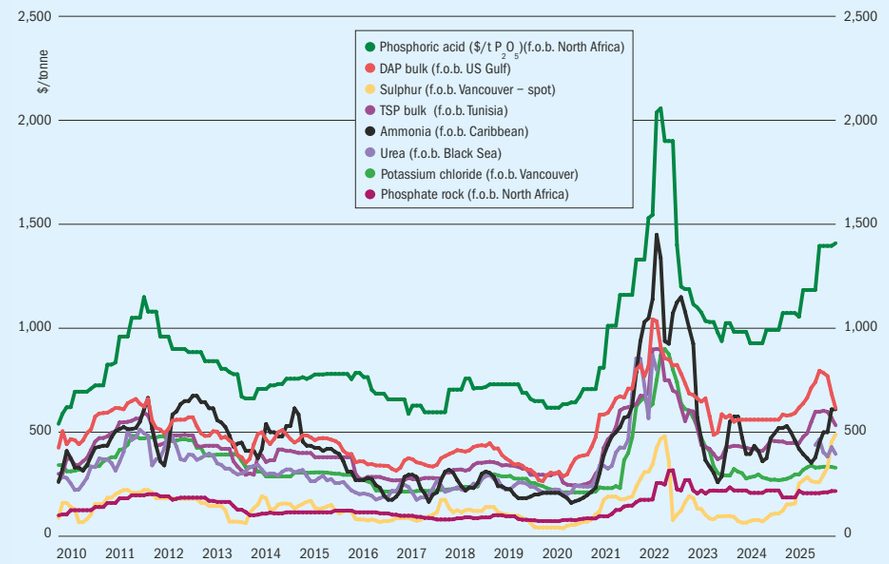
With supply remaining tight, and Chinese export restrictions unlikely to lift, phosphate prices will remain high compared to historical norms. This has made phosphate projects a more attractive prospect. We therefore expect to see an increasing number of investments made into riskier jurisdictions and backed by foreign financing, especially from China. We have already seen early-stage announcements for large-scale projects in Egypt, Algeria, Tunisia, Uzbekistan and Turkmenistan, for example.

Potash projects internationally will face further delays and capital overruns – *while Russia continues to explore further projects and expansions.*

China's anti-involution policy will not result in fertilizer capacity consolidation – *but it may lead to looser urea export restrictions.*

China's anti-involution policy is designed to prevent excessive price cutting (price wars) and reduce overcapacity. Yet China's nitrogen capacity has, in fact, been expanding since 2022, while its (resource-constrained) phosphate and potash capacities are expected to remain stable. The anti-involution policy may, however, lead to a relaxation in export restrictions when prices fall to cost levels – as implied by the unexpected fourth quota allocation for urea exports announced in November. ■

Historical price trends $/tonne



Source: CRU

PRICE TRENDS

Market snapshot, 18th December 2025

Urea slowdown upended by fresh Indian tender. The urea market was surprised on 16th December by the news that India's National Fertilizers Limited (NFL) had returned to the market with a tender for 1.5 million tonnes – this having been expected in late December or early January. NFL has also requested shipment from load ports prior to 20th February, a tight timetable given the number of previously acquired cargoes that are yet to ship to India.

China's likely participation in the NFL tender is unclear. Remaining urea availability under its existing export quota allocation is put at 100,000 tonnes with no indication – so far – that the Beijing authorities will approve more export volumes.

In Southeast Asia, Brunei Fertilizer Industries (BFI) reportedly committed to two 6,000 tonne granular urea lots in the $380s/t f.o.b. range for January shipping. Petronas in Malaysia was also linked to January lots at $395-400/t f.o.b. In the Middle East, Oman's SIUCI has agreed a 40,000 tonne granular urea cargo for late January-early February shipping at a rumoured $395/t f.o.b.

West of Suez, Mopco sold two lots of granular urea (10,000 tonnes and 6,000 tonnes) in mid-December and Abu Qir another granular lot (6,000 tonnes), all at $440/t f.o.b. for January loading out of Egypt. Algeria's Sorfert also sold 6,000 tonnes of granular urea at $450/t f.o.b.

In the US, business was upended India's return to the urea market, with December-January barges trading as high as $376/st f.o.b.

Ammonia up in the Middle East as CBAM rattles US. Middle East ammonia prices were up at $500-539/t f.o.b. – their highest level since February 2023 – on confirmation of a sale by Sabic. The Saudi producer was also said to have suffered an unplanned outage that may last for a month.

The NW European ammonia benchmark retreated to $668/t cfr in mid-December from its end-November peak of $693/t cfr, its highest level since February 2023. This high point, which came amid a number of global supply failures, was 41% above the benchmark's 2025 low of $435/t cfr.

The most significant ammonia market news was the publication of official default values for the carbon border adjustment mechanism (CBAM) by the European Commission. These values effectively price US tonnes out of Europe.

DAP/MAP price falls slow despite limited demand. Global DAP and MAP benchmarks showed signs of stability following the rapid falls of recent months. The Brazil MAP benchmark appeared to have reached a bottom, although the key DAP India benchmark declined further. Overall, while global spot demand remained lacklustre, expectations of exceptionally tight 2026 availability added price support. The recent news that China will restrict DAP, MAP and NP exports until August has added to bullish market sentiment.

MAP sales to Brazil have remained flat at $630/t cfr for several weeks. News

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Market price summary $/tonne – mid-December 2025

Nitrogen	Ammonia	Urea	Ammonium Sulphate	Phosphates	DAP	TSP	Phos Acid
f.o.b. Caribbean	610	-	f.o.b. E. Europe 301	f.o.b. US New Orleans*	615	-	-
f.o.b. New Orleans	-	368		f.o.b. North Arica	709	533	1,409
f.o.b. Middle East	475	375	-	cfr India	673	-	1,290
f.o.b. Black Sea	-	395					
Potash	KCl Standard	K_2SO_4	**Sulphuric Acid**		**Sulphur**		
f.o.b. Vancouver	329	-	cfr US Gulf 143		f.o.b. Vancouver	490	
cfr India	349	-			f.o.b. Arab Gulf	515	
fca Western Europe**	-	590			cfr China	513	
f.o.b. Baltic	303	-			cfr India	525	

*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. ** €/t*

that Mosaic is idling SSP production at its Fospar and Araxá sites in Brazil – due to recent sharp sulphur price increases – is likely to cause concern about phosphate fertilizer availability in the coming months.

Spot prices for DAP sales to India were down at $670-675/t cfr in mid-December. Since August, the Indian DAP benchmark has fallen from $810/t cfr.

Potash prices steady despite Belarus sanctions shift. US MOP prices remained stable, with NOLA values holding at $305-315/st f.o.b., as market activity remains subdued amid thin spot demand and comfortable inventories. The immediate impact of the recent US decision to lift sanctions on Belarusian potash is expected to be muted. Historically, volumes from Belarus into the US have been modest, with Canada accounting for roughly 80% of US deliveries.

Brazil remains the focal point of the global potash market, with prices heard in the $355-370/t cfr range as suppliers continue to push offers higher. This raises questions about potash affordability, given that farmer buying interest was limited even at $350-355/t cfr price levels.

MOP prices in Southeast Asia were broadly stable as the tender season draws to a close. Standard MOP held steady at $360-380/t cfr, while granular MOP remained unchanged at $380-400/t cfr.

Sulphur prices reach new highs. Market prices have surged to new multi-year highs. The clearest price signal came from Indonesia, where a tender award from PT Lygend reportedly landed in the mid-$540s/t cfr. The strong Asian market has directly supported Middle East export prices, with these rising to $505-525/t f.o.b., their highest level since September 2008.

In China, the government has intervened and instructed acid smelters to use 11th December sulphur prices as a benchmark and to prioritise domestic buyers. It has also told sulphur producers to decouple their pricing from international markets. Sulphur prices for the Chinese import market, meanwhile, held steady at $515/t cfr.

Sulphur prices in Brazil surged to a new multi-year high of $530-540/t cfr, surpassing the previous June 2022 peak. Mosaic's announcement that it is idling single super phosphate (SSP) production at two of its sites in Brazil, citing the sharp increase in sulphur prices, is a clear sign of the margin squeeze facing Brazil's fertilizer producers.

OUTLOOK

Urea market poses questions. Prices are forecast to rebound in the first quarter of 2026, as Chinese exports are halted and regional demand picks up, only to soften by the middle of the second quarter with China's return to the market. Indian demand and seasonal Egyptian outages are then expected to provide price support towards the end of the second quarter and into the third.

Ammonia prices to remain firm before slumping on returning supply. Ammonia prices are forecast to decline significantly in the coming months, following their dramatic run up in the fourth quarter of 2025. Prices are poised to ease in January on expectations of improved supply, although news of the Sabic outage may temper this decline. Prices should correct significantly lower, if and when supply additions are confirmed, but are expected to remain broadly stable until then.

Phosphates prices expected to remain high on supply shortage. DAP/MAP prices have continued to fall more quickly than expected, with further downside likely early in 2026. Prices are, however, expected to begin increasing again later in the first quarter, supported by tight availability, with prices likely to remain historically high even during the low points of the coming year. Prices could go even higher, and remain there for longer, if supply is tighter than expected due to stronger export restrictions from China.

China's surprise contract settlement sets tone for potash. Despite recent stagnation, CRU has revised its forecast for MOP prices upwards on the anticipation of strong demand in key markets – the higher floor set by the earlier-than-expected China contract settlement being one example. Extra potash supply will largely rely on higher utilisation rates from existing producers, given the limited new capacity arriving in 2026.

Sulphur prices to peak in January before declining. CRU is forecasting a sulphur price trajectory that peaks in January followed by a period of gradual price softening throughout 2026. This projection has, however, been revised upwards on a stronger-than-expected price surge supported by supply constraints. Nonetheless, high sulphur prices are starting to cause demand to fade in countries like China. Sulphur prices could be pushed lower in 2026, if the eventual correction is more aggressive than currently projected. ■

UNITED STATES

Fertilizers exempted from US tariffs

The US ended 'reciprocal tariffs' on fertilizer imports on 14th November.

With a stroke of a pen, President Trump reversed a seven-month-long experiment that pushed up the cost of fertilizers and made the US one of the highest-priced destinations for nitrogen and phosphates in the world.

The policy shift – made via an amendment to Executive Order 14257 – should provide price relief for US farmers struggling with poor crop nutrient affordability by opening the door to more product from overseas producers.

The most significant impact is expected to be felt in the US phosphate market. DAP prices at New Orleans – immediately prior the announcement – were up 27% since the start of 2025 and at their highest level since Russia's full-scale invasion of Ukraine in 2022.

The imposition of US import tariffs in April added to an already tight domestic DAP/MAP market caused by countervailing duties (CVDs) on Moroccan and Russian imports. While President Trump's tariff exemption for fertilizers does not remove CVDs, it does make DAP/MAP imports from Saudi Arabia, Jordan and Lebanon more likely. It also opens the door for more TSP from Egypt, Lebanon and Israel.

US imports of DAP/MAP dropped 30% year-on-year (y-o-y) to just under one million tonnes during January-July 2025, according to Global Trade Tracker (GTT) data, while TSP imports into the US were down 41% y-o-y at around 210,000 tonnes. (July trade data are the latest available due to the US government shutdown.)

International suppliers of urea to the US also stand to benefit from the carve-out for fertilizers, having originally been hit with substantial tariff rates on 2nd April. African urea producers in particular, including those in Algeria, Egypt and Nigeria, will be favoured by a return to the pre Trump tariff era – as they will now be free to compete with Russian producers who were never subject to tariffs on their urea and urea ammonium nitrate (UAN) imports.

Ammonia appears to be unaffected by the latest tariff policy change. Imports from Trinidad, for example, are thought to remain subject to a 15% tariff rate.

PHOTO: TEDEYTAN/FLICKR

The Whitehouse at dusk.

Tariffs announced, paused and gone

The rescinding of US import tariffs on fertilizers in November is the latest plot twist in an on-off saga. Having originally announced widespread 'Liberation Day' tariffs on 2nd April, President Trump then announced a three-month implementation pause on 9th April (*Fertilizer International* 526, p7) – later extended to the 7th August. With the exception of China, this saw the US cut its so-called 'reciprocal tariffs' on imports to 10% for five months.

During this period, fertilizer producers supplying urea, UAN, ammonia and DAP/MAP/TSP to the US generally faced a blanket 10% rate. Tariffs on urea imports from Algeria were cut from 30% to 10%, for example, while Nigeria's urea tariff was cut from 14% to 10%. The rate on Middle Eastern urea producers was unchanged, being at 10% already.

'Liberation Day' levies on granular phosphate imports from Jordan (20%), Israel (17%) and Tunisia (28%) also fell to the more favourable 10% flat rate during the five-month pause. Saudi Arabia and Australia were already at this lower rate and therefore unaffected.

Importantly, a number of fertilizer commodities were already exempted from US import tariffs under the Harmonized Tariff Schedule (Annex II). These include potassium chloride, potassium nitrate, potassium sulphate, phosphate rock and NP/NPK fertilizers.

Similarity, 'Trump tariffs' did not apply to America's northern and southern neighbours, Canada and Mexico, either. Instead, any imports from these two countries that comply with the United States-Mexico-Canada Agreement (USMCA) were exempted from the current 25% tariff imposed by the US.

This USMCA exemption notably covers US potash and sulphur imports. While US sulphur consumption is primarily domestically sourced, imports still account for around 20% of total demand, with Canada being the primary supplier, making up 90% of total non-US purchases.

In response to the ending of fertilizer tariffs, Corey Rosenbusch, president and CEO of US fertilizer trade body The Fertilizer Institute (TFI), said:

"The fertilizer market is highly competitive and characterized by a complex web of global supply and demand factors. While the U.S. has robust domestic fertilizer manufacturing and production, it is a net fertilizer importer and relies on both domestic production and imports during busy spring planting and fall application periods.

"Without farmers, there would be no fertilizer industry, and as farmers continue to face economic challenges the focus of the industry remains working with the Trump Administration to promote a strong, resilient fertilizer industry that supports U.S. agriculture and ensures affordable food prices for American families." ■

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UNITED STATES

US classes phosphate and potash as critical minerals

Potash and phosphate have been added to the updated *2025 List of Critical Minerals* published in the US Federal Register on 6th November.

The 2025 list adds 10 critical minerals to the 50 critical minerals on the previous list dating on 2022, taking the new total to 60. Potash is making a reappearance – having been included in the original 2018 critical minerals list but subsequently omitted from the 2022 update.

The new status of potash and phosphate as critical minerals in the US was welcomed by American trade body The Fertilizer Institute (TFI), who viewed this as a lobbying success.

"Getting phosphate and potash back on the list is something the industry has been working on since they were oddly left off in 2022. A high priority for TFI has been educating congressional offices, policymakers, media, and the public about how closely phosphate and potash are tied to abundant and nutritious food," said Cory Rosenbusch, TFI's president and CEO. "These are two minerals where stable supplies are absolutely necessary to fill our plates and feed our communities."

TFI pointed to the concentration of phosphate and potash supply globally. China and Russia account for around 53% of global phosphate production, it said, while China, Russia, and Belarus are responsible for around 67% of global potash supply. The US also imports roughly 97% of its potash needs, according to TFI, mostly (86%) from Canada.

"Rightfully recognizing phosphate and potash as critical minerals will support American farmers across the country and help ensure high crop yields and stocked grocery store shelves for consumers," Rosenbusch said. "The majority of the world's phosphate and potash resources are concentrated in only a few countries, leaving them open to supply chain vulnerabilities and geopolitical instability."

Mosaic sells SOPM business for $30 million

The Mosaic Company has sold its Mosaic Potash Carlsbad business in New Mexico to newly-formed company International Minerals Carlsbad for $30 million.

A definitive agreement was signed on the 22nd December with the transaction expected to close in the first half of 2026. It provides International Minerals Carlsbad with ownership of Mosaic's potash and water business in New Mexico and the associated potassium magnesium sulphate (SOPM) brands K-Mag (fertilizer grade) and Dynamate (feed grade).

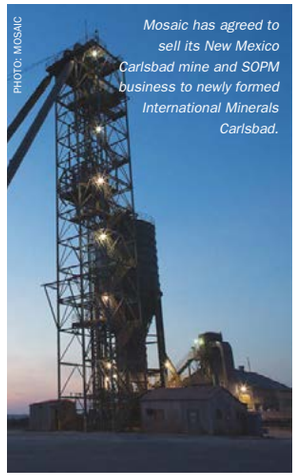

PHOTO: MOSAIC

Mosaic has agreed to sell its New Mexico Carlsbad mine and SOPM business to newly formed International Minerals Carlsbad.

International Minerals Carlsbad is a new business entity, reportedly with leadership and staff who worked previously for Mosaic and Intrepid Potash. While Mosaic does not disclose SOPM production and sales volumes, the company sold 865,000 tonnes of 'performance' potash products in 2024, with this volume including sales of its K-Mag and Aspire (boron enriched potash) products alongside animal feed ingredients.

The agreement will see International Minerals Carlsbad take ownership of the operations, assets and liabilities Mosaic's Carlsbad mine in New Mexico. It will also take on responsibility for the asset retirement obligations associated with this mine.

In return, Mosaic will receive an initial cash payment of $20 million (subject to adjustment on closing) followed by a deferred cash payment of $10 million. The latter will be payable to Mosaic in three equal annual instalments beginning in 2029.

"This transaction is a win for all parties," said Karen Swager, Mosaic's Executive Vice President, Operations. "We are pleased that International Minerals Carlsbad will provide continuity for our Carlsbad employees at the site, and that Mosaic has taken another step to focus on core assets. Our potash production is now entirely focused on our operations in Saskatchewan, Canada which are expected to continue to generate strong returns."

"The acquisition is an exciting business opportunity, and we look forward to building upon the 100+ year legacy of the potash industry in New Mexico," said Sergio Saenz, the CEO of International Minerals Carlsbad. Kelvin Feist, the company's Chief Commercial Officer, added: "Our priority is to ensure a seamless transition of the business for employees, customers, suppliers and all stakeholders."

Separately, Mosaic reported on 16th December that it was idling single super phosphate (SSP) production at its Fospar and Araxá sites in Brazil – as well as suspending future sulphur purchases for the time being – due to recent sharp sulphur price increases. The company said it may review these decisions in 30 days.

EUROPE

New CBAM package disappoints industry

Trade body Fertilizers Europe says the EU's new carbon border adjustment mechanism (CBAM) package "will significantly weaken the mechanism and prevent it from delivering on its promises".

This was in response to a new CBAM policy package released by the European Commission on 17th December, specifically the announcement of a flat 1% markup on fertilizer default values.

PHOTO: EUROPEAN COMMISSION

The European Commission's College of Commissioners.

The default values are designed to encourage non-EU fertilizer producers to report their actual production emissions.

The trade body also criticised the Commission's new proposal to set up a temporary decarbonisation fund for European industry, saying this "falls short of delivering a real solution for EU-based exporters" and would "not address the competitive disadvantage EU producers face on global markets".

The new fund will offer financial support to EU fertilizer producers by partly reimbursing their emissions trading system (ETS) costs.

"Since its announcement, European fertilizer producers have viewed CBAM as a necessary instrument to equalize carbon costs between EU producers and non-EU competitors. The European Commission deserves recognition for establishing a mechanism that seeks to reconcile climate ambition with industrial competitiveness," said Antoine Hoxha, Fertilizers Europe's director general.

Hoxha did, however, criticise making default values for fertilizers subject to a 1% markup. By watering down the rules, this would "undermine CBAM's core objectives of fair competition and transparency", he said.

"The Commission's decision to start with the markup for default values at 1% reflects a genuine effort to address farmers' concerns about the CBAM launch, and we acknowledge that. At the same time, extending a 1% markup on default values indefinitely will discourage the reporting of real emissions by overseas producers – particularly those with a higher footprint than their country's average," Hoxha said.

Hoxha agreed that watertight implementation will be critical to the success and credibility of CBAM. "Addressing the risk of circumvention is essential, and the Commission's announcement is a step in the right direction. The real test, however, will be whether these measures prove effective and enforceable in practice," he said.

A "real solution for EU-based [fertilizer] exporters" was also notably absent from the Commissions' new CBAM package, in Hoxha's view.

"The temporary decarbonisation fund is just a patch that fails to address the fundamental issue whereby EU-made products, often with lowest environmental footprint globally, will be pushed out of international markets due to uneven carbon costs. Such an approach will further deteriorate the competitiveness of EU fertilizer producers, undermining sector's ability to invest in clean technologies," he said.

Nonetheless, Fertilizers Europe said it remains committed to engaging constructively with the EU to ensure that the CBAM for fertilizers fully delivers on its objectives.

CBAM entered its definitive implementation phase on 1st January 2026. Please refer to the comprehensive explainer in our May/June 2025 magazine for further information on this complex EU policy (*Fertilizer International* 526, p14).

ITALY

Nextchem buys Ballestra

NEXTCHEM has signed a binding agreement to acquire Ballestra Group for around €126.5 million. The announcement was made by Maire – Nextchem's parent company – on 24th December.

Founded in 1960 and headquartered in Milan, Ballestra is global leader in the licensing, design and engineering of chemical plants, as well as the supply of proprietary technologies and equipment to the chemical industry. The company is known within the industry for its strong intellectual property and R&D expertise. This notably includes pilot plants in Italy and Switzerland, with these serving as innovation hubs for testing and scaling-up new technological processes.

Ballestra operates in more than 120 countries, has around 450 employees, with offices in Europe and Asia, and a proven track record of more than 6,400 chemical plants installed worldwide. Ballestra S.p.A. also acts as a holding group for Buss ChemTech AG (Switzerland) and Ballestra Engineering and Projects Pvt. Ltd (India).

Rome-headquartered Nextchem is already a well-established nitrogen industry player through its Netherlands-based subsidiary Stamicarbon, the world's leading urea technology licensor. The acquisition of Ballestra will broaden the company's fertilizer industry offering by extending its footprint into phosphate and potash.

Ballestra notably designs and supplies production plants for sulphuric acid, merchant-grade and purified phosphoric acid (MGA and PPA), single superphosphate (SSP), triple superphosphate (TSP), potassium sulphate (SOP) and granulated NPK fertilizers. It can also implement an integrated approach to phosphate production, offering both MECS technology for sulphuric acid plants and Prayon technology for phosphoric acid plants through its long-term partnerships with both companies.

On top of that, Ballestra also offers a leading fluorine recovery process for phosphate plants through its ownership of Swiss-headquartered Buss ChemTech.

Alessandro Bernini, Maire's CEO, said: "The acquisition of Ballestra Group is consistent with the business plan already announced and a perfect strategic fit with NEXTCHEM's purpose of enabling decarbonization through proprietary technologies, while deepening our access to new fast-growing end-markets. As clients race to electrify, recycle and improve efficiency, they need partners that combine proven technologies with reliable project delivery. MAIRE is building exactly that: a European technology platform with global reach, able to convert innovation into industrial realities."

The final purchase price for Ballestra will be subject to adjustments at the closure of the binding agreement. This is expected in the first half of 2026.

CHINA

Eighth 'Ultra-Low Energy' urea project for Stamicarbon

Stamicarbon has been awarded a contract for the licensing, process design package (PDP) and the supply of proprietary equipment for a new urea plant in Eastern China.

The new 2,700 tonnes per day (t/d) plant – for an unnamed "prominent fertilizer producer" – will feature Stamicarbon's proprietary NX STAMI Urea™ technology and adopt the company's Ultra-Low Energy design. This innovative design reduces plant steam consumption by 35% and cooling water usage by 16%, compared to a conventional urea plant.

The urea production process and prilling tower design also generate high-quality prills with very low biuret content. Stamicarbon will provide key equipment to the plant, including the pool reactor and stripper, both constructed using E-type super duplex stainless steel.

"This project marks the tenth global application of Ultra-Low Energy technology and the eighth in China, with seven operational plants demonstrating our benchmark role for energy efficiency in

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PHOTO: PRAYON

Prayon has opened a new SHMP unit at its phosphate production complex at Engis in Belgium.

large-scale urea production," said Fabio Fritelli, Nextchem's managing director. "This contract further strengthens NEXTCHEM's presence in this geography and demonstrates our unwavering commitment to enhancing the sustainability of the fertilizer sector through cutting-edge technological advancements."

BELGIUM

Prayon opens new Engis unit

Prayon has officially opened a new sodium hexametaphosphate (SHMP) production unit at its Engis complex in Belgium. The €30 million investment is designed to strengthen the company's position in the food and technical phosphates market.

The unit was officially inaugurated on 27th November in the presence of Her Royal Highness Princess Astrid of Belgium, Adrien Dolimont, Minister-President of the Walloon Government, and Pierre-Yves Jeholet, Walloon Minister for the Economy and Employment.

The new 10,000 tonnes per annum (t/a) capacity Engis unit complements Prayon's existing SHMP unit at its Les Roches-de-Condrieu site in France and will double the company's SHMP's output capabilities.

The new state-of-the-art SHMP plant is built to high environmental standards with, for example, a closed-loop water circuit that guarantees zero process water discharge. Prayon said the investment reaffirmed its commitment to "industrial performance, excellence in customer service and environmental responsibility", and consolidating its role as a global leader in phosphorus chemistry.

"In a European environment with high energy and labor costs, we can't be a cost leader. With this new unit, we are strengthening our reliability for our customers and continuing our growth strategy in high value-added specialty phosphates," said Geoffrey Close, Prayon's CEO. "This objective is fully in line with our Solution Provider approach, which is centered on our customers, offering them not only greater reliability but also solutions that meet their needs for their specific applications."

Prayon's continuing investment in the region and its job creation efforts were praised by Pierre-Yves Jeholet, Vice-President and Minister for the Economy, Industry, Digital, Employment and Training.

"Excellent news to see Prayon strengthen its foothold in Wallonia. This industrial flagship represents 1,500 jobs worldwide, more than half of them in our region. We must continue to proactively support ambitious projects," Jeholet said. "With Wallonie Entreprendre, our strategic partner and 50% shareholder, we are proving that together, public authorities and companies can facilitate and accelerate investment, and seize opportunities to prepare for the future."

AFRICA

Multiple contracts for Dangote Fertilizer projects

Leading European engineering companies and technology licensors secured contracts with Dangote Fertilizer in November and December 2025 for two new large-scale nitrogen fertilizer projects in Nigeria and Ethiopia.

The awards are part of an industrial plan by Dangote to construct six integrated ammonia-urea plants – four at its existing Lekki production complex in Nigeria and two at a new fertilizer complex at Gode, Ethiopia. They include:

- The award of two contracts to Saipem for basic engineering and design services for six urea units – four in Nigeria and two in Ethiopia.
- A strategic agreement with Thyssenkrupp Uhde Fertilizer Technology (UFT) a subsidiary of thyssenkrupp Uhde, to license UFT Fluid Bed Granulation Technology for four new urea granulation units in Nigeria.
- The award of licensing agreements to Topsoe for six new ammonia production units (2,500 tonnes per day capacity each) – four in Nigeria and two in Ethiopia.

Saipem's two new contracts with Dangote Fertilizer include licenses for its proprietary Snamprogetti™ urea technology and engineering services for the construction of six urea production units. Each unit will offer a record 4,235 tonnes per day (t/d) of production capacity – the highest ever achieved worldwide, according to Saipem.

Additionally, Saipem and Dangote Fertilizer have signed a letter of intent for front end engineering design (FEED) services for a new fertilizer complex at Gode in the Somali region of Ethiopia. This plant, which is being developed by Dangote in partnership with Ethiopian Investment Holdings, will have an annual urea production capacity of three million tonnes.

UFT's four new granulation units will be constructed in Lekki, Nigeria, adjacent to Dangote's existing fertilizer complex. Two UFT units have been operating at this site since 2021, each with the capacity to produce 3,850 t/d of urea.

Dangote's new agreement with UFT covers technology licensing, a comprehensive process design package (PDP), and the supply of proprietary equipment such as granulators and scrubbers. Each of the four new granulation units will have a nameplate capacity of 4,235 t/d, boosting Dangote Fertilizer's annual urea granulation capacity at Lekki from approximately 2.65 million tonnes to more than eight million tonnes.

The new units will incorporate UFT's energy-efficient scrubbing system. This is designed to minimise pressure drop while effectively controlling dust and ammonia emissions. They will also feature Ammonia Convert Technology (ACT). This integrates ammonium sulphate by-products into urea granules and eliminates waste streams.

Nadja Haakansson, CEO of thyssenkrupp Uhde, said: "This partnership with Dangote Fertiliser Limited underscores our shared vision for sustainable industrial development and global food security. By deploying our proven UFT Fluid Bed Granulation Technology, we are setting new standards in efficiency and environmental stewardship in fertilizer production."

Aliko Dangote, president of Dangote Group, said: "We are pleased to deepen our collaboration with thyssenkrupp Uhde Fertilizer Technology for the expansion of our fertilizer operations in Lekki. This initiative reflects our commitment to agricultural self-sufficiency and industrial progress across Africa." ■

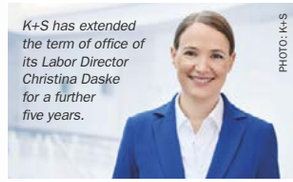

PHOTO: K+S

K+S has extended the term of office of its Labor Director Christina Daske for a further five years.

K+S has extended **Christina Daske's** mandate as Labor Director for a further five years. The extension to her term of office was confirmed by the company's supervisory board on 12th December. Ms Daske's mandate will now run until 30th November 2031.

"By extending the term of office of the Labor Director, K+S is strengthening its strategic focus on sustainable organization and partnership-based cooperation with employees and representatives," K+S said in a statement.

Ms Daske has been an executive director and a K+S board member since December 2023. In addition to her role as Labor Director, she oversees the company's supply chain and IT departments. She held various senior management positions at K+S prior to her current role.

"Christina Daske embodies reliability and strong communication skills. She utilizes modern human resources management strategies to support our transformation. Her experience and dedication to the workforce and diversity are essential to K+S's success in an ever-changing world of work," said Dr Harald Schwager, chairman of the company's supervisory board. ■

ICL announced the passing of **Dr Patricia Imas**, the company's renowned Chief Agronomist, on 17th December 2025. The company issued the following statement:

We are deeply saddened by the passing of our beloved colleague, Dr Patricia Imas.

Patricia was a highly skilled agronomist, regarded as an expert in plant nutrition and a true pioneer in her field. Her passion for plants and agriculture was at the heart of everything she did.

For more than 30 years, she dedicated her life to advancing crop nutrition and sustainable agriculture, working closely with farmers and scientists around the world to improve food production while preserving soil fertility.

She was a driving force behind countless research projects, training programs, and marketing initiatives, always eager to share knowledge and inspire others.

Her commitment, professionalism, and deep love for agronomy made her a role model for all of us.

Patricia's legacy will live on through the knowledge she shared and the tremendous impact she made on global agriculture.

We will remember her for her expertise, her passion, and her unwavering dedication.

Dr Imas was well known to *Fertilizer International* readers through her many articles over the past decade. CRU and the magazine will miss her insights and agronomic expertise very much.

"This is a great loss to our industry," commented **Simon Inglethorpe**, Editor, *Fertilizer International*. "May you rest in peace, Patricia. You will be remembered, as will your contribution to fertilizers, agriculture and feeding the world." ■

Calendar 2026

JANUARY

26-28
Fertilizer Latino Americano 2026, MIAMI, USA
Contact: Argus Media
Tel: +55(11)45603597
conferencesupport@argusmedia.com

FEBRUARY

10-12
CRU Nitrogen+Syngas Expoconference 2026, BARCELONA, Spain
Contact: Event Client Services
Tel: +44 (0) 20 7903 2444
Email: conferences@crugroup.com

APRIL

7-9
AFA International Annual Conference & Exhibition, CAIRO, Egypt
Contact: Arab Fertilizer Association
Tel: +202-23054464 – 67
Email: events@arabfertilizer.org

13-15
CRU Phosphates+Potash Expoconference, PARIS, France
Contact: Event Client Services
Tel: +44 (0)20 7903 2444
Email: conferences@crugroup.com

21-23
CRU Nitrogen+Syngas Expoconference USA, DALLAS, Texas, USA
Contact: Event Client Services
Tel: +44 (0) 20 7903 2444
Email: conferences@crugroup.com

MAY

4-6
IFA Annual Conference 2026, ABU DHABI, UAE
Contact: IFA Conference Service
Tel: +33 1 53 93 05 00
Email: ifa@fertilizer.org

JUNE

2-4
IFA Cultivating Tomorrow, BUDAPEST, Hungary
Contact: IFA Conference Service
Tel: +33 1 53 93 05 00
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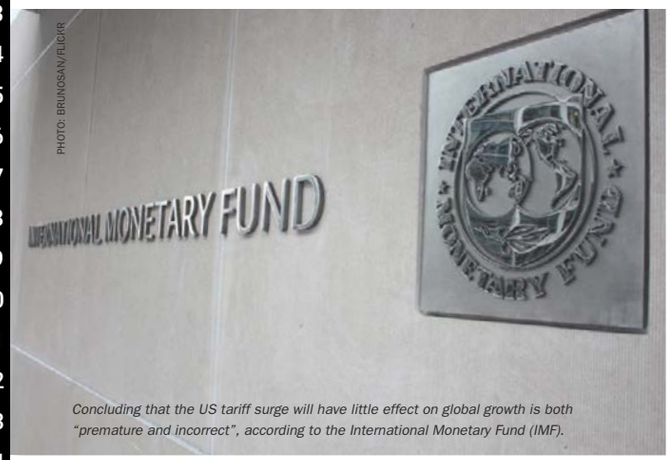
The year ahead – new geopolitical rules

We look ahead at fertilizer industry prospects for the next 12 months, including the key economic and agricultural drivers likely to shape the market during 2026.



Concluding that the US tariff surge will have little effect on global growth is both "premature and incorrect", according to the International Monetary Fund (IMF).

Tariff shock dims lacklustre growth

The International Monetary Fund (IMF) expects world economic growth to remain relatively stable at 3.2 percent in 2025 and 3.1 percent in 2026.

The economic impacts of US tariffs have been smaller than previously anticipated – so far – according to the Fund's latest *World Economic Outlook* report published in October[1].

"The good news is that the growth downgrade [from US tariffs] is at the modest end of the range. The reasons are clear. The United States negotiated trade deals with various countries and provided multiple exemptions. Most countries refrained from retaliation, keeping instead the trading system largely open. The private sector also proved agile, front-loading imports and speedily re-routing supply chains," said Pierre-Olivier Gourinchas, the IMF's economic counsellor and director of research.

Gourinchas caveated this by adding that it would be "premature and incorrect" to conclude that the US tariffs introduced in April 2025 are not affecting global growth:

- **Premature** – because effective US tariff rates remain high and trade tensions continue to flare up with no guarantees yet on lasting trade agreements. Tariff costs, which so far have mainly fallen on US importers, may still be passed onto US consumers through higher retail prices. International trade may also reroute permanently, leading to global efficiency losses.
- **Incorrect** – because counteracting economic forces are simultaneously at play. In the US, for example, economic activity is being supported by loose financial conditions, the softening of the dollar in the first half of 2025 and an AI-driven investment boom. Elsewhere, China is weathering higher tariffs with a weaker exchange rate and redirected exports to Asia and Europe, while Germany's fiscal expansion is lifting Eurozone growth.

Looking ahead, Gourinchas says the US tariff shock is dimming already lacklustre growth prospects.

"We expect a slowdown in the second half of this year [2025], with only a partial recovery in 2026, and, compared to last October's projections, inflation is expected to be persistently higher. Even in the United States, growth is weaker and inflation higher than we projected last year – hallmarks of a negative supply shock," Gourinchas said.

Consequently, the global economic outlook remains fragile with risks tilted to the downside. In particular, the IMF highlights the risk of higher tariffs emerging due to renewed and unresolved trade tensions. This, together with supply chain disruptions, could lower global output by 0.3% in 2026, concludes the Fund.

The IMF names "four simmering downside risks" to the world economy as especially worrying:

- **The AI surge** – promise or peril?
- **China's structural struggles** – particularly the financial risks from its shaky property sector
- **Mounting fiscal pressures** – facing some governments in major advanced economies.
- **Imperilled institutional credibility** – with central banks under political pressure to ease monetary policy to support the economy, a move which always backfires, says the IMF, because it endangers price stability and/or increases debt servicing costs.

WHAT DRIVES FERTILIZER DEMAND?

Fertilizer demand is influenced by the complex interplay of many factors – some of which are harder to predict than others. In the short-term, the main drivers of demand include:

- The macroeconomic environment, interest rates, currency exchange rates and farm economics
- Crop prices and fertilizer-to-crop price ratios
- Crop mix, growing areas and crop yields
- Soil nutrient levels and nutrient replenishment
- Policy, regulation and fertilizer subsidies
- Sustainability, nutrient management and nutrient recycling

Many of these factors vary from country-to-country and region-to-region. Adding to the complexity, these primary drivers are in turn influenced by a host of secondary considerations.

Macroeconomic conditions, by triggering slowdowns or expansions in global, regional and national growth, control overall economic demand and affect the health of agricultural markets. **Farm economics** and attendant issues such as working capital, interest rates, credit availability and barter ratios have a more direct impact on the cost of doing business and the ability of farmers to purchase fertilizers.

Crop prices and fertilizer-to-crop price ratios act as key controls on crop nutrient demand as they play a critical role in determining farm buying power and (alongside exchange rates) fertilizer affordability. Crop prices in turn are driven by the **harvest size** annually, **stock levels** and **demand** for agricultural commodities. Fertilizer industry analysts pay particularly close attention to the prices of cereals, oilseeds, cotton, sugar and palm oil, the main fertilizer-consuming crop types globally.

The **biofuels market** is also an important driver of fertilizer demand due to large-scale cultivation of maize and sugarcane for ethanol and oilseed rape (canola) for biodiesel (*Fertilizer International* 474, p22). Crop failures due to extreme weather events such as **El Niño** (*Fertilizer International* 475, p38) and **La Niña** can also affect fertilizer demand in the short-term.

Ag commodities – pawns on a geopolitical chessboard.

Global agricultural has entered a new phase where geopolitics – alongside traditional market drivers – will dictate trade flows, prices and production decisions, according to Rabobank's *Agri Commodity Outlook 2026* published in November[2].

Trade wars, by reshaping long-standing patterns of production and export through tariffs and subsidies, are leading to a fragmented, policy-driven global food system, the report concludes.

Increasingly, the world is becoming divided between two spheres of influence – the United States and China – with agricultural commodity exports becoming "pawns on a geopolitical chessboard", Rabobank reports.

"Agriculture is no longer playing by supply-and-demand rules, it's also playing by geopolitical ones," said Carlos Mera, Rabobank's head of agri commodity markets research. "We are only at the beginning of the middle game."

A trade conflict that began with tariffs has now evolved into a global subsidy race. Governments across the world – from the US and Brazil to Indonesia, Argentina, and Russia – have intensified agricultural support through direct payments, minimum price guarantees, and biofuel mandates, the report suggests.

"This widespread protection has muted the reaction of farmers to low prices and will likely sustain high total planted areas, keeping global grain and oilseed prices subdued for 2026," says Rabobank.

> **"Increasingly, the world is becoming divided between two spheres of influence – the United States and China – with agricultural commodity exports becoming pawns on a geopolitical chessboard."**

In the US, soybean plantings have fallen to their lowest level in six years – as US farmers anticipated export barriers with its dominant soybean buyer China – while corn area has expanded to its largest area since the 1930s. The consequent rise in US corn stocks by the end of the 2025/26 season will depress volatility and keep corn prices low, the report predicts.

Tariffs and trade barriers are also leading to widening price gaps between agricultural producing regions.

"Before the Trump-Xi agreement, Brazil's soy export prices benefited from strong Chinese demand, while US prices were heavily depressed. US and Brazil soybean prices have come closer together since the announcement of the agreement but, given that we still see a lot of trade barriers ahead, more price differences are likely," Mera said. "We expect these geographic price differentials to persist or increase in 2026."

The unintended consequences of the tariff war are still being corrected, the report notes. US authorities, for example, are reviewing tariffs on products the country does not produce – such as coffee and cocoa – which could ease costs for US consumers and restore trade flows from producing nations.

Rabobank highlighted three other ag commodities trends for 2026:

Wheat. While prices are expected to be capped by cheap corn, these could be lifted by adverse weather or renewed geopolitical tensions. The 2025/26 season is set to deliver the first global wheat surplus in six years, with output up by 25 million tonnes. Lower prices in 2025 (USc 533/bu average) will, however, most likely trigger area reductions next season, resulting in a projected 4 million tonnes deficit in 2026/27.

Coffee. After record-high arabica and robusta prices in 2025, Rabobank expects supply and demand to balance in 2025/26 and then be followed by the first significant global surplus in five years in 2026/27 – estimated at 7-10 million bags. After some short-term volatility, coffee prices are expected to stabilise at between $2.5-3.5/lb by the end of 2026.

Cocoa: Prices nearly halved in 2025, amid a rebound in production and weak demand. Rabobank forecasts a 328,000 tonne cocoa surplus for 2025/26 building to a potential 403,000 tonne surplus in 2026/27. With cocoa production shifting from Côte d'Ivoire and Ghana toward Latin

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America and Indonesia, overproduction and price volatility risks will increase in future.

The only certainty for ag commodities is uncertainty, concludes Carlos Mera, with geopolitical fragmentation redefining global agriculture.

"We foresee continued trade disruptions, fluctuating regional prices, heavy government intervention, and a high probability of unexpected events. Farmers, traders, and policymakers alike must prepare for a world where trade is disrupted and the unexpected is now the baseline," Mera said.

Fertilizer demand growth slows

Globally, the International Fertilizer Association (IFA) is forecasting a sharp slowdown in fertilizer consumption growth in its latest *Short-Term Fertilizer Outlook*[3]. This is expected to increase by just 0.9% year-on-year (y-o-y) to 209.5 million tonnes nutrients ($N + K_2O + P_2O_5$) for the fertilizer year 2025 (FY2025). That compares to y-o-y consumption growth of 4.1% in FY2024 and 5.7% in FY2023 (Figure 1).

Lower crop prices and reduced fertilizer affordability affected fertilizer use last year, according to the Association. These factors have acted in concert with high interest rates, import duties, currency depreciation and unfavourable weather to depress demand[3].

The consumption pattern for individual nutrients is mixed:

- Nitrogen fertilizer use is set to grow relatively strongly in FY2025 – rising by 2.0 million nutrient tonnes to 119.8 million tonnes N – driven by strong national support programmes in Asia.
- Meanwhile, a small decrease in phosphate fertilizer use is expected in FY2025 – down by 0.4 million nutrient tonnes to 48.5 million tonnes P_2O_5 – linked to consumption declines in North America, East Asia and Oceania.
- While potash fertilizer use overall is expected to grow in FY2025 – up by 0.3 million nutrient tonnes to 41.2 million tonnes K_2O – increases in Latin American and South Asian consumption are partly offset by declines in North America and the palm oil producing countries of East Asia (Malaysia and Indonesia).

After slowing in FY2025, IFA expects global fertilizer demand growth to rebound by 1.7% this year (FY2026), with consumption set to increase in most regions across the globe – except for North America and Oceania. Uncertainties still abound, however, and the following year-on-year changes in regional consumption in FY2026 are subject to a number of caveats:

- **Eastern Europe & Central Asia**: +4% demand growth. Assumes higher application rates in Russia and a better agricultural outlook in Ukraine.
- **Africa**: +4% demand growth. Assumes optimism prevails and governments provide support.
- **West Asia**: +3% demand growth.
- **South Asia**: +3% demand growth. Assumes normal rainfall and continued government subsidy support.
- **Latin America**: +3% demand growth. Assumes higher crop prices and improved fertilizer affordability.
- **East Asia**: +1 demand growth. Assumes more affordable fertilizers and continued government support.
- **Western & Central Europe**: +1% demand growth. While phosphate fertilizer use is expected to recover, the forecast is subject to many uncertainties, including the EU's introduction of CBAM, the carbon border adjustment mechanism (*Fertilizer International* 526, p14).
- **North America**: a -1% demand contraction is expected linked US economic uncertainties.
- **Oceania**: a -4% demand contraction is forecast on the expectation of drought.

Summing up, IFA's says that, while geopolitics and trade remain wildcards, fertilizer demand fundamentals are robust and confidence in economic growth is strong.

> **"Farmers, traders, and policymakers alike must prepare for a world where trade is disrupted and the unexpected is now the baseline."**

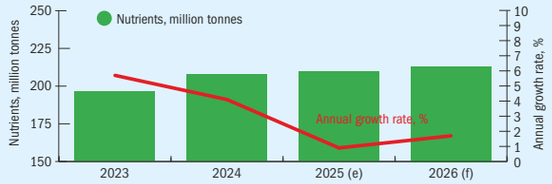
Urea and potash output at record highs

IFA's preliminary estimates of 2025 global production and trade for the main fertilizer commodities – versus 2024 – are as follows[3]:

- **Urea** production (+2%) and trade (+4%) increased to record levels of 204 million tonnes and 56 million tonnes, respectively, led by China's rebound and international re-entry.
- **Monoammonium phosphate and diammonium phosphate (DAP/MAP)** production is reported to be back on track (+1% to 67.7 million tonnes), while trade remained sluggish (+1% to 39.4 million tonnes).
- **Muriate of potash (MOP)** production globally (+1% to 77.1 million tonnes) saw its second consecutive year of record-breaking output, while trade also grew strongly (+5% to 63 million tonnes).

IFA is currently forecasting the following fertilizer production capacity additions over the two years 2025-2026[3]:

Fig. 1: **World fertilizer consumption (nutrient tonnes) and annual growth rate: fertilizer year* (FY) 2023-2026**



**The fertilizer year (FY) is the full 12-month period for fertilizer demand used by IFA. It refers to the calendar year starting in January for most countries in Latin America, Africa, East and Southeast Asia and Eastern Europe & Central Asia (EECA). For other regions, including North America, West & Central Europe (WCE) and South Asia, the FY starts in either the second-quarter or the mid-point of the calendar year.*

Note: 2025 = estimate, 2026 = forecast *Source: IFA (January 2026)*

PHOTO: FLICKR/OLEKSANDRK

The 2025/26 season is set to deliver the first global wheat surplus in six years, with output up by 25 million tonnes.

- A 7.8 million tonne increase (+4%) in nitrogen capacity (ammonia) from 195 million tonnes to 203 million tonnes N – driven by new capacity in China and low-cost projects in the US and Russia. This includes the start-up of a large-scale (1.2 million tonnes per annum) 'blue' ammonia project in Qatar.
- After a very quiet year for phosphate capacity (phosphoric acid) in 2025, with few global changes to report, the installation of new capacity is expected to rebound by 2.6 million tonnes (4%) this year, mainly located in Africa and China, taking total global capacity to 65.7 million tonnes P_2O_5.
- After a lull in 2024, potash expansion projects (Russia, Laos, Canada, Jordan, Spain), together with two new projects (Laos and Belarus), will see global potash capacity expand by 3.8 million tonnes to 68.1 million tonnes K_2O over the two years 2025-2026.

Summing up

The key takeaways from IFA's latest *Short-Term Fertilizer Outlook*[3] are:

- After two strong years, fertilizer demand growth is expected to slow in FY2025 before rebounding in FY2026.
- Nitrogen fertilizer use will lead on growth over this two-year period, followed by potash and then phosphate.
- Regionally, Asia and Latin America are expected to drive fertilizer consumption globally in 2025-2026, with economic uncertainties affecting demand elsewhere.
- A steady pace of investment in fertilizer supply capacity is expected during 2025-2026, with this then accelerating from 2027.
- While many factors are shaping global fertilizer supply – from geopolitics to policy and regulation – market fundamentals are expected to remain the ultimate drivers of fertilizer output.

> **"Asia and Latin America are expected to drive fertilizer consumption globally in 2025-2026, with economic uncertainties affecting demand elsewhere."**

CRU in its top fertilizer calls for 2026 predicts:

- European affordability pressures will lead to lower fertilizer import duties and CBAM carve outs.
- China NP exports to slow on a shift back to DAP/MAP – while global importers continue to evolve towards a more diverse product mix.
- Phosphate investment builds momentum – with capital from less traditional sources for projects in riskier jurisdictions.
- Indian urea and DAP imports to remain high as domestic production faces limitations.
- China urea exports will start earlier and be more substantial – CRU forecasts almost 6 million tonnes.
- Potash projects internationally will face further delays and capital overruns – while Russia continues to explore further projects and expansions.
- Sulphur prices to remain above historical norms in the first half of 2026 – but the year's second half will see price relief as supply tightness eases.
- European nitrogen majors to invest in US ammonia capacity and offtakes – pivoting away from their existing high emissions sources.
- China's 'anti-involution' policy will not result in fertilizer capacity consolidation – but it may lead to looser urea export restrictions. ■

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CRU-Veeries Brazil market report

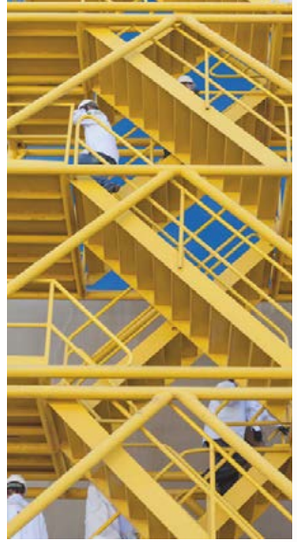


PHOTO: MAARTEN ZEEHANDELAAR/SHUTTERSTOCK.COM

Large freighter, Rio de Janeiro. Nitrogen fertilizer imports into Brazil remained buoyant in November 2025, with strong lineups in place for December.

Fertilizer sales to Brazilian farmers are currently in line with the average of the past three years, despite variations by crop and state. CRU's **Anthony Rizzo** and **Bruno Fardim Christo** of Veeries provide an update on the status of fertilizers and crops in the Brazilian market.

CRU and Veeries – new strategic partners

CRU launched a new strategic partnership with Brazilian research house Veeries in September 2025 with the publication of the inaugural *Brazil Fertilizers and Crops* monthly report. These joint reports deliver a comprehensive view of the Brazilian agricultural market – highlighting both developing trends in prices and supply/demand fundamentals.

Carrying content from both CRU and Veeries, the reports provide deep insights into key N, P and K fertilizers, along with major crops such as soybean and corn. They aim to bring clarity and transparency to the fast growing and strategically important Brazilian market. They also highlight the impacts Brazil faces from price trends in international markets.

This summary article is based on the in-depth December *Brazil Fertilizers and Crops* report from CRU-Veeries published on 4th December 2025.

Market snapshot – December 2025

Nitrogen: Imports of nitrogen fertilizers remained high in November 2025, with strong lineups already in place for December (Figure 1). This trend has led to an early buildup of stocks ahead of the second corn crop (safrinha), allowing for advance deliveries (Figure 2).

Despite the large import volumes and solid inventories, a significant portion of this growth has been driven by less concentrated products, such as ammonium sulphate. Total nitrogen fertilizer consumption is increasing by around 8%, but nutrient consumption is rising by only about 2%, reflecting the shift in product mix. The same pattern is evident in inventories: while total stock levels have increased by about 60% year-on-year, the nutrient increase is closer to 40%.

Looking ahead, the safrinha corn area is expected to expand by over 800 thousand hectares. This, together with strong fertilizer demand from the coffee crop, should help absorb currently elevated stock levels over the coming months.

Phosphates: As anticipated, phosphate imports continued their decline in November, and look set to decline again in December, as part of efforts to reduce the high inventories accumulated earlier in the year (Figure 3 & 4).

Similar to the nitrogen segment, while phosphate fertilizer consumption is projected to increase by approximately 7% in 2025, nutrient consumption is expected to grow by only 4%, due to the increased use of single superphosphate (SSP), a lower-concentration phosphate source. Similarly, phosphate inventories are likely to increase by about 30% compared to last year on a product basis, yet only increase by around 15% when measured as nutrients.

Potash: Modest potassium chloride (KCl) imports in recent months have helped maintain balanced stock levels through 2025 and prevented oversupply (Figures 5 & 6). This has supported firmer domestic prices, with slight upward adjustments, which is an unusual seasonal pattern for this time of year.

Potash imports are expected to increase in the coming months, to ensure an ample supply for the second corn crop (safrinha).

Barter ratios stable

Soybeans: While soybean barter ratios deteriorated slightly at the end of November (Figures 7 & 8), there are currently no remaining volumes to be negotiated for the 2025/26 season (except in Rio Grande do Sul). Consequently, the market focus is now shifting to forward barter ratios and early purchasing activity.

Corn: Barter ratios weakened slightly but remain close to historical averages. This has slowed the pace of fertilizer purchases for the 2025/26 second crop (safrinha). Purchases could increase significantly in December and January, however, if nitrogen fertilizer prices fall slightly and corn prices rise.

Cotton: Barter ratios remain unfavourable for farmers, and fertilizer purchases for the cotton area have been delayed due to low lint prices. There are few signs of improvement on the horizon, and a decline in Brazil's planted area is expected for the 2025/26 cycle – something not seen since 2020/21.

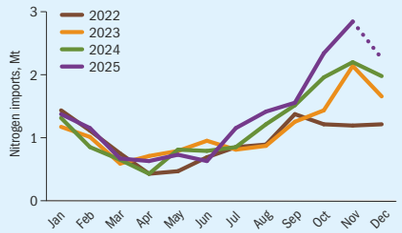
Coffee: Favourable barter ratios across Brazil are encouraging early fertilizer purchases. High coffee prices continue to encourage investments in new plantings and sustain solid demand, especially in the differentiated and premium segments.

Sugarcane: Barter ratios for sugarcane have remained stable, from mid-September to end-November, but are still at a higher level than in the past two years. The situation has been exacerbated by the narrow margins in the sugar-energy sector, resulting in less intensive fertilization of the crop in 2025 and 2026.

Veeries Fertilizers Sales Index

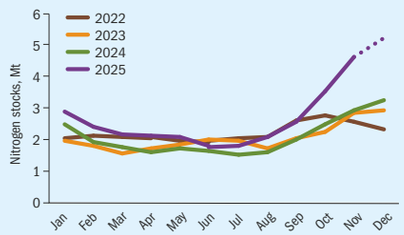
The Veeries Fertilizer Sales Index consolidates the percentage of fertilizer sales for the main crops (soybeans, summer corn,

Fig. 1: **Brazilian nitrogen imports each month, million tonnes**



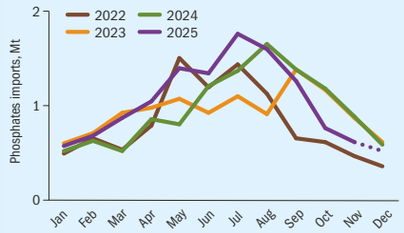
Source: Veeries

Fig. 2: **Brazilian nitrogen stocks at the end of each month, million tonnes**



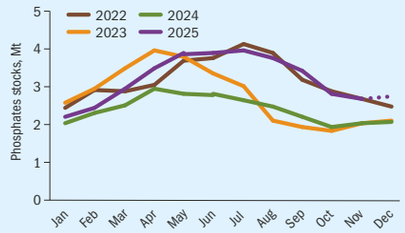
Source: Veeries

Fig. 3: **Brazilian phosphate imports each month, million tonnes**



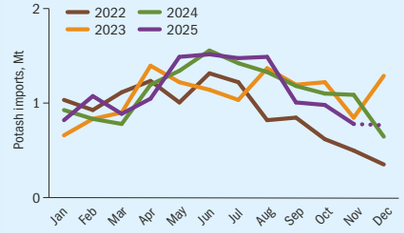
Source: Veeries

Fig. 4: **Brazilian phosphate stocks at the end of each month, million tonnes**



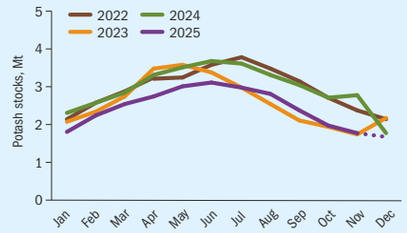
Source: Veeries

Fig. 5: **Brazilian potash imports each month, million tonnes**



Source: Veeries

Fig. 6: **Brazilian potash stocks at the end of each month, million tonnes**



Source: Veeries

COUNTRY REPORT

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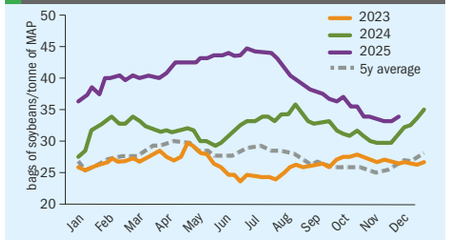
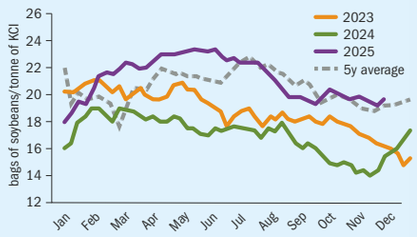
Fig. 7: **Soybean barter ratio (Mato Grosso mid-north), bags of soybean per tonne of monoammonium phosphate (MAP)**



Source: Veeries

Fig.8: **Soybean barter ratio (Mato Grosso mid-north), bags of soybean per tonne of potassium chloride (KCl)**



Source: Veeries

safrinha corn, cotton, sugarcane, wheat, and coffee) across their respective producing states.

The index shows that fertilizer sales to Brazilian farmers are currently in line with the average of the past three years (Figure 9) – signalling a buying pattern within the normal range – despite variations by crop and state. For the 2026/27 season, the index is already at 5%, driven by early soybeans and safrinha corn purchases in Mato Grosso.

Individual fertilizer sales patterns for safrinha corn and soybean are highlighted in more detail below.

Safrinha corn 2025/26

Fertilizer sales evolution for the 2025/26 Safrinha corn season was tracking at 66% at the end of November (based on average annual sales for the last three seasons), above last year's level (2024/25 season) but 12 percentage points below the three-season average.

Fertilizer sales are maintaining a slower-than-average pace, with agricultural producers waiting for corn prices to rise or for fertilizer prices to fall. There is room for a nitrogen fertilizer price drop of about $10/t from December to January, in our view, and for corn prices to increase (due to second crop risk).

Fertilizer sales have advanced more in Parana and Mato Grosso do Sul states – due to the good calendar for the second crop – and some farm cooperatives there have already reached 80-85% of their sales targets.

Phosphates demand is notably above average. This is linked to the fact that agricultural producers did not apply fertilizers systematically before soybean planting due to the high cost of monoammonium phosphate (MAP) at the time.

Soybean 2026/27

Fertilizer trading for the 2026/27 soybean season was tracking at 9% (based on average annual sales for the last three seasons) at the end of November, with fertilizer sales above the level at this time last year (2025/26 season) but one percentage point below the three-season average.

Advance fertilizer sales are being limited by prices and freight costs. Fertilizer prices have risen since late October and minimum freight rates are making fertilizers even more expensive. Discounts are generally small, although Russian fertilizer companies have the more aggressive offers.

There were more fertilizer price quotes than actual deals at the end of November. Concluded deals were mostly with large producers/groups in Mato Grosso, Goias, Parana and MAPITOBA (Maranhao, Tocantins, Piaui, Bahia) states.

Many agricultural producers are waiting for fertilizer prices to fall by around 5%. On that basis, the end-November MOP (muriate of potash) price of $355/t cfr Paranagua and $492/t cif Sorrisio would need to fall to around $340/t cfr and $475/t cif, respectively, for farmers to close deals, in our view.

Continuing the farmer buying behaviour reported in the November monthly update, 2026/27 fertilizer sales negotiations are being driven by phosphates (lower-concentration SSP). This contrasts with the same period in 2024 when deals were driven by potash (MOP). ■

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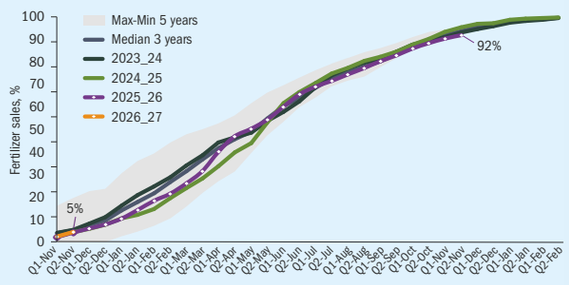
Please contact Anthony Rizzo (anthony.rizzo@crugroup.com) or Anuradha Ramanathan (anuradha.ramanathan@crugroup.com) at CRU and comercial@veeries.com.br at Veeries for further information about the latest January 2026 Brazil Fertilizers and Crops report.

Fig.9: **All crops Brazil – Fertilizers sales index* (%)**



Source: Veeries

The shift in food and agriculture

The ATOME-CASALE Villeta Project in Paraguay represents a significant step forward for fertilizer sustainability. As the fertilizer industry moves toward decarbonisation, the project is emerging as a leading reference for future low-carbon fertilizer production. CASALE's **Giovanna Roviello**, Process Manager, and **Francesco Baratto**, Head of Syngas Department, provide an update on the progress of Villeta as it approaches a final investment decision.

IMAGE: ATOME/CASALE

Graphic visualisation of the ATOME-CASALE Villeta project in Paraguay.

Introduction

The global fertilizer industry is undergoing a profound transformation as producers seek out low-carbon feedstocks and sustainable production routes. Within this context, the ATOME-CASALE Villeta Project in Paraguay stands out as one of the sector's most promising and advanced green fertilizers developments.

Supported by abundant baseload hydropower and state-of-the-art process design, the project aims to deliver competitive, low-carbon fertilizer for both domestic and international markets. This article presents an overview of the project – with a particular focus on engineering progress and the EPC (engineering, procurement and construction) development strategy.

A fully-integrated production centre

The Villeta project has been conceived and engineered as a fully integrated production complex, covering the complete value chain from the sourcing of the renewable electricity to the manufacture of calcium ammonium nitrate (CAN) at the scale of 260,000 tonnes per annum (t/a). The project's design philosophy focuses on high energy efficiency, operational reliability, and minimal environmental impact. All core process technologies are sourced from the CASALE portfolio, ensuring a high level of integration, consistent design standards, and optimised performance across the entire plant.

At the front end of the production complex, renewable electricity and water are converted into green hydrogen. This is combined subsequently with a high purity nitrogen feedstock and processed into ammonia and downstream products such as nitric acid and CAN.

The main process units of the complex include:

- **A water electrolysis plant**. This produces green hydrogen using renewable power.
- **An air separation unit (ASU)** supplying high-purity nitrogen.
- **An ammonia synthesis loop**. This operates with CASALE's proprietary SMART-N technology with a configuration designed for high efficiency and flexible operation under variable power supply.
- **A nitric acid plant**. This is based on CASALE's dual-pressure DualPURE process and provides high conversion efficiency and low emissions.

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- **An ammonium nitrate solution (ANS) production unit**. This utilises CASALE's NitroPIPE technology, with enhanced safety and heat management.
- **A granulation plant for CAN production**. This is based on CASALE's NitroCULTIVA drum granulation technology to deliver consistent product quality and robust granule strength.

The complex – beyond the core process units – is also equipped with comprehensive utilities and offsite systems. These include water treatment, cooling facilities, power distribution, and storage infrastructure, as well as administrative, maintenance, and logistics buildings to support long-term operation.

Villeta, the selected location for the production complex (Figure 1), offers access to reliable, cost-effective renewable electricity, due to its close proximity to Paraguay's hydropower grid. This advantage is a critical enabler for the economic viability and competitiveness of both green ammonia production and – ultimately – the downstream manufacture of fertilizer at the site.

Fig. 1: **The Villeta Green Fertilizer Project (GFP) is located in Paraguay, 35 kilometres from the capital city of Asuncion on the River Paraguay.**

The shift in food and agriculture

Nitrogen fertilizers are the backbone of modern agriculture, being responsible for feeding up to 50% of the world's population. Yet agri-food systems also contribute 30% towards global greenhouse gas (GHG) emissions. Hence the fertilizer industry, which has largely been driven by production volumes previously, is now shifting its focus towards agronomic efficiency and more sustainable ways of making affordable crop nutrients at scale.

When it comes to sustainability, the production of low-carbon nitrogen fertilizers – from ammonia via the green hydrogen route – offers a particularly impactful and scalable near-term solution. The ease with which this manufacturing process can be readily integrated within today's food and farming value chains, versus other options, also makes it a highly promising production route. Indeed, the evidence from recent reports (Hydrogen Council, McKinsey & Company) is that using low-carbon fertilizer can reduce up to 30% of food product emissions while adding only an extra 1-3% to food product end-costs.

Major food and consumer packaged goods (CPG) companies are also now taking decisive steps and setting ambitious Scope 3 emissions targets – aided by the market push from the regulatory environment and global standards (e.g., CBAM, REDIII, SBTi) – a move which is supporting the adoption of low-carbon fertilizers across their value chains.

The low-carbon fertilizer supply agreements already announced between Yara international (the marketing partner for Villeta) and both PepsiCo and chocolate manufacturer Barry Callebaut are notable examples. Major players such as Nestlé, Unilever, Mars and M&S are among other major brands committed to sustainable farming practices to tackle Scope 3 emissions.

The Villeta project represent an accelerator of this sustainability shift in food and agriculture, with a production process that could potentially displace up to 12.5 million tonnes carbon dioxide equivalent (CO_2e) over its life. Moreover, at a time when demand for sustainable fertilizer products is intensifying, the CAN market itself is growing due to the product's superior agronomic performance. Compared with widely-used urea-based fertilizers, CAN has a higher nutrient use efficiency (NUE) – making it better positioned for the farming needs of the future.

Project Status

The Villeta project has successfully completed conceptual engineering and FEED (front-end engineering design) phases. Key permits are obtained, initial site preparation activities are underway, and the necessary vendor engagement for long-lead equipment items has been completed. Discussions with financing institutions, meanwhile, are near to completion – with early 2026 being the current target for a final investment decision (FID).

Engineering

Engineering work for this green fertilizer project is at an advanced stage and continues to progress ahead of the contractual schedule in several critical areas. Following completion of the FEED, a series of detailed engineering tasks has been initiated and completed ahead of the FID.

A thorough review of the Contractual Project Schedule has been carried out. This identified priority engineering activities with particular emphasis on the first 12 months of execution and critical-path activities. The gains from this review have meant progress to date has been ahead of schedule, reinforcing overall confidence in the ability to meet the contractual project duration.

Key engineering deliverables have been completed or are well advanced, including process unit documentation, equipment datasheets, and P&IDs (piping and instrumentation diagrams). Reviews of the 3D model and HAZOP (hazard and operability) studies for technological units are ongoing, enabling early incorporation of client feedback and mitigation of potential downstream impacts.

Procurement

Procurement activities are advancing in parallel with engineering, with a particular focus on long-lead and schedule-critical equipment packages.

Technical specifications, bid evaluations and tabulations have been prepared for major equipment, including electrolysers, electrical systems (switchyard, trans-

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PHOTO: CASALE

ATOME and CASALE at the latter company's HQ, Lugano, Switzerland.

formers and switchgear), the air separation unit, main compressors, converters and heat recovery equipment.

For several critical packages, commercial and technical negotiations with suppliers are already underway, while others have entered, or are ready to enter, the purchase order placement phase. Early and structured engagement with vendors is enabling confirmation of delivery schedules and manufacturing capacities, thereby reducing exposure to supply-chain constraints and mitigating the risk of cost escalation.

Construction

Construction preparatory activities are progressing in parallel with engineering and procurement. The site preparation engineering package has been completed, for example, and ATOME is working with subcontractors to handover the site area to CASALE ahead of the original schedule. In addition, early arrangements have been defined to accelerate the availability of power supply and river water at the plant battery limits, supporting early mobilisation and overall construction readiness.

In parallel, subcontractor scouting and prequalification are underway, together with permitting and logistics planning, to ensure that construction activities can commence promptly once the project becomes executable.

Project execution programme from FID

Following the FID, the project execution strategy will have a total duration of around 40 months – from the commencement date to complex handover – with plant start-up scheduled for the first quarter of 2029. This execution timeline is achievable, despite the scale and complexity of the project, thanks to CASALE's extensive track record in delivering lump-sum turnkey EPC fertilizer projects.

Fundamental to the execution strategy is CASALE's integrated delivery model. This places the licensor and EPC contractor together as part of the same project organisation throughout the project's full lifecycle, from technology licensing through to the point when the complex is in a ready-for-start-up condition. This integration eliminates transition risks between different project phases, avoids bottlenecks relating to licensing approval, and ensures early involvement of the construction and commissioning teams.

Construction and commissioning considerations are embedded within the project as key drivers from the earliest engineering stages. The engineering organisation operates in close coordination with construction and commissioning specialists, enabling early identification and mitigation of execution risks.

Throughout all project phases, rigorous project control processes are applied to ensure schedule adherence, cost discipline and quality compliance. These include:

- An integrated planning and progress measurement system covering the full project duration.
- Structured cost control with forecast trending of costs and worker-hours.
- The application of CASALE's Quality Management System across both supplier and subcontractor scopes.

CASALE's quality system is fully compliant with the UNI EN ISO 9001:2015 standard, ensuring consistent and effective control of project activities.

Conclusions

The ATOME-CASALE Villeta Project represents a significant step forward for sustainable fertilizer production in Latin America and the wider global industry. Supported by a strong business case and market conditions, available renewable resources and a solid lumpsum turnkey EPC execution plan, the project demonstrates how green fertilizers can be produced competitively and at scale.

As the industry moves toward decarbonisation, the Villeta project – as a leading reference for future low-carbon fertilizer production – offers a replicable model that combines technical reliability, environmental integrity and commercial viability. ■

FertiCoat – the ultimate fertilizer coating?

FertiCoat is a specialised fertilizer coating developed by Omnia Specialities Australia for granular, liquid, and soil applications. The coating's unique biostimulant formulation, by helping to reduce soil fixation and leaching losses, makes key nutrients more available for plant uptake.


PHOTO: OMNIA

Omnia Specialties Australia is based in Morwell, Victoria.

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 address these farm productivity concerns, Omnia Specialities Australia 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 coating for granular fertilizers (NP, NPK and urea) and functions as an effective additive for liquid fertilizers like urea ammonium nitrate (UAN). Crucially, when added to urea, FertiCoat ensures that nitrogen stays in root zone, preventing wastage and nutrient loss through volatilisation and/or leaching.

Multiple benefits

FertiCoat offers a range of agronomic and physical benefits.

Agronomically, it acts to improve both nutrient retention and soil fixation. In sandy soils, the humic acid present in FertiCoat helps prevent the loss of water-soluble nutrients to leaching by providing a charged surface able to retain these. FertiCoat also complexes with nutrients, particularly phosphorous, to prevent these becoming fixed or 'locked up' in soils. In acidic (low pH) soils, for example, it acts

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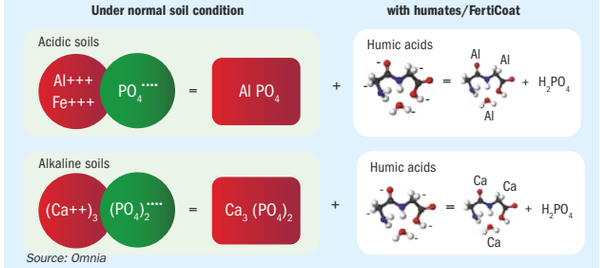
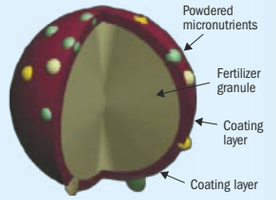
Fig. 1: **Nutrients such as phosphorus can be 'locked up' in soils due to fixation in acid soils by aluminium and iron (left, top), and fixation by calcium, magnesium, and bicarbonate in alkaline soils (left, bottom). FertiCoat improves nutrient availability, and helps prevent undesirable soil fixation, as nutrients form complexes with humic acid instead (right, top and bottom).**



Source: Omnia

Fig. 2: **An effective way of delivering micronutrients to crops is to embed these within a layer of FertiCoat applied as an external coating to fertilizer granules.**



Source: Omnia

to stop phosphorus fixation by aluminium and iron. Similarly, it helps avoid fixation by calcium, magnesium, and bicarbonate in alkaline (high pH) soils (Figure 1).

Physically, FertiCoat also improves fertilizer handling by reducing dust and caking, improving flowability, and enhancing granule hardness, while also providing an effective carrier for micronutrient additives (Figure 2).

Preventing crop burn

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

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.


PHOTO: OMNIA

FertiCoat application system.

Ease of application

FertiCoat can be applied to fertilizer granules using various equipment, such as granulation drums, coolers, coating drums, blenders, screw augers, or conveyors. Omnia also offers a dedicated FertiCoat applicator system with a controller, pump and double spray jets for good coating coverage (see photos).

Crop trial results

Worldwide crop trials have provided independent evidence of FertiCoat's ability to increase yields and generate higher revenues.

FertiCoat's efficacy was demonstrated in a series of crop trials on wheat and maize over three years (2008-2010) at 25 locations in South Africa. It was applied in conjunction with micronutrients as a coating to NP/NPK fertilizer granules. FertiCoat delivered a 4.1-6.2% and 4.1% yield improvement for wheat and maize, respectively, versus the untreated control, in trials located in South Africa's Central and Cape regions.

"From the South African data, there is a 96% probability of getting a 300% or greater return on investment (ROI) from FertiCoat," said Omnia.

In Australia, positive results were obtained using FertiCoat treated urea (coating applied at 5 litres/tonne) in a pasture trial in Victoria. FertiCoat treatment increased pasture dry matter by 4.1 kg/day, around 11% greater than the control, for a 100 kg/ha urea application rate.

In ballpark terms, this extra pasture yield could translate to an increase in annual farm income of more than AUD 472/ha when used for grazing by a dairy herd, based on the following calculation:

- 4.1 kg dry matter/day = 8.2 litres of extra milk/day
- 8.2 litres/day milk x 8 months = 1,968 litres/ha/year extra = 78.7 kg more milk solids (about 4%)
- 78.7kg milk solids = AUD472.2/ha/annum (assuming 1 kg of milk solid = about AUD6).

Elsewhere, leading Indian fertilizer manufacturer Deepak Fertilizers and Petrochemicals Corporation Limited (DFPCL) has been producing NPK fertilizers coated with FertiCoat, after extensive agronomic trials showed significantly higher yields across a range of crops. These included yield improvements for potato, wheat and onion of around 23%, 7% and 9%, respectively, with FertiCoat treated NPKs, relative to the untreated control (Figure 3, left to right).

At the forefront of biostimulants

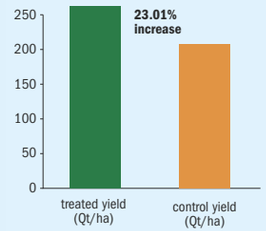
Omnia Specialties Australia is a leading manufacturer of speciality fertilizers, biostimulants (humates, fulvates, kelp), micronutrients, and foliar fertilizers. Based in Morwell,


PHOTO: OMNIA

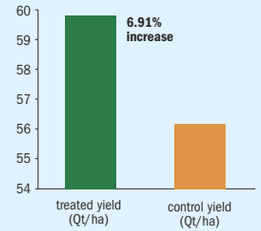
FertiCoat application system inspected by Teferi Belayneh, Omnia's commercial & technical development manager.

Fig. 3: **Deepak Fertilizers and Petrochemicals crop trial results in India for potato (left), wheat (centre) and onion (right). Yield results for FertiCoat treated NPKs versus uncoated NPK control.**

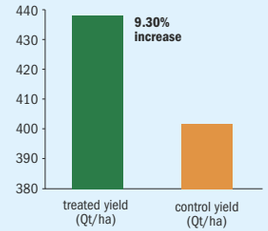
FertiCoat yield assessment for a potato trial at Mahatma Phule Krishi Vidyapeeth (MPKV) agriculture university, Rahuri, Maharashtra. Coated and uncoated 10:26:26 NPK fertilizer.



FertiCoat yield assessment for a wheat trial at Agharkar Research Institute (ARI), Pune, Maharashtra. Coated and uncoated 16:16:16 NPK fertilizer.



FertiCoat yield assessment for onion trial at National Horticultural Research and Development Foundation (NHRDF), Nashik, Maharashtra. Coated and uncoated 16:16:16 NPK fertilizer.



Source: Deepak/Omnia

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Victoria, the company is Australia's largest producer of humate and fulvate products and exports to more than 30 countries.

With a focus on soil health, Omnia utilises the best quality leonardite to produce highly concentrated humic acids. The company controls every step of the process, from mining leonardite in the Gippsland Basin – one of the richest sources of humic substances in the world – to developing and testing advanced biostimulant products to ensure these meet strict agronomic and environmental standards. Omnia's team of agronomists and scientists also work closely with growers, offering tailored advice and technical support.

FertiCoat is well positioned within the fast growing biostimulants sector, with humic substances and seaweed extracts leading the market. This innovative coating also supports the shift to regenerative agriculture – helping growers get more from their fertilizer inputs by reducing losses, improving soil health and encouraging microbial diversity.

FERTICOAT: KEY BENEFITS AND FEATURES

PHOTO: OMNIA

Jan De Jager, Omnia's export managing director, views the application of FertiCoat to granules on a conveyor.

A different kind of coating

FertiCoat isn't just another fertilizer additive, according to its manufacturer Omnia:

"It's a carefully engineered coating that brings together humic and fulvic acids from Australian leonardite, seaweed extracts, amino acids, and proprietary polymers. This blend is designed to help plants get the most out of every granule of fertilizer."

The humic acids in FertiCoat hold onto nitrogen, keeping it in the root zone and reducing losses to the air and water. At the same time, phosphorus stays available for plant uptake, and the seaweed and amino acids boost root growth and soil life.

FertiCoat is also easy to use – with urea, NPK and UAN fertilizers – whether applied as granules or liquids. For liquid UAN, it can even help prevent leaf burn, a common headache for growers.

Agronomic and environmental benefits

- **Improved nutrient use efficiency:** Makes applied nutrients more available to plants.
- **Reduced nutrient lockup:** Prevents nutrients like phosphorous from becoming fixed in soils and unavailable to crops.
- **Less leaching:** Helps retain water-soluble nutrients in the root zone.
- **Improved yields:** Extensive trials consistently demonstrate significant increases in crop yields.
- **Micronutrient application:** an excellent agent for coating micronutrients directly onto fertilizer granules.

Physical/handling advantages

- **Dust absorption:** Absorbs up to 3% of dust, which translates to an additional 30 kg/t of fertilizer output.
- **Improved flowability:** Dust suppression leads to better product flow.
- **Reduced caking:** Stacking tests show no hard lumps or caking in storage.
- **Excellent storability:** Treated granules (standard 6 litres/tonne coating rate) show less than 1% breakdown after 10 heat cycles.
- **Rapid drying:** Coating dries quickly after application.
- **Granule hardness:** The coating either improves or maintains the hardness of fertilizer granules.
- **Reduced machinery buildup:** Significantly reduces sticking and buildup in blending and coating machinery, leading to less downtime for maintenance.

Liquid application with UAN

When mixed with urea ammonium nitrate (UAN) for foliar application, FertiCoat offers:

- **Reduced leaf scorch risk:** Significantly mitigates the risk of leaf burn commonly associated with foliar UAN applications, allowing for potentially higher application rates.
- **Improved nitrogen uptake:** The addition of humic acids has been proven to increase nitrogen uptake by the plant.
- **Increases yield potential:** Improved nutrient uptake plus lower crop stress contribute to higher yields.

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Advanced sulphur nutrition for soybean-maize systems in Brazil

Recent field research conducted in Goiás and Mato Grosso in Brazil's Cerrado region provides fresh evidence on how advanced sulphur sources, such as patented Micronized Sulphur Technology (MST®) from Sulvaris, influence nutrient availability, crop uptake, and yield in high-output soybean maize systems. **Mark Howell**, Head of Agronomy & Product Development at Sulvaris, provides some new insights.

Soybeans ready for harvest, 2025 field trials, Federal University of Goias.

Sulphur – a critical role

Sulphur (S) availability has become an increasingly important determinant of crop productivity in Brazil's major grain-producing regions. In the Cerrado, a region where soybean–maize cropping systems dominate, the interaction between soil properties, climate, and fertilizer inputs creates conditions in which sulphur supply frequently limits yield.

Brazilian Cerrado soils are typically highly weathered, acidic, and low in organic matter. Sulphate – the form of sulphur absorbed by plants – is weakly retained in these soil profiles and readily lost through leaching during periods of high rainfall, with significant consequences for yield and farm income. Sulphur plays a critical role in nitrogen metabolism, protein synthesis, and biological nitrogen fixation. Improved sulphur availability therefore supports more effective nitrogen use and contributes to higher yield potential.

Sulphur transformation in soil

Elemental sulphur fertilizers must first be converted to sulphate through microbial oxidation in the soil. The efficiency of this process is strongly influenced by particle size, as oxidation occurs at the particle surface. If elemental sulphur particles are too large, crop productivity can be impaired if only partial oxidation occurs within the season of application.

Micronized Sulphur Technology (MST®) strikes a balance by engineering elemental sulphur into ultrafine particles, with 95% of particles ranging from 1–12 microns (average size 7 microns). This dramatically increases surface area and microbial access, accelerating oxidation while maintaining a sustained nutrient release profile. The result is sulphur that becomes available rapidly enough to support the crop in the year of application, yet gradually enough to reduce leaching losses.

Phosphate+MST®

Importantly for fertilizer producers, MST® is not a coating but a co-granulated technology. Valuably, this eliminates the accumulation of concentrated sulphur dust, offers a greater ability to scale production, and improves prolonged release.

Scanning electron microscopy confirms the uniform distribution of MST® throughout phosphate granules (Figure 1). While there is considerable market acceptance for sulphur enhanced phosphate products, MST® through its flexibility and efficacy is one of the few technologies well-suited to triple superphosphate (TSP) production.

Field trial design and conditions

High cropping intensity is one of the defining characteristics of Brazil's production systems, with maize planted immediately following soybean harvest. Under these conditions, the reduced leaching risk during the rainy season associated with MST®, combined with its nutrient carryover abilities, become particularly valuable – as these properties support sulphur availability beyond the soybean crop and provide sulphur nutrition to the maize crop as well. Fertilizer inputs applied ahead of soybean can extend their value from the first crop to the subsequent maize crop by using two of the 4R principles: right source, and right rate.

Field trials assessed sulphur fertilizer efficacy for a soybean-maize rotation in the 2024-25 cropping season. These were established by several research organisations, including the Mato Grosso Foundation and the Federal University of Goiás. At these locations, phosphorus and sulphur were applied prior to soybean planting (30 kg S/ha), a strategy designed to reduce the number of application passes on the field and focus soil fertility investments on the highest value crop.

Available soil sulphur concentrations ranged from 7 to 9.5 ppm, with soil pH between 5.2 and 5.5 and organic matter levels of 1–2%. These values are representative of many Cerrado soils classed as marginal to deficient in sulphur. Other nutrients were balanced across treatments to allow differences in crop performance to be attributed primarily to sulphur source effects. Measurements included grain yield and sulphur uptake at key growth stages.

Fig.1 Scanning electron micrograph (energy dispersive x-ray) imaging of the interior of a Phosphate+MST® granule showing MST® (yellow) distributed throughout the phosphate (blue).

Crop response to sulphur fertilization

Across the trial locations, both soybean and maize exhibited clear positive yield responses to sulphur fertilization. The largest impact was shown by TSP+MST® in Mato Grosso, with a 16% yield increase in soybeans followed by 17% for maize.

Results confirm sulphur as a limiting nutrient under these field conditions – conditions which are therefore effective for efficacy testing of sulphur fertilizers. While yield improvements varied by site, reflecting differences in soil properties and environmental conditions, sulphur-responsive locations consistently demonstrated the importance of adequate sulphur supply (Figure 2 & 3).

Treatments containing MST® produced positive yield responses in soybean across different soil types. Responsive sites showed an average yield increase of approximately 14% with TSP+MST®, based on all Brazilian trials conducted in 2025 (including

To test responses to sulphur fertilization, TSP+MST® granules (inset) were applied prior to planting in Cerrado field trials for a soybean-maize rotation In the 2024-25 season. Soybean seedlings (left) emerging from the field compared to well-established leafy soybean plants (right) later in the season.

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soybean only trials). There was a clear difference between TSP+MST® and other sulphate sources, with the latter consistently demonstrating lower yield in the following corn crop, an impact we would expect from losses due to nutrient leaching and immobilisation. These results confirm that MST® can effectively enhance the agronomic value of TSP by incorporating a high efficiency sulphur source that functions throughout the dominant cropping sequence in Brazil.

Sulphur uptake over two crops

It is critical for crops to have access to sulphur to support grain yield and quality, particularly when growth is most rapid in late vegetative and early reproductive stages.

Therefore, in addition to yield, total sulphur uptake in biomass was measured at different critical vegetative and reproductive growth stages at the Mato Grosso location throughout the soybean and maize seasons (Figure 4). Results show a clear differentiation in sulphur uptake between sulphur sources. These confirm that having less sulphur in the crop affects the ability to produce grain yield – as well as other critical biochemical processes that impact everything from photosynthesis to plant defenses.

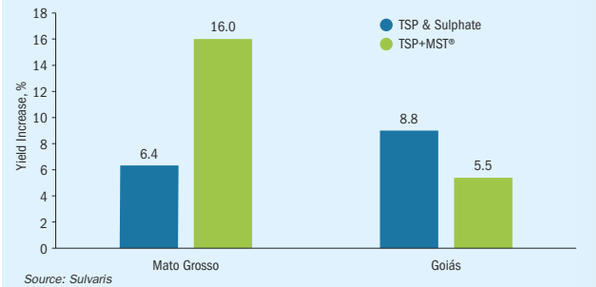
Implications for fertilizer management

Effective sulphur fertilization requires a balance between timely availability and retention within the root zone. Fertilizers that deliver sulphur availability through progressive oxidation helps mitigate leaching losses while simultaneously maintaining crop access to sulphur throughout critical growth stages – this being especially evident in these trials.

This observation, which is not unique to Brazil, has international nutrient management implications and offers opportunities with global impact. Sulvaris has already explored the benefits of effective sulphur fertilization in over 400 agronomic trials globally on a wide range of crops and conditions.

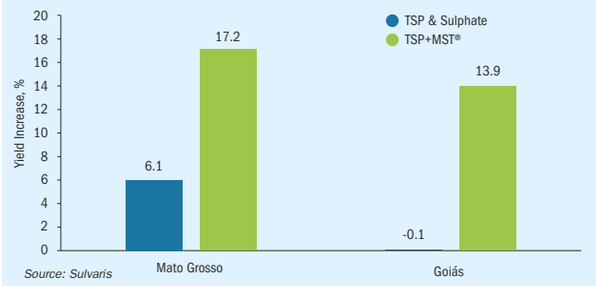
Integrating sulphur directly into phosphorus fertilizers such as TSP also supports more economical and efficient nutrient delivery in regions where logistics and transport costs are significant. Higher nutrient density reduces the volume of material required to supply crop demand, while co-granulated formulations simplify application and improve handling characteristics. ■

Fig. 2: **Soybean yield increase in Goias (Federal University of Goias) and Mato Grosso (Mato Grosso Foundation)**



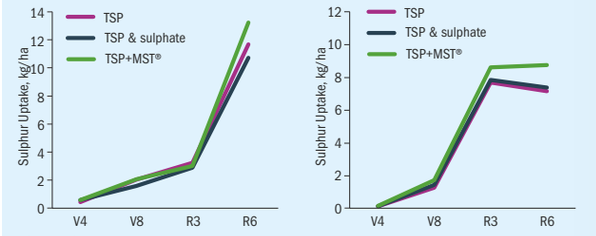
Source: Sulvaris

Fig. 3: **Maize yield increase in Goias (Federal University of Goias) and Mato Grosso (Mato Grosso Foundation)**



Source: Sulvaris

Fig. 4: **Sulphur uptake throughout the growing season at vegetative (V) and reproducive (R) growth stages in Mato Grosso for Soybean (left) and the following maize (right) crops**



Source: Sulvaris

About Sulvaris

Sulvaris is a leading provider of agricultural technology solutions. Through proprietary process technologies like MST® and CCT®, and field-ready systems like SAGE™, Sulvaris drives system-wide improvements in productivity, field-performance, and environmental impact. At Sulvaris, we are committed to Elevating Agriculture by Making Good Better™.

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Boron and its effects on coffee plant nutrition

Field research has shown that coffee is highly sensitive to boron, and that fertilization with this micronutrient can improve crop quality and yield. **Fabiano Silvestrin** of U.S. Borax reviews the evidence – with special reference to Brazil and Latin America.

PHOTO: U.S. BORAX/IAC

Field trial area at a coffee plantation, São Sebastião da Grama, SP, Brazil.

Deficiency signs and symptoms

There is a high occurrence of boron deficiency in many of the world's coffee producing countries. Leaf analysis of 16,000 coffee plants from Brazil, Colombia, El Salvador, Guatemala, Kenya, Tanzania, Uganda, and Vietnam, for example, revealed that boron concentrations were below the critical level (< 45 mg/kg) in almost one-third of plants (29%) tested[1].

Boron deficiency in coffee plants typically causes:

- Stunted root growth and development
- Flower drop
- Poor fruit formation
- Reduction in productivity.

Deficiency usually occurs if:

- Soil boron levels are below 1.0 mg/dm³
- Excessive amounts of limestone have been applied
- High doses of potassium chloride are used
- There are long periods of drought or heavy rainfall.

The symptoms of boron deficiency initially appear on new leaves, which become deformed, tapered and small with rounded edges. They may also show necrosis, flaccidity, and loss of shine (see photos, right). Leaves and terminal buds then become corrugated and deformed, as deficiency worsens, with this eventually leading to the death of the shoots.

Boron is essential in the parts of plants where active growth occurs – meristematic tissue – such as the root tips, developing leaves and shoots. Consequently, boron deficiency is often observed as changes to the plant structure in these growth zones.

Notable deficiency signs in coffee plants include a marked reduction in the root system, as well as death of the ends of the roots[2]. These negative effects reduce the root's ability to absorb water and nutrients, making coffee plants more sensitive to drought and impairing their ability to respond to fertilization.

Table 1: **Shoot height, shoot diameter, leaf area and number of plagiotropic branches (NPB) of coffee plants after 250 days of treatment application**

Treatment	Height (cm)	Diameter (mm)	Foliar Area (cm²)	NPB (number)
Complete	31.13 a[1]	p.25 a	227.44 a	11.25 a
– B	10.52 d	4.45 d	88.21 d	2.50 d
– Ca and B	10.38 d	4.25 d	84.22 d	2.50 d
– Zn and B	10.08 d	4.50 d	88.13 d	3.50 d
CV (%)	13.22	6.52	10.64	17.40

Source: U.S. Borax

1 Averages followed by the same letter vertically do not differ statistically at 5%, according to the Scott-Knott test

PHOTO: U.S. BORAX

New coffee plant leaves may show necrosis, flaccidity, and loss of shine due to boron deficiency

Boron increases coffee yield

The effects of boron sources and doses on coffee cultivation were evaluated as part of a long-term field trial carried out by U.S. Borax | Rio Tinto in partnership with Brazil's Instituto Agronômico de Capinas (IAC). This research was conducted over four years covering the 2020-2023 annual coffee harvests.

The field trial took place at a coffee plantation in São Sebastião da Grama,

Table 2: **Root, shoot, and total dry matter mass; relationship between dry matter mass of aerial part and root (AP/R) and CR of coffee plants after 250 days of application of treatments.**

Treatment	Root (R)	Areial part (AP)	Total	AP/R	CR[2] (%)
Complete	9.73 a[1]	51.96 a	61.7a	5.34a	100
– B	4.90 b	6.35 b	11.25 d	1.30 d	18
– Ca and B	5.05 b	6.53 d	11.58 d	1.29 d	19
– Zn and B	4.91 b	6.40 d	11.31 d	1.30 d	19
CV (%)	19.14	10.38	10.88	10.38	–

Source: U.S. Borax

1 Averages followed by the same letter vertically do not differ statistically at 5%, according to the Scott-Knott test

2 Regarding total dry matter production

BORON IN COFFEE CULTIVATION: SUMMARY OF THE EVIDENCE

Scientific studies have conclusively demonstrated the beneficial effects of boron on coffee crop productivity and quality. Boron is required for the growth and development of coffee plants, making adequate nutrition essential.

Conversely, boron deficiency results in negative biochemical, anatomical, and physiological changes. According to the literature, boron in plants plays an important physiological role in:

- Hormonal regulation
- Flowering
- The transport of photoassimilates (especially sugars)
- The structure of cell walls and membranes.

In coffee plants (cultivar *Catuaí Amarelo*), available soil boron has been found to have a strong influence on the Relative Harvest Index – correlating with parameters such as leaf boron content, branch length, and number of leaves[3]. These variables are vital for coffee plant productivity (yield) because vertical growth determines the formation of nodes and the plagiotropic branches which give rise to leaves and inflorescences[4]. Subsequent flowering depends on the number of branches, branch length, the number of nodes, and the number of leaves per node, since many nodes without leaves do not flower.

A study examining the effects of boron on coffee seedlings (*Catuaí Vermelho* cultivar) found that coffee production increased significantly with the addition of boron due to its influence on plant height, stem diameter, length of plagiotropic branches and number of leaf pairs[5]. The best results were obtained 19 months after planting with boron application at doses of 1 g/plant and 2 g/plant. Other researchers found a positive relationship between branch length and leaf boron content[6].

The effects of the absence of four nutrients (calcium, boron, copper, and zinc) on coffee plant (*Coffea arabica* L.) growth, leaf nutrient concentration, and visual signs of deficiency were evaluated in a greenhouse study[7]. This study reported a reduction in the height and diameter of shoots, the leaf area, the number of plagiotropic branches (NRP) and total dry matter. These changes were observed for coffee plants grown in nutrient solutions in three different scenarios: without boron alone; without boron and calcium; without boron and zinc.

PHOTO: WSFURLAN/ISTOCKPHOTO.COM

Harvesting the coffee bean crop, Brazil.

Boron demand is greatest during the reproductive phase of coffee plants. Being essential for the formation and germination of pollen grains and pollen tubes, boron is needed to ensure coffee plant flowers are properly fertilized. Conversely, pollen tube formation, germination and viability of pollen grains are all severely impacted by low boron availability. The adequate supply of boron during the reproductive phase – because it increases flower retention and fruit and seed development – is therefore fundamental to coffee productivity.

A study of Catuaí Amarelo coffee plants revealed that flowers are a surprisingly strong sink for boron. The element was present in the flowers of this cultivar at a concentration of 37.3 mg/kg. In coffee plants aged 30 months, boron was also distributed between flowers at 95.7 g/ha (11.8%), in leaves at 549.8 g/ha (68%) and in branches at 166.1 g/ha (20.2%).

Cell wall damage due to boron deficiency can result in numerous secondary physiological, biochemical, and anatomical effects. Coffee plant leaves with boron deficiency have fewer and malformed stomata, for example, and will therefore have a lower transpiration rate. Boron deficiency also disrupts the xylem vessels (vascular bundles) in the main vein of coffee plants leaves – impeding the transport of water, nutrients, and photoassimilates[8]. ■

MICRONUTRIENTS

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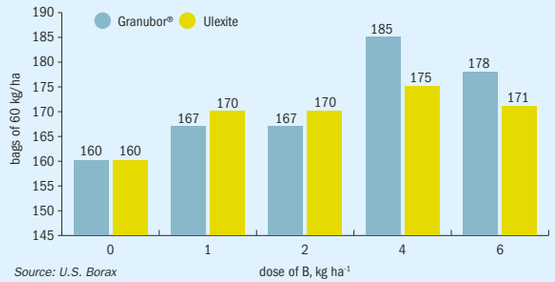
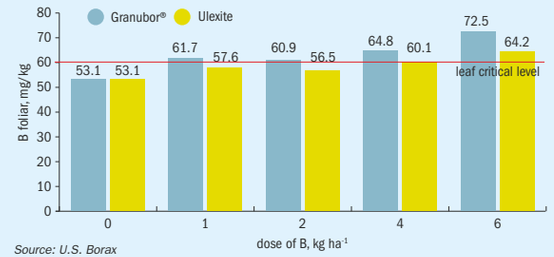
Fig. 1: **Cumulative coffee yield (number bags of 60 kg bags per hectare) for different boron sources and doses. Results for Arabica coffee grown in Yellow Latosol (Oxisol), São Sebastião da Grama, SP, Brazil. Cumulative total for the harvests over the four years 2020, 2021, 2022 and 2023.**



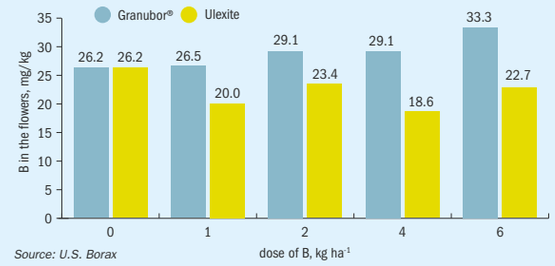
Source: U.S. Borax

Fig. 2: **Variation in the boron content of coffee plant leaves in coffee plants for different boron sources and doses. Results for Arabica coffee grown in Yellow Latosol (Oxisol), São Sebastião da Grama, SP, Brazil. Average for the harvests over the four years 2020, 2021, 2022 and 2023.**



Source: U.S. Borax

Fig. 3: **Variation in the boron content of flowers in coffee plants for different boron sources and doses. Results for Arabica coffee grown in Yellow Latosol (Oxisol), São Sebastião da Grama, SP, Brazil. Average for the harvests over the four years 2020, 2021, 2022 and 2023.**



Source: U.S. Borax

São Paulo, Brazil. This site, which is planted with the cultivar *Catuaí Amarelo* on a 'Yellow Latosol' (Oxisol) soil, is 1,180 metres above sea level. During the trial, two boron sources (sodium tetraborate pentahydrate and ulexite) and five boron doses (0.0, 1.0, 2.0, 4.0 and 6.0 kg B per hectare) were tested. Fertilizers were applied annually as three split applications, timed from the beginning of flowering until the beginning of summer.

Coffee productivity (yield) was reported as the number bags of 60 kg bags per hectare, based on the cumulative total for the four 2020-2023 harvests. Foliar and floral boron contents of the coffee plants were also evaluated.

The application of 4.0 kg/ha of boron using sodium tetraborate pentahydrate (Granubor®) delivered the highest coffee productivity (185 bags/ha), a yield increase of 15.7% (extra 25 bags/ ha) compared to the control treatment (Figure 1).

The highest coffee yield was achieved using sodium tetraborate pentahydrate (Granubor®) as the boron source at doses of 4 kg/ha and 6 kg/ha. The greatest differences in yields between the sources – sodium tetraborate pentahydrate (Granubor®) versus ulexite – was also seen at these two dose rates.

These results illustrate the strong yield response of coffee crops to boron application. Soil boron content (0.7 g/dm³) at the trial site was also below the critical reference level (>1.0 mg/kg of boron) for perennial crops[9]. The presence of a highly deficient soil highlighted the plantation's high potential for a boron fertilization response – as was subsequently confirmed and verified by the trial results (Figure 1).

Trial results also demonstrate that the type of boron source has a significant effect on foliar boron content (Figure 2). The application of sodium tetraborate pentahydrate (Granubor®), at boron doses of 1.0 kg/ha and above, reached the minimum value of the sufficiency range (60-100 mg/kg) for leaf boron[9], as shown by the horizontal bar in Figure 2.

Maintaining foliar boron content within this sufficiency range is necessary for adequate coffee plant nutrition. This is because boron within the leaf acts as a reserve stock that plants can access throughout different phenological phases, especially in periods of high demand such as flowering and fruiting.

As observed for coffee yield, the highest boron levels in leaves – as well as the greatest differences between sources – were obtained using boron doses of 4 kg/ha and 6 kg/ha. Ulexite only reached the minimum sufficiency for leaf boron when the applied dosage reached 4 kg/ha of boron, showing the limited boron release from this source (Figure 2).

Boron sources and doses also had significant effects on the boron levels in coffee flowers. The sodium tetraborate pentahydrate source (Granubor®) produced flowers with higher boron levels, in comparison to ulexite, regardless of the dose used (Figure 3). These results highlight the importance of applying the right boron source at adequate doses to ensure the effective distribution of boron to flowers.

> **"Boron is a nutrient of great importance in coffee cultivation, with positive agronomic effects that improve crop quality and yield."**

Take action!

The studies and results presented in this article show the great importance of boron as a nutrient for coffee cultivation, with positive agronomic effects that improve the quality and yield of this crop. U.S. Borax recommends periodic soil fertility assessments and crop tissue sampling to determine the potential response to boron fertilization. ■

About the author

Fabiano Silvestrin is Principal Advisor, Global Market Development Agriculture at U.S. Borax

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AGI delivers first fertilizer tower system in Brazil

AGI (Ag Growth International) is a global leader in the manufacture of fertilizer blending systems. The company recently installed its first vertical fertilizer blending tower system in Brazil for Mosaic. This case study highlights how engineering innovation, strategic collaboration and market-specific customisation are transforming precision blending in the fertilizer industry.

Introduction

With agricultural production booming, Brazil's powerhouse status is being hampered by significant storage infrastructure deficits – not only for grain, but for crucial inputs like fertilizer. AGI (Ag Growth International), as a global leader in the grain, fertilizer, feed, seed, and food sectors, is well positioned to engineer solutions that can address these deficits and help transform the country's agricultural sector.

This year, AGI successfully delivered its first vertical fertilizer tower blending system in Brazil for Mosaic at Tocantins, marking a major milestone in its strategic expansion into high-growth agricultural markets. This technologically advanced project showcases AGI's ability to collaborate with customers and adapt and innovate in response to regional needs.

Strategic expansion into Brazil's fertilizer market

"Brazil is one of the world's largest agricultural producers, consuming over 46 million tonnes of fertilizer annually with growth projected at 49 million tonnes by 2030," says Robson Engers, AGI's Director of Operations. "Our customer – already holding 20% of the Brazilian fertilizer market – sought to expand its footprint in the country's northern agricultural frontier. Our partnership underscores a shared commitment to innovation, efficiency and market responsiveness."

PHOTO: AGI

AGI has successfully delivered an advanced fertilizer blending plant for Mosaic at Tocantins in Brazil The unit, which is now fully operational, is designed to handle more than one million tonnes of fertilizer annually.

Located in a remote region around 2,000 kilometres from AGI's Sao Paulo base, the new plant is one of the most advanced fertilizer blending facilities in Brazil. The project includes a complete receiving, blending and load-out system with a fully automated process managed by the customer. The facility is designed to handle more than one million tonnes of fertilizer annually and includes more than 100,000 tonnes of storage capacity.

Engineering innovation and customisation

This project, says Engers, pushed AGI beyond its standard solutions, requiring extensive custom engineering and new product development. Key innovations include:

- Custom bucket elevator leg: Designed with reinforced mild steel casing and conveyor belt side panels, this feature reduces material costs while maintaining structural integrity – offering a cost-effective and durable solution tailored to the customer's unloading systems.
- Liquid impregnation system: Integrates liquid additives into dry fertilizer, enhancing nutrient delivery and crop yield – supporting sustainable agriculture and better farm outcomes.
- Dosing bins and scale hoppers: Engineered using finite element analysis (FEA) to ensure structural integrity and precise metering, essential for accurate blending and operational reliability.

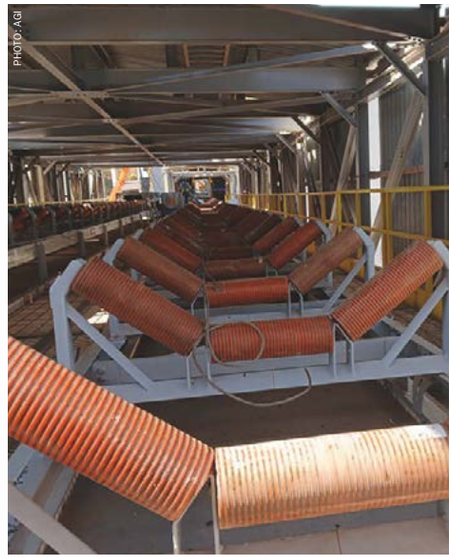

PHOTO: AGI

The interior of Mosaic's new large-scale precision blending plant at Tocantins, Brazil, showing conveyor installation during the construction phase.

- Modular construction: Due to the remote location, systems were designed for sectional transport, ensuring seamless integration and minimal material loss.

Collaboration and risk mitigation

According to Engers, the project's success was driven by AGI's Technical Risk Summary and Plan (TRSP) process, which identified and mitigated potential risks early in the project lifecycle.

"Cross-functional collaboration between global product management, engineering and local Brazilian teams was instrumental in navigating challenges related to logistics, weather and cost competitiveness," he adds.

A model for future product transfers

This project exemplifies AGI's evolving approach to technology transfers – not as simple replications, but as unique opportunities for market-specific innovation.

"The lessons learned and technologies developed for our customer in Brazil are now being considered for reverse transfer into North America and other global markets," says Engers.

As AGI continues to refine its global product transfer strategy, the Mosaic project stands as a benchmark for future initiatives.

"With a focus on listening to local market needs, fostering cross-border collaboration and embracing innovation, AGI is well-positioned to lead the next wave of agricultural infrastructure development worldwide," sums up Engers.

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Brazil's UGF project – delivering the energy transition

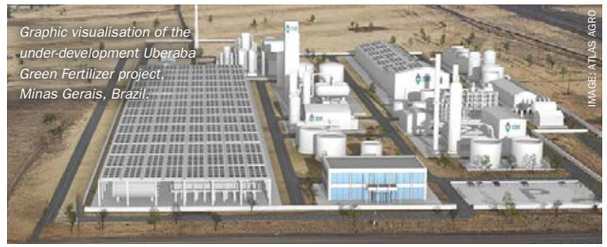
Brazil has the renewable energy capacity, agricultural scale and industrial expertise to lead the global transition to low-carbon 'green' fertilizers, according to Atlas Agro. The under-development Uberaba Green Fertilizer (UGF) project in Minas Gerais state is the first step in that direction, as **Petter Ostbo**, CEO and founder, Atlas Agro, explains.

Brazil is one of the world's agricultural powerhouses. Yet the country imported around 95% of its nitrogen fertilizer needs in 2024, a structural dependency that exposes the country's farmers to global volatility, logistics risks, currency shocks and geopolitical disruptions.

While Brazil's agricultural output has continued to grow – by more than 15% over the last 5 years – domestic nitrogen production has stagnated. This growing mismatch in Brazil between agricultural expansion and stalled fertilizer production, if left unchecked, is a direct risk to global food security and threaten Brazil's international competitiveness, in our view.

At the same time, Latin America is on the frontline of climate change. The Amazon, for example, is approaching an irreversible tipping point driven by climate change and deforestation, according to renowned Brazilian climate scientist Carlos Nobre, beyond which the rainforest ecosystem could collapse. Agricultural productivity in Brazil – and its long-term strategic autonomy – is therefore inexorably linked to environmental stability and climate action.

This is the context driving Atlas Agro's Uberaba Green Fertilizer (UGF) project in Minas Gerais state. UGF is designed to be the first industrial-scale plant in Brazil to produce nitrate fertilizers using only renewable electricity, air and water as raw materials. There is no natural gas consumption, no coal consumption and therefore no carbon emissions.



Graphic visualisation of the under-development Uberaba Green Fertilizer project, Minas Gerais, Brazil.

Decentralised green industrialisation

The project's business logic is simple: move fertilizer production closer to the farmers and decouple it from fossil fuel feedstocks. By producing 'green' nitrate fertilizers in Brazil, the UGF project avoids the embedded carbon footprint of conventional (natural gas-based) urea and ammonium nitrate currently supplied to the domestic market.

The UGF project is a textbook example of 'powershoring' – essentially moving production to where green power is found. It relocates a hard-to-abate, energy-intensive industry based on fossil fuels to a region where there is abundant renewable power – and where energy is structurally cheaper, cleaner and more reliable.

In our view, Brazil is the best place to 'powershore' green fertilizer production since it has:

1. One of the lowest LCOE (levelised cost of renewable energy) globally.
2. An electricity grid that is already around 88% renewable, making it uniquely suitable for green hydrogen and green ammonia production.
3. A nitrate fertilizer market that is more than 95% import dependent.

Producing green nitrate fertilizers within Brazil and substituting these for domestically produced ammonium sulphate and urea also avoids the local pollution, soil acidification and agronomic inefficiencies associated with these two fertilizer products.

Atlas Agro believes that the planned UGF plant will be a cornerstone asset for Brazilian agriculture: it will create jobs, reduce emissions, add value to local economies and strengthen the resilience of Brazil's agricultural supply chain.

At Atlas Agro, our goal is not to look back and replicate the fossil fuel model of the 20th century. Instead, our goal is to create a paradigm shift – one that redefines fertilizer production for a 21st century agricultural economy.

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Engineering, sponsors and institutional backers

The UGF project is currently at the front-end engineering design (FEED) stage, after three years of pre-feasibility and feasibility studies. A final investment decision (FID) is expected in the first half of 2027 with construction then scheduled to start in the second half of that year.

The project represents a strategic investment of up to BRL 6 billion in the integrated production of green hydrogen, green ammonia and green fertilizers. UGF, as an industrial-scale project, will require several million worker hours to complete. Its scale is large enough to materially change Brazil's fertilizer balance in favour of domestic production and, once complete, will remain operational for generations.

Atlas Agro has executed a Memorandum of Intent with the government of the state of Minas Gerais. This formally confirms the establishment of the UGF industrial complex in Uberaba. State support for the project includes the following targeted industrial incentives:

1. A special tax regime ensuring ICMS exemptions and deferrals for machinery, equipment and consumables (particularly energy, the single largest driver of operating cost).
2. A credit mechanism that reduces the effective tax burden on domestic and interstate fertilizer commercialisation.
3. Dedicated support from INVEST MINAS to attract and expand local suppliers, while also prioritising industrial as well as energy grid licensing.

These mechanisms strengthen the project's economic viability and underscore the state government's commitment to securing long-term structural investment in Minas Gerais and its industry.

UGF is also backed by a robust 'ecosystem' of industrial, financial, technical and public sector support. To develop the project, Atlas Agro has aligned itself with strategic partners across many sectors, including customers (fertilizer buyers/distributors) and technology providers. The project's main sponsor, Macquarie Asset Management, notably provides the necessary institutional backing and long-term investment discipline.

Organisations tasked with bringing about the energy transition are also involved. Collaborations with the Industrial Transition Accelerator (ITA) and the Brazil Investment Platform for Energy Transition (BIP), in particular, have galvanised stakeholder engagement over the past year.

Both initiatives are designed to build bridges and improve coordination between industry, investors and policymakers in Brazil. They also provide a conduit for a constructive dialogue with the Ministry of Mines and Energy and other federal institutions. These government bodies are now working alongside Atlas Agro on the UGF project, in pursuit of common goals on Brazilian infrastructure, industrial policy and national competitiveness.

Offtake agreements and commercial progress

Farmers, cooperatives and distributors understand the agronomic advantage of nitrate fertilizers – including higher nutrient use efficiency, reduced nutrient losses, improved soil health, and superior crop yields and quality. Increasingly, important buyers are recognising that switching to low-carbon crop inputs is no longer optional, and is becoming central to their future competitiveness instead.

Atlas Agro is pleased to confirm the signing of its third firm offtake agreement, this time with Tereos, one of the leading players in Brazil's sugar, ethanol, and bioenergy value chains. This agreement consolidates confidence in nitrate fertilizers, in our view, and marks an important milestone in the commercialisation of UGF.

"Through our partnership with Atlas Agro, we reinforce our commitment to contributing to a low-carbon Brazilian agriculture by bringing to the field a technology that redefines the emissions standard of the most critical input for agricultural productivity. Access to low-carbon fertilizers is a fundamental part of achieving our agricultural decarbonization targets and our SBTi commitment, accelerating our journey toward large-scale production with a lower carbon footprint," says Felipe Mendes, Director of Sustainability, New Business, and Institutional Relations at Tereos.

Atlas Agro has signed two additional firm offtakes to date, although these remain confidential at the time of writing. This brings the total value of contracted volumes for the UGF project to around half a billion US dollars in confirmed, multi-year commitments.

Showing COP30 climate leadership

Atlas Agro, instead of waiting for trends to mature, is also helping shape them through its advocacy and business model.

The company was highly active at the UN's COP30 climate conference in Brazil this year, both during the event itself and as part of agenda setting process beforehand. This included participation in high-level discussions on clean industrialisation, food systems, green commodity chains and the decarbonisation of agricultural inputs.

COP30 brought together policymakers, private sector leaders and international organisations, at a moment when climate action is moving beyond theory to execution.

Our presence at the conference was not symbolic either. It reflects the fact that fertilizer production is one of the world's largest sources of industrial emissions, making up around 2% of global greenhouse gas (GHG) emissions, roughly equivalent to aviation and around 50% more than shipping. The transition to green nitrogen fertilizers can reduce production emissions by up to 99%, compared to the standard 'grey' production process via conventional steam methane reforming (SMR).

The UGF project alone is expected to avoid more than one million tonnes of carbon dioxide equivalent (CO_2e) annually. These are real, measurable, large-scale carbon reductions – equivalent to removing nearly 230,000 passenger vehicles from the planet's roads.

During COP30, Atlas Agro presented the UGF plant as a concrete example and proof that decarbonisation is an executable, bankable and scalable proposition. Our COP30 conversations, before and during the event, centred on three core observations:

1 **Food security and climate stability are inseparable**. Agricultural resilience cannot depend on fossil-based inputs.
2 **Industrial transition requires local production**. Green manufacturing must be anchored in the countries that consume their output.
3 **The private sector must lead**. Waiting for perfect policy alignment is a recipe for stagnation. Companies must build, invest and deliver.

The reaction from policymakers and financial institutions was clear and highly positive: green fertilizer plants are strategically aligned with national priorities for climate, agriculture, energy security and economic development.

Agricultural advantages

Setting aside the climate dimension and decarbonisation, nitrate fertilizers offer agronomic benefits that traditional urea or ammonium sulphate cannot match. They eliminate ammonia volatilisation, improve nutrient availability and deliver higher yields and quality, for example. They also mitigate soil acidification and support long-term farm productivity.

In practice, that means better outcomes for farmers, improved resilience for farm cooperatives, and more sustainable and competitive agricultural exports for Brazil, a country that feeds more than a billion people globally.

WHAT MAKES UGF DIFFERENT?

UGF is not a symbolic low-carbon pilot project: it is a full-scale industrial plant designed to permanently replace fossil fuel-based fertilizer factories. Atlas Agro – instead of following a high-emission path and then attempting to retrofit decarbonisation later – will eliminate emissions from day one.

UGF – key performance characteristics

Parameter	UGF Impact
CapEx	~$1.1 billion
Emissions avoided	>1 million tCO_2e/year
Technology	Renewable-based electrochemistry
Product	Nitrate fertilizers
Feedstocks	Air, water, renewable energy
Construction effort	Several million man-hours
Delivery horizon	Turn of the decade

Brazil's agricultural producers are efficient. The missing link has been industrial sovereignty in nitrogen fertilizer. UGF directly addresses this gap. ■

In short, Atlas Agro believes UGF is where clean power becomes clean food.

Next horizon

Atlas Agro's broader vision is to replicate the business imperatives driving the UGF project across other parts of Brazil and Latin America. As a company, we are not building a single plant. We are establishing a new paradigm for 'local and green' industrial development that can be scaled and adapted in different countries.

The strong alignment in objectives we are now witnessing, between customers, investors, technical partners and policymakers, is stronger than at any previous moment. The feasibility studies for UGF are complete, the engineering is advancing, while the market is not waiting for green fertilizers – it is actively asking for them.

Brazil has the renewable capacity, agricultural scale and industrial expertise to lead a fertilizer transition on a global level. The UGF project is the first step in that direction. The journey is long, but the opportunity is undeniable in our view ■

PROJECT UPDATE

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Dry bulk market to weaken in 2026?

PHOTO: CANPOTEX

BIMCO, the leading international shipping association, expects the global supply/demand balance for dry bulk freight to loosen slightly in 2026 – albeit from a high baseline. This may lead to weaker freight rates over the next 12 months, explains **Filipe Gouveia**, BIMCO's shipping analysis manager, especially for the ship sizes used to transport fertilizers.

The bulk carrier Ultra Regina.

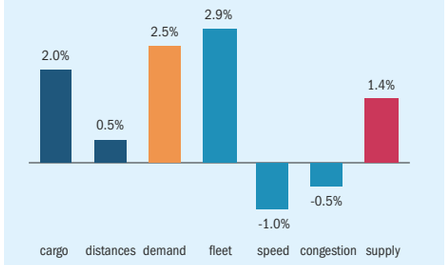
2025 defied expectations

The dry bulk supply/demand balance tightened in 2025, with an estimated 2.5% rise in ship demand for the year outpacing 1.4% growth in ship supply (Figure 1). The Baltic Dry Index (BDI), meanwhile, fell 30% year-on-year (y-o-y) during the first half of 2025, but rose 15% y-o-y between July and November (Figure 2). After a weak start, dry bulk demand eventually firmed up in 2025 across the three largest dry bulk commodities: iron ore, coal and grains (Figure 3).

Average sailing distances lengthened by an estimated 0.5% in 2025, driven up by stronger iron ore and minor bulk shipments. Longer sailing distances, in turn, boosted ship demand – since ships take longer to finish each trip – with more ships needed to transport the same amount of cargo.

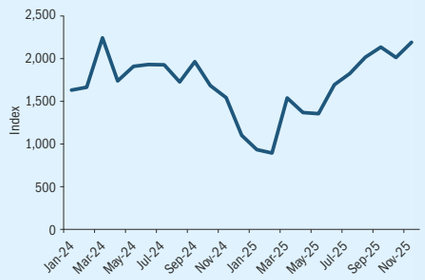
Cargo demand growth slowed y-o-y to 2% in 2025 (down from 2.7% in 2024), as weaker economic conditions combined with commodity-specific developments. Changes in US trade policy dampened overall economic activity and directly affected coal, grains and steel shipments. The global economy did, however, fare better than expected, due to the scale-back in US tariffs and several trade agreements

Fig. 1: **Ship supply/demand developments in 2025, year-on-year change**



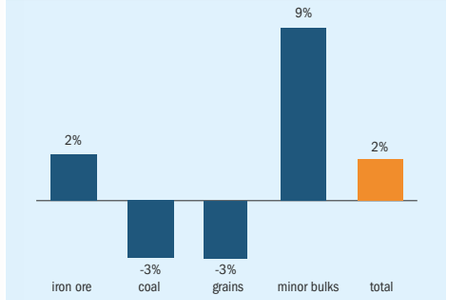
Source: Bimco

Fig. 2: **Baltic Dry Index (BDI)**



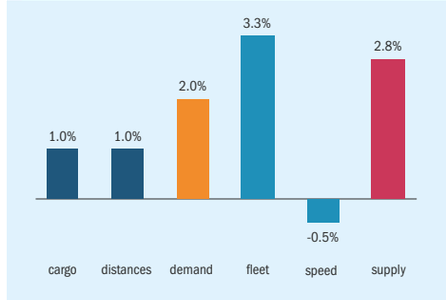
Source: Baltic Exchange

Fig. 3: **Dry bulk cargo growth, January-November 2025, year-on-year change**



Source: BIMCO

Fig. 4: **Ship supply/demand developments in 2026, year-on-year change**



Source: Bimco

agreed by the Trump administration, including one with China.

Minor bulk cargoes were a key demand driver last year, growing 9% y-o-y between January and November 2025 (Figure 3). Shipments of ores and concentrates grew particularly strongly, surging by 16% over this period. These commodities play a key role in the energy transition with growth supported by strong demand in China – driven by the rapid expansion of the country's renewable electricity capacity, electric vehicle production and aluminium output.

Iron ore shipments grew by 2% y-o-y in 2025 (Figure 3), growing most strongly towards the end of the year, as China built up inventories. Iron ore is used to produce virgin steel with China – the world's largest steel producer – accounting for 54% of global production.

> **"Bulk freight rates could weaken over the next 12 months, according to BIMCO, especially for the ship sizes used to transport fertilizers"**

Between January and November 2025, coal and grain shipments fell by 3%, compared to the same period the previous year (Figure 3). Coal import demand fell amid weaker steel production, greater renewable electricity generation in India and China, and higher domestic coal supply in China. Grain shipments, meanwhile, fell due to lower wheat shipments as trade out of the Black Sea weakened.

On the ship supply side, the dry bulk fleet is estimated to have grown 2.9% in 2025, driven by high deliveries of panamax ships (Figure 1). Ship recycling remained low compared to historical levels but was still up 33% y-o-y between January and December 2025. Overall, ship supply is estimated to have grown 1.4% in 2025 (Figure 1), 1.5 percentage points below expected fleet growth (2.9%). This was due to a decrease in fleet productivity as sailing speeds fell and congestion increased.

Poor outlook for iron ore and coal shipments

BIMCO expects the dry bulk market to weaken slightly in 2026, albeit from a high baseline, a development that could lead to lower freight rates. Ship demand is forecast to grow 1.5-2.5% y-o-y in 2026, outpaced by the expected 2.8% growth in ship supply (Figure 4).

Supply growth is expected to be slowest for capesize ships, a segment which is also expected to benefit from longer sailing distances. Conversely, the panamax and supramax fleets are expected to grow the fastest, with a consequent negative impact on the freights rates for both these segments.

For the forecast 1.5-2.5% growth in ship demand in 2026, BIMCO expects around half of this growth (0.5-1.5%) to be attributed to higher cargo demand and half to longer sailing distances. This increase in distances is mainly driven by higher iron ore and bauxite shipments from the South Atlantic to East Asia, combined with a decline in coal shipments typically associated with below average sailing distances.

A downturn in economic conditions could also negatively affect dry bulk cargo demand this year. The global economy is forecast to grow 3.1% in 2026, according to the International Monetary Fund, its slowest growth rate since 2020. In China, economic growth is expected to slow to 4.2%, with the country's lingering real estate crisis, manufacturing overcapacity and weak domestic demand all exerting a negative effect.

Growth in iron ore shipments of just 1% or less is expected in 2026, as Chinese steel demand is forecast to weaken further. China's property sector crisis and the resulting drop in construction activity will continue to affect steel demand, while steel demand from manufacturing and for infrastructure could also slow. Consequently, we expect any growth in demand for iron ore imports this year to be driven by lower iron ore export prices. A price fall would boost the competitiveness of iron ore exports, versus China's domestic iron ore supply.

BIMCO expects coal shipments to fall by 1-2% fall in 2026, due to higher renewable electricity generation and a timid steel demand outlook. The International Energy Agency is forecasting a doubling in global renewable energy capacity between 2025 and 2030. China is leading this rapid expansion in renewables with its capacity nearly tripling by 2030. Despite the poor demand outlook, an apparent slowdown in domestic coal mining in India and China could boost trade and keep shipments from falling further.

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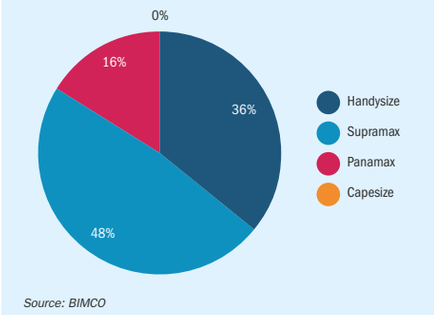
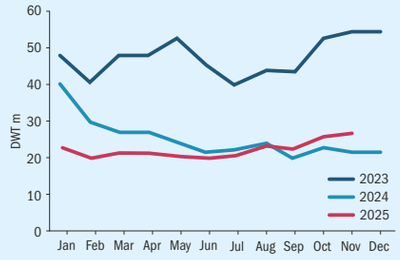
Fig. 5: **Fertilizer shipments by segment, January-November 2025**



Source: BIMCO

Fig. 6: **Bulk freight capacity transiting via the Gulf of Aden (Red Sea) route**



Source: BIMCO

Grain shipments look set to rise by 4-5% in 2026 amid ample supply. The projected growth in soybean shipments, for example, is supported by a large harvest in Brazil and a resumption in Chinese purchasing of US cargoes. The outlook for maize and wheat shipments also appears positive, due to a large exportable surplus from the northern hemisphere harvests and a stable outlook for southern hemisphere harvests in early 2026.

Growth in minor bulk cargo shipments this year, at between 2.5-3.5%, is expected to be down on 2025 because of weaker economic conditions. A slowdown in bauxite shipments is expected during the year as China is nearing its government-mandated aluminium production cap. A rise in trade barriers for Chinese steel exports could also contribute to lower growth for steel shipments.

The dry bulk fleet is expected to grow by 3.3% this year (Figure 4) – its fastest rate since 2022 – supported by a 17% y-o-y increase in ship deliveries. The panamax and supramax segments are expected to grow the fastest, accounting for 35% and 27%, respectively, of ship capacity delivered in 2026.

The loosening of the supply/demand balance this year could result in a decrease in ship sailing speeds of up to 1% – with attendant cost savings due to lower fuel consumption – as well as a slight increase in ship recycling. While weaker freight rates could encourage the recycling of older and less competitive ships, BIMCO still expects ship recycling to remain below historical levels.

Fertilizer shipments growth to slow in 2026?

Fertilizer bulk shipments rose by 10% y-o-y between January and November 2025, driven by strong demand and supported by competitive nitrogen and potash prices. In addition, China's relaxation of fertilizer export restrictions led to a 42% y-o-y increase in its shipments.

Global fertilizer shipments are expected to keep growing in 2026 but at a slower pace due to lower agricultural demand. The International Fertilizer Association is forecasting annual global fertilizer demand growth of just 1-2% between 2025 and 2029, versus growth rates of 4.5% and 4.4%, respectively, in 2023 and 2024 (fertilizer year basis).

Fertilizer cargoes account for 4% of dry bulk cargo and are primarily shipped by smaller vessels below capesize class. Between January and November 2025, for example, 48% of fertilizer cargoes were transported by supramax ships, 36% by handysize ships and the rest mainly by panamax ships (Figure 5).

Over this period, handysize ships were more commonly used for shipments out of Morocco or the East Mediterranean, transporting cargoes for shorter distances on average. Panamax ships, in contrast, were more frequently used to transport Chinese, Omani and Jordanian cargoes.

Freight rates for segments smaller than capesize may weaken in 2026. Fleet growth is expected to be highest for the panamax and supramax segments, which could pressure rates, while an expected drop in coal shipments would negatively impact demand for these segments.

Weaker demand if ships return to the Red Sea

Our forecast for 2026 assumes that ships travelling west of Suez will continue sailing around the Cape of Good Hope instead of via the Red Sea route. Bulk carriers began avoiding the Red Sea in January 2024 and, since then, vessel capacity transiting via the Gulf of Aden has averaged around half of 2023 levels.

This rerouting has boosted sailing distances and led to higher ship demand, especially for the supramax and panamax segments. We estimate that a full return of bulk ships to the Red Sea would be equivalent to a 2% drop in dry bulk demand as sailing distances shorten.

The likelihood of a return of shipping to the Red Sea route increased during the fourth quarter of 2025 with the Gaza ceasefire. This was followed by an announcement by the Houthis in Yemen that they would stop attacks on ships if the ceasefire held.

Much uncertainty remains, however, over when ships will fully return to the Red Sea. While a slight increase in Red Sea transits was observed in November 2025, with a 6% rise in ship capacity transiting the Gulf of Aden compared to October 2025, these transits remained 51% below their November 2023 levels (Figure 6). ■

Author's note

The 2026 forecast in this article is based on BIMCO's October 2025 *Dry Bulk Shipping Market Overview & Outlook* report. Updates to this report are released quarterly in January, April, July and October.

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Kpler – tracking global fertilizer markets in real time

Kpler monitors global fertilizer markets in real-time using comprehensive vessel tracking and cargo data. The company's commodity intelligence provides actionable insights on fertilizer supply chains, enabling market participants to optimise operations, mitigate risks, and capitalise on emerging opportunities.

Real-time monitoring increasingly critical

Last summer, as tensions in the Middle East escalated, the Suez Canal, the Bab el-Mandeb Strait, and the Strait of Hormuz gained global attention as major maritime chokepoints for international trade.

Due to these vulnerabilities, geopolitical shocks in the Middle East can destabilise the global fertilizer supply chain and associated agricultural markets – a consequence of the natural centralisation of fertilizer production in the region. The fact that alternative fertilizer supply sources and trade routes are also limited currently adds to this already significant risk, intensifying market volatility and further complicating the situation.

The upshot is that, from physical traders to agricultural merchandisers to national governments and more, the need to monitor real-time fertilizer trade flows is becoming increasingly critical.

Founded in 2014, Kpler is a leading data and analytics firm that delivers real-time intelligence across global commodity flows. The company leverages the world's largest proprietary network of vessel tracking, port-call monitoring, and cargo information. Kpler provides data on interconnected commodity markets by tracking the entire seaborne fertilizer supply chain, from upstream feedstocks, through intermediate chemicals, to downstream finished products (Figure 1).

Turning raw data into actionable intelligence

The monitoring of cargo requires tracking the individual vessels that carry these. Kpler's global automatic identification system (AIS) network for shipping combines satellite, terrestrial, and roaming coverage to provide continuous visibility from coastal waters to the deep ocean, enabling real-time tracking of over 30,000 cargo vessels, including tankers, dry bulk carriers, and general cargo ships. The quality and granularity of Kpler's AIS data allow real-time tracking of commodity flows down to specific ports, terminals, and berths.

Capturing precise vessel movements helps users monitor exact loading and discharge operations, analyse port congestion patterns, and identify supply chain bottlenecks. AIS data also capture crew-reported updates on vessels' future destinations and estimated arrival times.

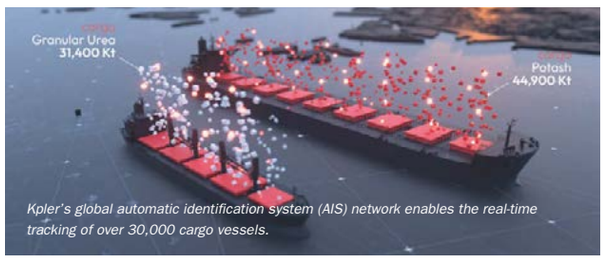
With this real-time intelligence, users can quickly identify potential diversions, from route alterations to complete destination changes. High-quality data standards also make it significantly easier to detect irregularities like AIS gaps or spoofing (the deliberate alteration of vessel location data), which often signal illicit activities such as sanctions evasion or illegal cargo transfers.

Consequently, Kpler's comprehensive vessel tracking infrastructure transforms raw maritime data into actionable intelligence, providing users with unparalleled visibility into global shipping operations and supply chain dynamics.

More transparency for opaque markets

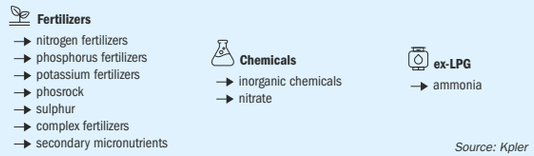
Kpler tracks global imports and exports by identifying individual vessel shipments and aggregating their specific volumes and cargo details. Historically, market professionals rely on country-level trade statistics that are published weeks or months after the fact. There is no visibility into the exact loading and discharge dates, nor a breakdown by specific ports or installations.

IMAGE: KPLER



Kpler's global automatic identification system (AIS) network enables the real-time tracking of over 30,000 cargo vessels.

Fig. 1: **Kpler tracks over 40 commodities including ammonia, chemicals, and fertilizers. Dry bulk sector coverage includes feedstocks, like phosphate rock and sulphur, as well as complex fertilizers such as NPK, NP, and NPS.**



Source: Kpler

Vessel lineups typically contain little information on real-time operations and the overall voyage. Was there port congestion? Did the vessel change its final destination? Kpler revolutionises this data collection and analysis process by layering cargo and commercial data onto its vessel tracking foundation, creating an integrated view that reveals vessel movements and much more.

Kpler's fertilizer coverage includes ammonia, liquid chemicals, and the primary NPK fertilizers, to complex and secondary micronutrients and inorganic feed phosphates. This includes, for example, detailed data from triple superphosphate (TSP) and diammonium phosphate (DAP) co-loading operations at Moroccan ports like Jorf Lasfar to the buyers, sellers, and charterers facilitating each shipment.

This level of granularity is achieved through an extensive network of more than 600 hard sources, including customs records, US Bills of Lading, fixture data, port line-ups, and market information, that deliver highly accurate data on fertilizer grades and the key commercial players involved (Figure 2).

Kpler's commodity intelligence also provides visibility into markets with limited or non-existent official statistical reporting. Its methodology relies on proprietary geospatial mapping that identifies berths dedicated to fertilizer operations. This allows vessels to be algorithmically matched with cargo in the absence of hard market data or sources with limited product granularity.

For instance, vessels loading at urea-only berths are most likely to load urea. This helps capture trades in opaque markets and establish reliable baselines for trade activity where none existed before. Kpler's real-time cargo tracking data enables market professionals to anticipate market movements with unprecedented precision, surpassing the limitations of traditional supply and demand analysis based on historical trade statistics and incomplete vessel schedules.

Identifying potential Iranian urea loadings

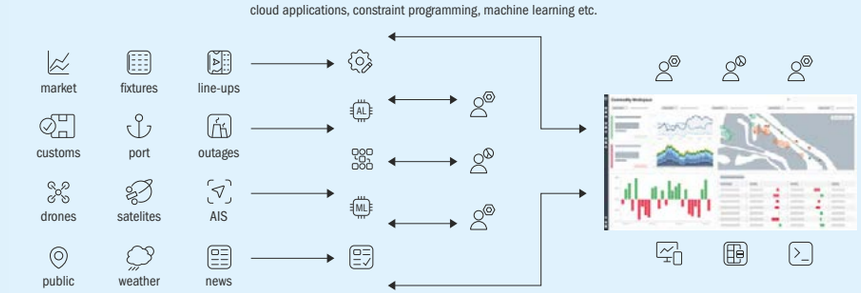
Unreliable reporting and strategic AIS manipulation can hide the true origins of shipments, which is typical of Iranian fertilizer exports, and create significant challenges in tracking potential urea loadings. Cargo data for imports to destination countries can be used to identify loading origins. This data becomes essential when the load operation occurs in a region with limited reporting. In the case of urea shipments from Iran to Brazil, the market typically uses Brazilian vessel lineups to identify product-specific imports. However, such lineups frequently misreport cargo sources, reporting Oman rather than Iran as the origin country. This is often because the bill of lading itself is modified to show Omani origin. In the example case of bulk carrier 'Madeleine' (vessel name anonymised for this article), an analysis of misreporting and historical vessel tracks can reveal patterns that distinguish legitimate operations from potential sanction evasions (Figure 3).

Working backwards, Madeleine's AIS signal clearly shows her discharging at a berth in São Francisco do Sul in Brazil from June 20th to 30th. Hard market data confirmed urea as the product on board. Following her AIS tracks back to the Gulf of Oman, a nine-day AIS gap from May 5th to May 14th is visible.

While the vessel lineups for Madeleine reported Oman as the origin, vessels genuinely loading in Oman maintain a clear and continuous AIS signal throughout their journey, showing precise positioning at loading berths. In contrast, vessels potentially loading Iranian urea will typically signal for Sohar and position around the Sohar Anchorage before intentionally disabling vessel tracking systems to conceal their actual location during cargo operations.

Madeleine's lengthy AIS gap and significant draught change of five metres, from

Fig. 2: **Kpler's complete network of hard data sources is combined with advanced analytics, machine learning, and models to deliver real-time commodity and vessel tracking.**



Source: Kpler

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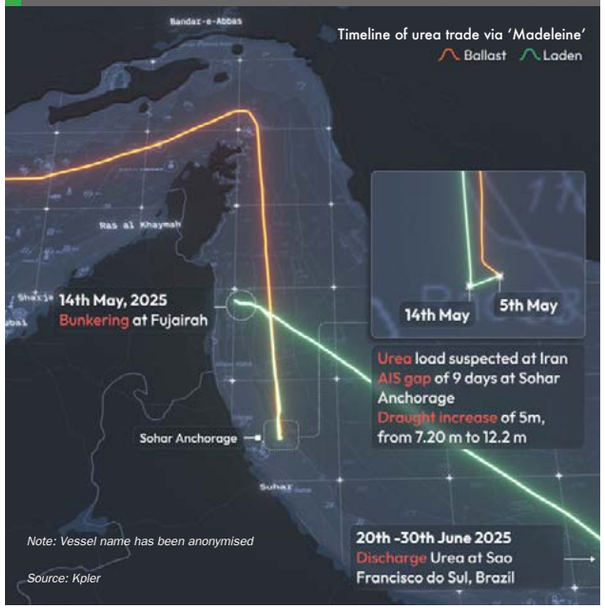
Fig. 3: **The historical AIS vessel track of bulk carrier 'Madeleine' reveals a 9-day gap in her signal with a sudden five-metre draught increase. AIS gaps combined with unreliable reporting can obscure a cargo's true origin.**



7.20 to 12.2 metres, suggests loading activities occurred when the vessel's transponder was offline. Despite sophisticated efforts to conceal operations, the combination of vessel tracking data with cargo information provides greater transparency into trade flows that conventional methods struggle to detect.

Tracking the UAE to Morocco sulphur shipping route

As a leading global phosphate producer, Morocco depends heavily on imported sulphur for its fertilizer production operations, with the United Arab Emirates (UAE) serving as one of its primary suppliers. Sulphur-carrying vessels depart from Ruwais Port in the Western UAE, not too far from the border with Saudi Arabia.

Traditionally, the vessels would then navigate through the four critical maritime chokepoints of the Strait of Hormuz, Bab el-Mandeb Strait, Suez Canal, and Strait of Gibraltar before reaching Moroccan ports. However, the surge in Houthi attacks on commercial shipping vessels in the Red Sea, beginning in the latter months of 2023, disrupted this established trade route for UAE sulphur exports and other Middle Eastern commodities.

The bulk carrier Magic Seas was attacked in early July 2025. She was loaded with steel and fertilizer from Ulsan, South Korea and Zhuhai, China, respectively. After suffering from a strike led by the Houthis, Magic Seas sank off the western coast of Yemen. The following day, the Houthis attacked another bulk carrier, Eternity C, shortly after she discharged American sorghum at Berbera in Somalia. Faced with escalating security risks in the Red Sea, many vessels have abandoned the Suez Canal for a longer but safer route around Africa's Cape of Good Hope (Figure 4).

Indeed, rerouting via the Cape of Good Hope has become the new standard for shipping. Since January 2024, all UAE sulphur exports to Morocco have travelled via the Cape of Good Hope, significantly extending both the voyage distance and transit time. A journey that was once approximately 5,300 nautical miles and 32 days is now, on average, about 9,800 nautical miles and 49 days.

Stakeholders across the spectrum suffer from the consequences of these longer travel times. Extended voyage times substantially increase shipping costs due to longer vessel charter periods, higher fuel consumption, and elevated insurance costs, these typically being based on voyage duration.

Overall, this maritime security crisis in the Red Sea has fundamentally reshaped global supply chains, with real-time commodity tracking now serving as a critical tool for anticipating and adapting to emerging route disruptions.

Navigating market volatility with Kpler intelligence

Kpler provides a comprehensive picture of global fertilizer markets through its unparalleled vessel tracking and cargo intelligence data, enabling market professionals to navigate an increasingly complex and volatile trade environment. In an era where geopolitical tensions in the Middle East threaten critical maritime chokepoints, real-time visibility into fertilizer supply chains is essential for anticipating supply-demand imbalances amid rapidly changing market conditions.

Ultimately, as global fertilizer trade faces growing challenges, from security risks to supply chain disruptions, Kpler's intelligence solutions offer the transparency and actionable insights necessary to maintain a competitive advantage in this critical commodity market. ■

Fig. 4: **Due to conflicts in the Red Sea, vessels carrying sulphur from the United Arab Emirates to Morocco now route via the Cape of Good Hope.**

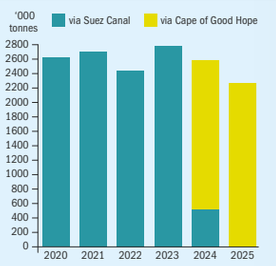


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PHOTO: ICL

How best to use enhanced efficiency fertilizers

From controlled-release to plant-level innovations, fertilizer technology is changing, boosting yields, cutting losses and supporting sustainability. ICL's strategy focuses on the use of enhanced efficiency fertilizers (EEFs), explains **Ronald Clemens**, the company's Global Portfolio Manager.

Eqo.x is the first controlled-release coating technology designed to meet the EU's 2028 biodegradability criteria.

Global food demand is rising, meaning agriculture must boost productivity while reducing input use, emissions, and environmental impact. Meanwhile, stricter legislation is pushing the industry to rethink long-standing fertilizer practises, with growers facing higher expectations than ever before.

ICL is positioning itself at the centre of this transition, advancing a new fertilizer narrative; one that moves beyond volume and formulation, and focuses on efficiency, biology and smarter nutrient management.

"ICL's approach is to make nutrients worker harder, aligning nutrient release with crop demand, improving uptake inside the plant, and reducing losses to air, soil and water," says Ronald Clemens, Global Portfolio Manager for controlled-release fertilizer (CRF).

Nitrogen remains the most essential – and problematic – nutrient in agriculture. Despite decades of improvement, nitrogen fertilizers remain highly inefficient. On average, only 40-60% of applied nitrogen is taken up by crops, with the remainder lost through ammonia volatilisation, nitrate leaching, run-off and denitrification. These losses represent both environmental damage and unnecessary cost.

Across Europe, this inefficiency is no longer tolerated. Policies like the European Commission's Fit for 55 package aim to cut greenhouse gas emissions by 55% by 2030, reduce nutrient losses by 50%, and lower fertilizer use by around 20%. Yet, despite these regulations, yield expectations remain unchanged.

A toolbox approach

ICL's strategy centres on enhanced efficiency fertilizers (EEFs), recognising that no single technology can address every cropping system, soil type, or climate. Instead, farmers are encouraged to adopt a 'toolbox' approach, combining technologies to manage different nitrogen loss pathways.

Stabilised nitrogen fertilizers use urease and nitrification inhibitors to slow nitrogen transformations in the soil, reducing volatilisation, leaching and nitrous oxide emissions. CRFs by contrast, physically isolate nutrients within a membrane, releasing them gradually as moisture penetrates the coating and osmotic pressure drives diffusion.

"By using a membrane around the granule, you can clearly improve efficiency," explains Ronald. "Nutrients that the crop cannot take up are not lost to the environment."

CRFs are particularly valuable in longer-cycle crops including maize, rice, potatoes, onions and forestry, where they reduce application frequency while maintaining yield.

The performance data behind CRFs is robust. A meta-analysis of 21 studies conducted by Australian researchers showed CRFs decreased nitrogen losses in all pathways – by up to 80% – compared with conventional urea. Field trials across Europe consistently confirm these findings, demonstrating improved uptake, reduced nitrogen losses and stable or increased yields across cereals, root crops and vegetables.

Fig. 1: **How eqo.x biodegradable coating technology works**

Source: ICL

Biodegradable coatings

Upcoming legislation is also reshaping CRF design. From October 2028, CRFs placed on the EU market will need to be rapidly biodegradable in soil and water, addressing concerns over long-term polymer accumulation.

In response, ICL is developing coating technologies that combine nutrient release with full biodegradability. Eqo.x is the first controlled-release coating technology (Figure 1) on the market designed to meet the EU's 2028 biodegradability criteria – four years ahead of regulation (*Fertilizer International* 510, p24; *Fertilizer International* 522, p24). This new approach integrates sulphur with biodegradable coating materials that maintain controlled nutrient release before breaking down naturally in the environment.

"Biodegradability is assessed through standardised tests," says Ronald. "Once certified these coatings set a new benchmark for sustainable nutrient delivery – and Eqo.x is the first to achieve this in the EU."

Cutting carbon

By reducing nitrogen losses and the number of applications required, CRFs can significantly lower field-level emissions. Field trials across Europe show that CRFs can reduce nitrogen leaching by up to 55%, while cutting greenhouse gas emissions.

In cereal systems, these efficiencies have translated into savings of up to 56kg CO_2-equivalent per tonne of grain, while potato systems have recorded reductions of 18kg CO_2-equivalent per hectare. As carbon reporting extends further down agricultural supply chains, such verified reductions are increasingly linked to sustainability premiums and emerging carbon credit schemes for growers.

Targeting innovation from all angles

ICL strives to create innovative nutrient solutions in its full product portfolio to make nutrient uptake more efficient in all possible ways. Innovation is also extending beyond macronutrients into biodegradable chelates and biostimulant science, challenging how micronutrients are delivered and how plants respond to stress.

Traditional chelates (which bond with micronutrients to keep them available to the plant) like ethylenediaminetetraacetic acid (EDTA) are effective but persistent. In many formulations, only around 15% of the product is nutrient, with the remainder consisting of synthetic material that offers no biological benefit and can accumulate in soils and waterways.

ICL has also developed new biodegradable chelates based on peptide structures and organic acids, which are designed to overcome these limitations. These molecules act as nutrient carriers and biostimulants, enabling rapid micronutrient uptake and activating plant defence and growth pathways.

Advanced imaging techniques, including synchrotron X-ray imaging, have allowed researchers to track nutrient movement inside living plants. The results showed zinc uptake in as little as 13-17 hours, compared with 26 hours for conventional sulphates, alongside improved remobilisation and stress tolerance. Laboratory tests also showed 100% biodegradation within 22 days, aligning with future regulatory expectations for biodegradable inputs.

PHOTO: ICL

Ronald, Clemens, ICL's Global Portfolio Manager, CRF.

Evolving innovation

Taken together, these technologies signal a fundamental shift.

"Fertilisation is no longer just about feeding the soil per applied kilograms, it is about managing plant physiology, soil biology and environmental impact," sums up Ronald.

"There is no single solution," he adds. "But by using the right tools, in the right place, at the right time, nutrients can work harder – for crops, for farmers and for the environment."

Acknowledgement

Additional reporting by Danusia Osiowy, Agri-hub.

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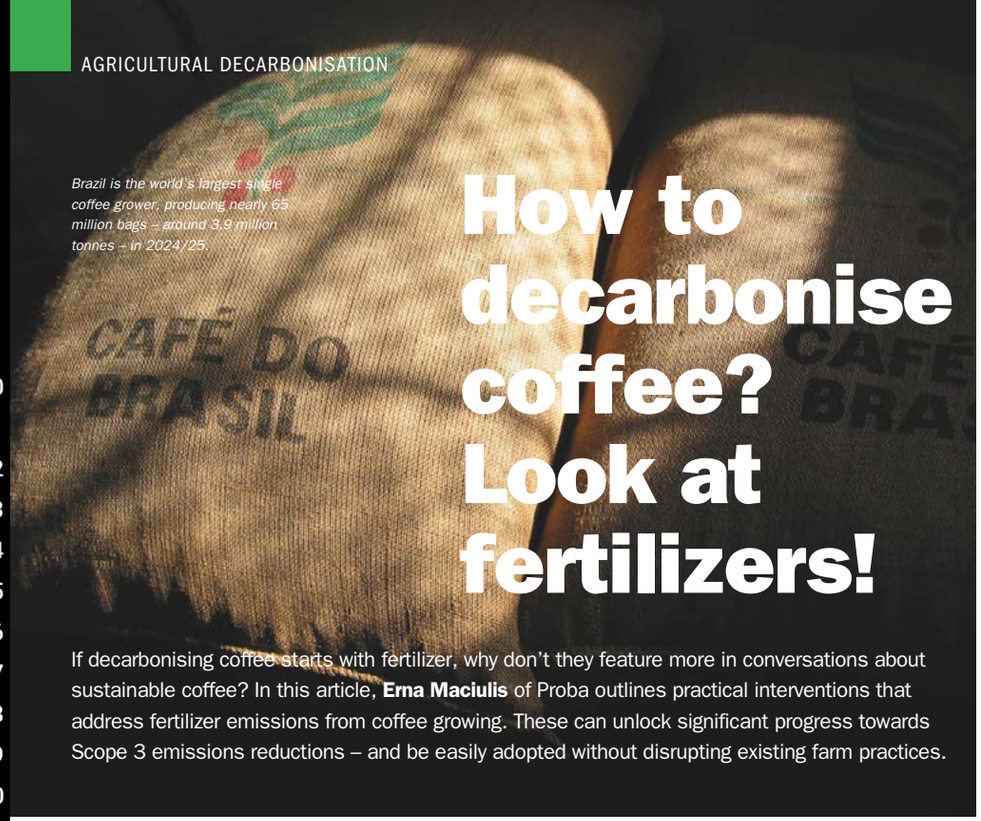


Brazil is the world's largest single coffee grower, producing nearly 65 million bags – around 3.9 million tonnes – in 2024/25.

PHOTO: TEMPORALATA/FLICKR

How to decarbonise coffee? Look at fertilizers!

If decarbonising coffee starts with fertilizer, why don't they feature more in conversations about sustainable coffee? In this article, **Erna Maciulis** of Proba outlines practical interventions that address fertilizer emissions from coffee growing. These can unlock significant progress towards Scope 3 emissions reductions – and be easily adopted without disrupting existing farm practices.

Better coffee from Brazil and Vietnam

If you drink coffee every morning, you're taking part in one of the most global supply chains on earth. Also, did you know that 40% of your coffee's carbon footprint is from fertilizers?

Most of coffee's emissions happen long before the beans even reach a roaster. A large part of its carbon footprint can be traced back to the production and subsequent use of fertilizer on coffee plantations.

Regenerative agriculture dominates conversations about sustainable coffee. Shade-grown systems, agroforestry, and soil health practices are widely promoted. Those interventions matter. Yet fertilizer-related emissions are sometimes overlooked – even though they are measurable, cost-effective to reduce, and central to decarbonising coffee supply chains.

Downstream companies often assume these emissions are beyond their control. They're not. Practical and accessible fertilizer-related interventions are, in fact, already available to reduce fertilizer emissions at scale. What's more, they can fit naturally into existing farming systems.

Missing from the conversation

Fertilizers are an essential input for coffee production, but they're also one of the largest sources of nitrous oxide (N_2O), a greenhouse gas with a global warming potential 273 times higher than carbon dioxide.

So, why does fertilizer usage receive less attention than regenerative agriculture, deforestation, or social impact programmes?

1. **Many downstream actors feel far removed from farm-level decisions**. Coffee changes hands several times before reaching exporters and roasters. Buyers often work through traders or aggregators with limited visibility into their upstream partner practices. As a result, fertilizer strategies feel out of reach.
2. **Interventions seem unfamiliar or complex to non-agronomists**. Supply chain and sustainability teams may know how to support agroforestry or training programmes, but fertilizer optimisation sounds more technical. It isn't, but the perception persists.
3. **Cost concerns and uncertainty over who pays**. Many farm-level interventions require upfront investment. Even when the cost is low, the responsibility for financing is often unclear, especially in fragmented markets dominated by smallholders. Proba believes that farmers should not bear the cost alone.
4. **Traceability challenges that make impact hard to track**. It's difficult to connect fertilizer use to specific coffee volumes without systems to capture field-level data. This has made companies hesitant to rely on fertilizer interventions in their Scope 3 strategies, even when the impact is clear.
5. **The narrative has long focused on land use and deforestation**. Coffee companies have spent years addressing deforestation. This remains important, but the emphasis on land use has overshadowed fertilizer-related emissions, which are sometimes treated as secondary despite their scale.

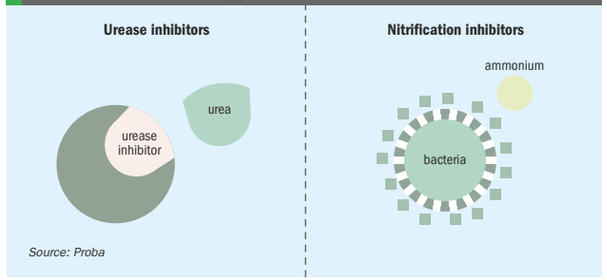
All of this has resulted in fertilizer interventions being underrepresented in sustainability strategies. Yet addressing fertilizer emissions is one of the fastest, most measurable ways for coffee companies to make progress.

Brazil and Vietnam reveal the scale of the opportunity

Brazil and Vietnam produce nearly half of the world's coffee. While having different farming systems, different regulatory environments, and different agronomic challenges, they share a reliance on fertilizers and a need for scalable climate solutions.

Looking at these two countries of origin should help downstream actors understand how fertilizer interventions can make an immediate difference and create a realistic picture of how these can be delivered.

Fig. 1: **The two types of nitrogen stabilizers: urease inhibitors (left) and nitrification inhibitors (right)**



Source: Proba

Vietnam: high fertilizer intensity and water use pressures

Growing practices in Vietnam, the world's largest producer of Robusta coffee, are highly fertilizer-dependent. Farmers often apply:

- Urea
- Phosphate fertilizers
- NPK blends.

Fertilizer rates per hectare tend to be high, sometimes higher than crop needs. Combined with over-irrigation, this puts pressure on groundwater in the country's Central Highlands and increases nitrous oxide emissions from soils.

Vietnamese coffee growing is also highly fragmented. Millions of smallholder producers manage small plots, each with different fertilizer practices. While this makes coordination challenging, it also highlights the potential for intervention: even modest fertilizer efficiency gains across such a large number of farms can deliver substantial reductions.

Brazil: scale, intensification, and climate stress

With plantations spanning roughly 1.9 million hectares, coffee growing in Brazil is vast in scale and notable for its large farm sizes and an increasing focus on irrigation. Fertilizer use is necessarily high – to supply adequate nitrogen, potassium and phosphorus to plants grown in nutrient poor soils – with many products imported.

> **"Fertilizer interventions are underrepresented in sustainability strategies. Yet addressing fertilizer emissions is one of the fastest, most measurable ways for coffee companies to make progress.**

Brazil has also faced historic deforestation linked to agricultural expansion, though producers today operate under the Forest Code and increasingly invest in soil health, agroforestry, and water conservation.

When it comes to coffee decarbonisation, what makes Brazil a standout for fertilizer solutions is the combination of:

- Strong focus on yield
- Increasing climate stress (especially droughts)
- Growing adoption of irrigation systems
- A willingness among many producers to innovate and adopt improved technologies.

Brazil shows how fertilizer efficiency can operate at scale – benefiting both farmers and downstream buyers that source large, consistent volumes.

Which fertilizers are used most for coffee?

Across most coffee plantations, urea fertilizer is the primary nitrogen source. When urea is applied to soil, it can lead to:

- Direct emissions: N_2O released during nitrification and denitrification.
- Indirect emissions: volatilised ammonia that later contributes to N_2O formation.

Because urea breaks down quickly, much of its nitrogen can be lost rather than absorbed by plants.

Nitrogen stabilisers (inhibitors) as an intervention

Nitrogen stabilisers are agricultural additives applied alongside fertilizers to reduce nitrogen losses and lower emissions. There are two types of nitrogen stabilizers: urease inhibitors and nitrification inhibitors (Figure 1).

Urease inhibitors slow the breakdown of urea, cutting ammonia loss, while nitrification inhibitors delay the conversion of ammonium to nitrate, reducing leaching and nitrous oxide emissions. By keeping more nitrogen in the soil for crops to use, stabilisers boost efficiency and help cut unnecessary greenhouse gas (GHG) emissions.

In coffee systems, nitrogen stabilisers can reduce N_2O emissions by up to 50%, and even as high as 70% in some favourable cases.

Nitrogen stabilisers consistently demonstrate:

- Lower direct N_2O emissions
- Lower indirect emissions from volatilisation
- Improved nitrogen-use efficiency (NUE)
- Stable or improved yields.

From a practical implementation standpoint, stabilisers:

- Fit easily into existing fertilizer practices
- Require no major equipment changes
- Are relatively low cost per tonne of carbon dioxide equivalent (CO_2e) avoided
- Can be adopted at both large and small scale.

For downstream companies, therefore,

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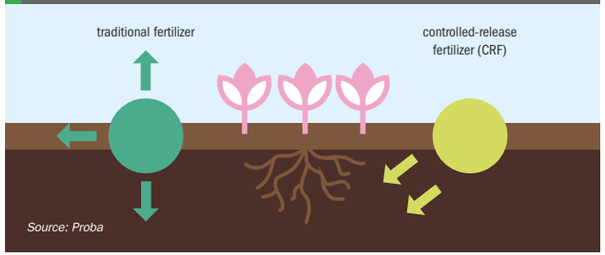
Fig. 2: **Controlled-release fertilizers (CRFs) release their nutrients gradually through an external coating, allowing plants to absorb these over a longer period**



stabilisers represent an intervention that is accessible, affordable and measurable.

Controlled-release fertilizers as an intervention

Controlled-release fertilizers (CRFs) release nutrients gradually from granules through an external coating, allowing plants to absorb nitrogen over a longer period (Figure 2). This reduces losses through leaching or volatilisation and can reduce excess N_2O emissions.

The advantages of using CRFs include:

- More consistent nutrient availability
- Reduced labour (fewer applications)
- Improved NUE
- Potential for higher yields
- Lower environmental losses
- Measurable reductions across both direct and indirect emissions.

Like stabilisers, CRFs require minimal changes to farm operations. They are gaining traction in several high-input agricultural systems and are increasingly relevant for coffee production where irrigation and climate stress affect nutrient availability.

While CRFs can be more expensive per bag than conventional fertilizers, the overall cost as a decarbonisation option (per tonne of CO_2e reduced) is competitive with other Scope 3 interventions, especially when combined with their crop yield benefits.

Reporting, traceability, and Scope 3 credibility

Fertilizer interventions are compelling for downstream actors because the results can be monitored and reported with confidence. When supported by verification frameworks, digital data collection, and clear quantification methodologies, companies can link reductions at farm level or sourcing region to their own Scope 3 claims.

Downstream companies can support fertilizer-efficiency interventions through:

- On-the-ground partnerships with cooperatives, agronomists, and local organisations.
- Carbon insetting models that link farm-level improvements directly to Scope 3 outcomes.
- Co-financed projects with traders or cooperatives to de-risk adoption for farmers.
- Using recognised quantification and reporting frameworks to ensure reductions are credible and auditable.

These approaches help align incentives between buyers and producers, ensuring farmers are compensated for adopting interventions, while companies can report credible Scope 3 reductions.

Proba's role in the sector

Proba works with supply-chain partners to quantify and reduce fertilizer-related emissions across agricultural value chains. We help companies identify emission hotspots, choose effective interventions, model the expected impacts, and support implementation at farm level.

Proba's platform tracks adoption, quantifies results, and supports credible Scope 3 reporting. By focusing on proven technologies, like nitrogen stabilisers and controlled-release fertilizers, and tailoring deployment to local farming realities, Proba makes it possible for buyers to achieve measurable emissions reductions while supporting farmer productivity.

A practical path for coffee buyers

Coffee companies face lots of pressures: tighter regulations, expanding climate disclosures, and demand from customers and investors to provide sustainable coffee and meet climate targets. In our view, impactful solutions exist that are relatively easy to implement.

In particular, interventions that address fertilizer emissions:

- Can unlock significant progress towards measurable and verifiable Scope 3 reductions.
- Be easily adopted without disrupting existing farm practices.
- Complement regenerative agriculture rather than compete with it.

> **"Proba works with supply-chain partners to quantify and reduce fertilizer-related emissions across agricultural value chains. We help companies identify emission hotspots, choose effective interventions and support their implementation at farm level.**

Encouragingly, coffee doesn't need to wait for future technologies or complex overhauls. Practical tools are available today to reduce emissions, strengthen supply chains, and build long-term resilience.

Practical, confidence-building partnerships

Proven, farmer-ready solutions already exist, and companies that act now can secure measurable Scope 3 reductions while strengthening relationships with producers. Proba works with coffee buyers, traders, and cooperatives to design practical interventions, implement them with agronomists on the ground, and quantify the impact with clarity and credibility.

If you're ready to explore what this could look like for your sourcing regions, Proba can help you identify the right interventions, model their impact, and build a practical plan with your local partners. ■

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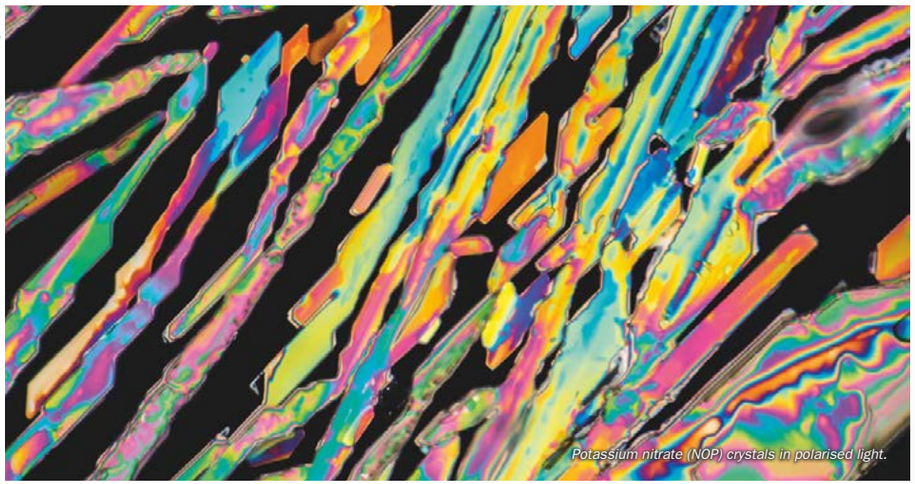
Specialty potash briefing

Price premia for specialty potash have hit record highs in recent times, with potassium sulphate (SOP) supply constrained by the return of Chinese export restrictions, as well as new projects over promising yet under delivering. In this CRU Insight, **Humphrey Knight** assesses the key market factors driving high SOP pricing – including China's export policy, US import reliance, and the failure to commercially develop and deliver new project capacity.

PHOTO: ISTOCKPHOTO.COM/PIRILL



Potassium nitrate (NOP) crystals in polarised light.

Demand remains niche

The global potash market is dominated by potassium chloride (MOP), a high analysis (60-62% K_2O) product that accounts for 92% and 84% of global potash production and consumption, respectively (Figure 1).

Specialty potash products, meanwhile, are a lower volume and more expensive option, in comparison to MOP, with limited market penetration. Despite this, niche demand exists in high-value agriculture – particularly for fruits, vegetables, tree nuts and tobacco – where they command substantial price premia over commodity MOP. Growers of these cash crops prize specialty potash products for their agronomically valuable qualities. These vary from product to product and include low chloride content, the supply of additional nutrients (sulphur, nitrogen, magnesium etc.) and applicability as water-soluble fertilizers in drip irrigation (fertigation).

The three main types of specialty potash are:

- **Potassium sulphate (SOP).** Contains 50-52% K_2O (low chloride, some forms water soluble) and accounts for 5% of global K_2O production and 10% of consumption
- **Potassium nitrate (NOP).** Contains c. 46% K_2O (low chloride, water soluble) and accounts for 3% of global K_2O consumption
- **K-Mg fertilizers (mainly SOPM, langbeinite).** Contain 11-48% K_2O (some forms low chloride) and accounts for 4% of global K_2O production and 4% of consumption.

Record price premia and a wide price range

Both SOP and NOP can command large price premia over MOP. The delta between SOP and MOP (both NW Europe), for example, having been on a rally since 2022, reached a new high of $283/t in 2025, while the delta between NOP (Chile) and MOP (NW Europe) is around $418/t currently (Figure 2). In general, attractive SOP premia have been a market fixture of the last decade, dating back to the MOP price slump in 2013.

The price paid for SOP does, however, vary widely across the globe. This divergence in pricing – with SOP showing a much greater price range than MOP (Figure 3) – reflects different patterns of

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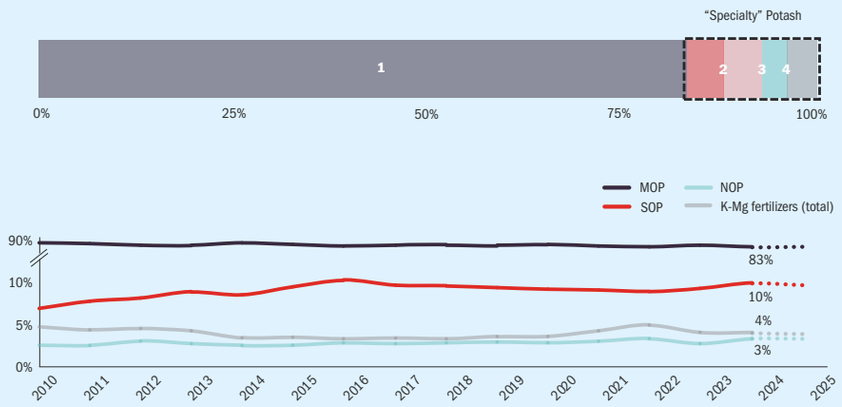
Fig. 1: **Global potash consumption by product type: in 2024 (top) and between 2010-2024 (bottom)**



Source: CRU Potassium Sulphates & Potassium Nitrate Market Outlook

production, trade and consumption within countries and regions. Nations such as Belgium, Germany and Taiwan are major SOP exporters, for example (Figure 4), whereas the US is import-reliant for SOP, while the Chinese SOP market is largely self contained. These disparate market conditions are reflected in the wide price range shown by the following SOP benchmarks (2024 averages):

- FCA NW Europe (standard grade) $633/t
- FOB Utah (all grades) $610/t
- FOB Taiwan (all grades) $582/t
- ExW Eastern China (standard grade) $477/t.

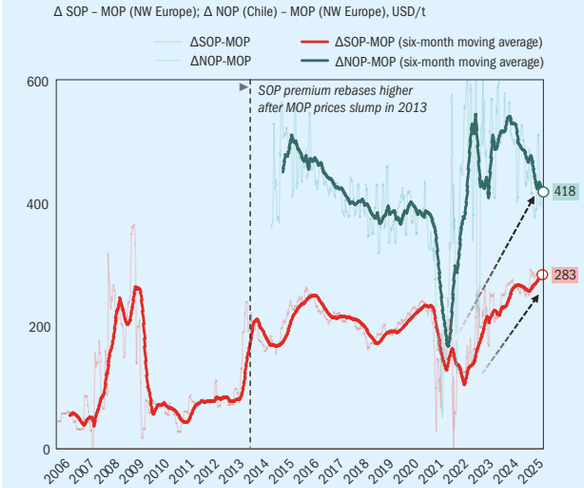
Self-contained China

While SOP price premia reached record highs in 2025, as already highlighted, the wide price spread for individual SOP price benchmarks is an equally notable market characteristic – being a function of the limited opportunities for arbitrage. Indeed, global SOP trade remains fragmented, with little volume moving between markets east and west of Suez.

International SOP supply also tightened in the early 2020s (Figure 4) as a consequence of:

- China's reintroduction of export restrictions
- MOP sourcing problems faced by Europe's Mannheim producers
- The exit of other exporters like Chile.

Fig. 2: **Price premia between specialty potash (SOP and NOP) and MOP**



Source: CRU Potassium Sulphates & Potassium Nitrate Market Outlook, GTT, Intrepid Potash, Longzhong

As the dominant SOP producing and consuming country – with domestic output and demand both above five million tonnes in 2024 – China's market behaviour is highly influential. While the country briefly became a major SOP exporter in 2019, having lifted export tariffs, export restrictions were re-introduced in October 2021 to safeguard against a decline in China's primary SOP production.

China's SOP exports are unlikely to return to 2019/20 levels, in CRU's view, this being linked to a shift from primary to secondary SOP production domestically (*Fertilizer International* 529, p40). In particular, looking ahead:

- While SOP is oversupplied within China, the country remains reliant on MOP imports for its secondary SOP output
- Primary SOP production is also facing depletion, further increasing China's reliance on secondary SOP production.

US reliant on SOP imports

The US, the second largest consumer of SOP after China, is an import dependent market, with key offshore supplier Western Europe meeting demand from the country's main consuming regions, California, the Midwest and Florida. The domestic production of primary SOP in Utah, meanwhile, has faced limitations.

Consequently, SOP imports are taking a growing share of US supply, with long-haul imports common from countries such as Belgium and Germany (Figure 5). California, in particular, has limited its reliance on domestic production in recent years by importing more SOP.

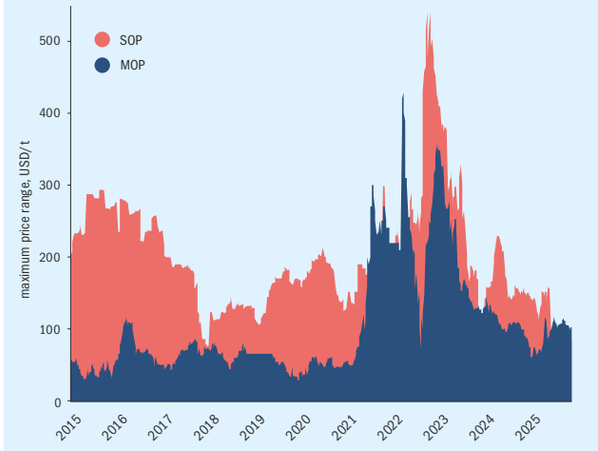
US consumers have the choice to substitute SOP with SOPM, a domestically-produced potassium magnesium sulphate fertilizer commonly known as langbeinite. Historically, on a K_2O-equivalent basis, SOPM (22% K_2O) has offered US growers a more affordable specialty potash option at times when SOP (50% K_2O) prices are high.

SOPM was last favoured in this way during the four year period 2017-2020 when SOP was at a premium over langbeinite. There are signs, however, that this price-based substitution of SOPM for SOP may no longer hold, with a lack of SOP availability instead becoming a more fundamental and limiting choice factor in the US specialty potash market.

Projects fail to deliver new supply

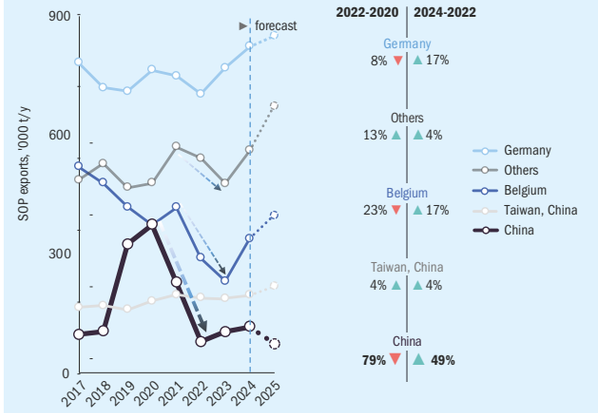
SOP demand outside China is likely to grow in the medium term, with CRU forecasting an increase in global demand from 7.87 million tonnes to 7.98 million tonnes between 2024 and 2029. Balancing this higher demand with extra supply requires new projects. It is therefore significant that, in recent years, a large number of announced SOP projects have failed to enter commercial production.

Fig. 3: **Maximum range of SOP price benchmarks versus those of MOP**



Source: CRU Potassium Sulphates & Potassium Nitrate Market Outlook, Compass Minerals, GTT, Longzhong

Fig. 4: **SOP exports by country**



Source: CRU Potassium Sulphates & Potassium Nitrate Market Outlook, GTT

The high failure rate for SOP projects in countries as diverse as Australia, Eritrea, Ethiopia and the US – which promised much yet delivered little – has dashed hopes of a significant increase in global supply (*Fertilizer International* 523, p41). This lack of supply growth, in turn, has sustained SOP market tightness and the attendant high-price environment.

In the medium term, CRU expects SOP demand outside China to grow by 0.52

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million t/a between 2024-2029 while SOP capacity will grow by 0.47 million t/a (Figure 6). Sev.en Global Investments' Lake Way project in Western Australia recently entered CRU's base case. It represents a large 200,000 t/a primary capacity addition in an otherwise thin SOP project pipeline, as rising MOP and sulphur prices squeeze secondary producers' costs.

Polyhalite – the future of specialty potash?

Unsurprisingly, given the faltering SOP project pipeline, the potential of polyhalite – a naturally–occurring potassium, magnesium and calcium sulphate fertilizer – has received a lot of attention over the last decade. ICL is the only global polyhalite producer currently, having started production at its Boulby potash mine in the UK in 2012. The company makes and sells around one million tonnes of polyhalite annually, having completely switched Boulby from MOP to polyhalite mining in 2018, partly due to geological difficulties.

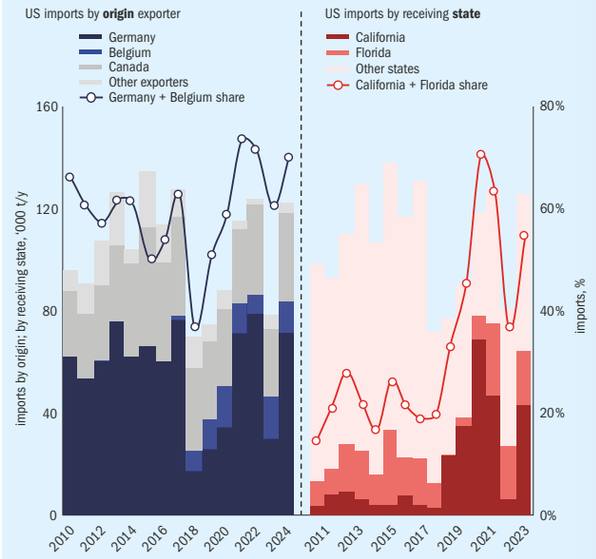
Also in the UK, Anglo American is slowing capital investment in its large-scale, under-development Woodsmith polyhalite mine – as it deleverages its balance sheet, looks for a project investor and decides whether to proceed to a final investment decision (*Fertilizer International* 528, p10). The company's ambitions for this multi-nutrient fertilizer are on a different level – with the polyhalite output from the Woodsmith mine potentially matching, on a product basis, total global specialty potash demand (Figure 7).

But, with plans for the Woodsmith mine currently on hold pending a FID and question marks over the profitability of existing production, polyhalite's future is not as promising as it once was.

Key takeaways

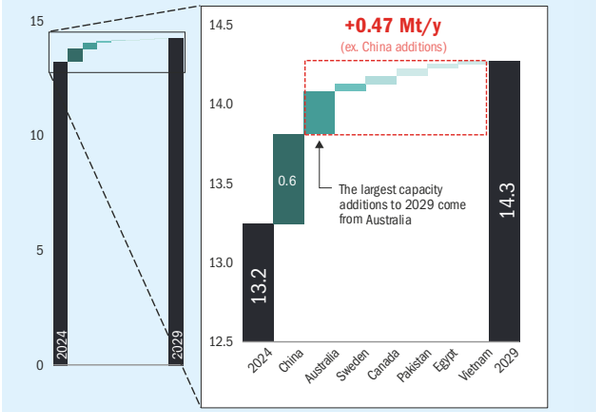
The depreciation of the US dollar and tight supply in 2025 has led to higher SOP and SOPM prices outside China. These higher prices, however, have not deterred overall growth in speciality potash consumption. NOP prices, meanwhile, have remained largely flat since the end of 2024, although slight increases in feedstock costs in recent months, particularly for MOP, have placed an upwards pressure on production costs.

Fig. 5: **US imports of SOP by origin (left) and destination (right)**



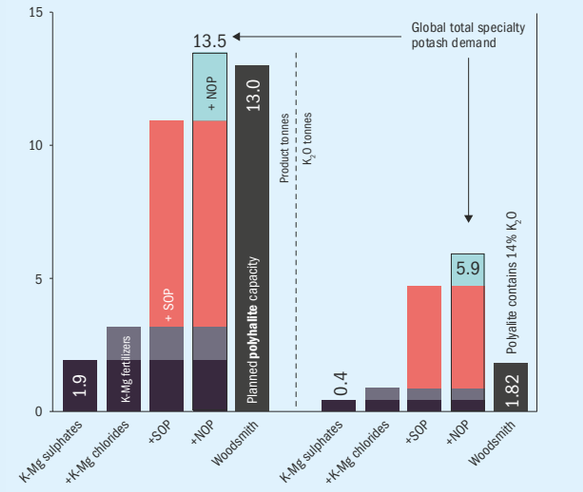
Source: CRU Potassium Sulphates & Potassium Nitrate Market Outlook, GTT

Fig. 6: **SOP capacity additions by country over the next five years**



Source: CRU Potassium Sulphates & Potassium Nitrate Market Outlook

Fig. 7: **Specialty potash demand (2024) on a product (left) and nutrient (K_2O) basis**



Source: CRU Potassium Sulphates & Potassium Nitrate Market Outlook, Anglo American, ICL UK

In summary:

- **Specialty potash prices remain high and disparate**. China's export restrictions are a key driver as the world's largest SOP supplier turns inwards once again.
- **Tight supply in the US SOP market is set to continue**. Long-haul imports of SOP remain vital, even with the option for significant substitution with domestically produced SOPM.
- **Little new capacity on the horizon**. SOP demand growth has outpaced extra supply capacity with a large number of SOP projects failing to enter commercial production.
- **Uncertain future for polyhalite**. With only one operative mine globally, this multi-nutrient fertilizer has yet to deliver promised large-scale production.

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Bringing balance to blueberries: the power of nitrate and iodine

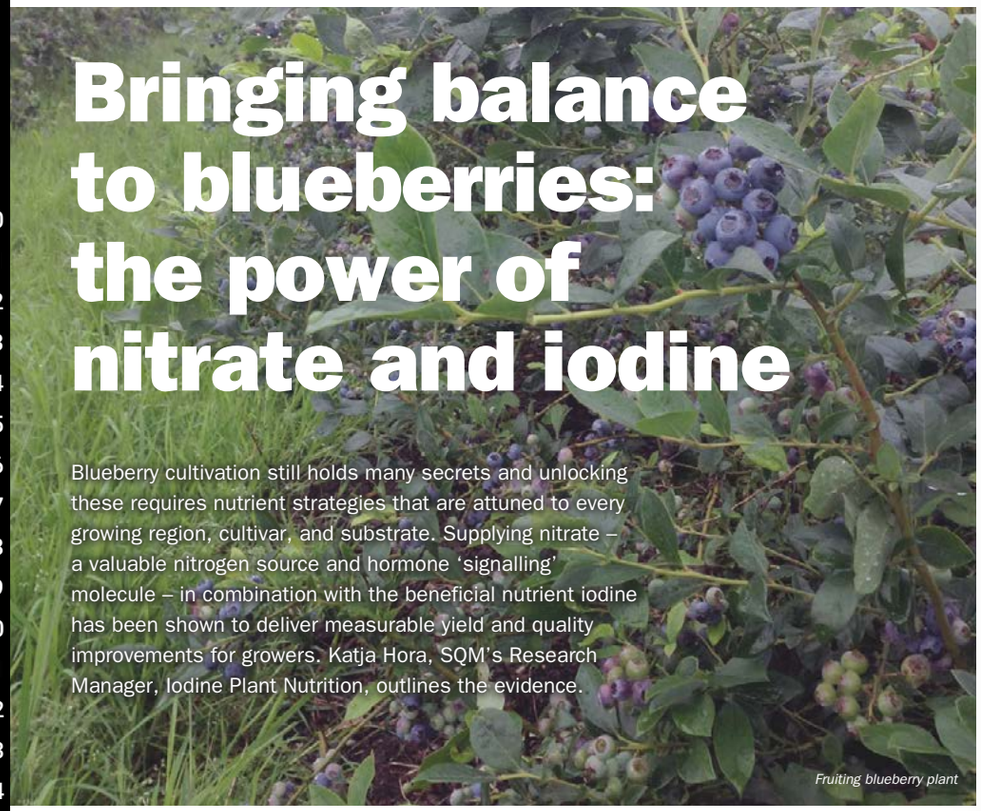

PHOTO: TESSENDERLO

Fruiting blueberry plant

Blueberry cultivation still holds many secrets and unlocking these requires nutrient strategies that are attuned to every growing region, cultivar, and substrate. Supplying nitrate – a valuable nitrogen source and hormone 'signalling' molecule – in combination with the beneficial nutrient iodine has been shown to deliver measurable yield and quality improvements for growers. Katja Hora, SQM's Research Manager, Iodine Plant Nutrition, outlines the evidence.

The economic rise of blueberries (*Vaccinium sp.*) has been extraordinary. They may be familiar as an elegant finishing touch on your dessert after a festive dinner in a wintery European city. Yet many don't realise that these berries will have travelled much further than most diners to reach the restaurant.

In fact, the pursuit by retailers and restaurateurs of a year-round supply of this global 'superfood' has sparked growth in blueberry production in horticultural regions across the world. This expansion opens the door to developing advanced nutrition guidance for blueberry growers, especially in places where the local soils and climate are not naturally suited to this crop.

A new arrival on our plates

The story of commercial blueberries is relatively young. The first domesticated highbush blueberry harvests were recorded in the early 20th century, driven by the desire to make use of the sandy, acidic soils of New Jersey's pine barrens[1].

While few other crops could grow on these soils, early studies of wild *Vaccinium* blueberry species revealed just how uniquely adapted these plants were to nitrogen-poor, acidic environments (with ideal soils between pH 4.0 and 5.5). As blueberry cultivation spread to new regions, growers encountered soils richer in clay, more neutral or alkaline in pH, and far outside the crop's natural comfort zone.

These conditions presented one of the central challenges still faced by today's commercial blueberry growers: how to optimise nutrient uptake in environments these soft fruit bushes did not evolve to handle. In particular, blueberries possess an extremely fine, fibrous root system and – unlike many crops – they lack root hairs. This trait is believed to reflect their evolutionary reliance on mycorrhizal partnerships in acidic, nutrient poor native soils.

Early agronomists observed that blueberries seemed to prefer ammonium (NH_4^+) over nitrate (NO_3^-), especially in high-pH soils where ammonium helped acidify the rhizosphere. Over time, extension literature distilled this into a widely adopted rule of thumb: use ammonium, avoid nitrate. But is this really true?

Modern research, in fact, paints a far more nuanced picture[2]. Recent studies show clearly that blueberries can absorb and assimilate nitrate as well as ammonium. Nitric nitrogen can be converted into amino acids in the roots, and nitrogen can move throughout the plant as amino acids, nitrate, or ammonium.

Even more importantly, blueberry plants often perform best when both forms of nitrogen are supplied together.

A mix of NH_4^+ and NO_3^- in a 1:1 ratio in a nutrient solution, for instance, has been shown to result in the highest shoot dry weight in blueberries, more flowers and more soluble sugar and starch in leaves, compared to unequal ratios[3,4]. This realisation opens the door to far more flexible, balanced, and adaptable fertilization strategies – this being especially promising news for growers working outside traditional blueberry soils.

Nitrate (NO_3^-)[1], besides being a valuable nitrogen source for plants, is also a 'signalling' molecule. It plays a key role in shaping plant hormone balance, by stimulating the expression of genes involved in producing zeatin-type cytokinins, for example[5]. Similar to their role in other crop species, cytokinins are central to shoot growth and tissue differentiation in blueberry[6]. Understanding how NO_3^- influences hormone balance in blueberries is therefore well worth exploring.

Nutrients for quality

Consumers, meanwhile, expect blueberries on supermarkets shelves and dining plates to remain sweet, firm, and visually appealing, even after long-distance transport. Potassium is essential for sugar translocation, while calcium plays a central role in fruit texture and shelf-life. This is, again, where nitrate plays an important supporting role by improving accumulation of K^+ and Ca^{2+} in blueberry[4].

As in many other fruits, most calcium enters blueberries during early development. It is well recognised that this is a challenge not easily solved by adding Ca^{2+} in the nutrient solution. Agronomists are still exploring new ways to enhance calcium uptake and movement to secure longer shelf-life and better fruit integrity at retail.

A newcomer to the discussion on improving calcium uptake is iodine. This halogen is now recognised as a 'beneficial nutrient' by ISO standard 8157 (2022)[7] using the following definition:

"Elements, other than those defined as primary nutrient element, secondary nutrient element or micronutrients, that are known to be needed for plant growth and development or for the quality attributes of the plant product, of a given plant species, grown in its natural or cultivated environment. Known beneficial nutrient elements include Si, Se, I, Co, Na, Al, and others as demonstrated."

> **"European findings highlight the potential of beneficial nutrients such as iodine to fine-tune nutrient programmes and help fruit plants respond to shifting climate conditions."**

The benefits of iodine relate to its capacity to bind covalently to plant enzymes that are essential for photosynthesis, assimilation and stress mitigation. Notably, iodine seems to be involved in the sensitive, calcium-dependent signalling process that determines the ability of plants to react to environmental stress.

Across Europe, agronomic studies have now demonstrated the effect of iodine on calcium translocation in tomato fruit. In the Netherlands, in plants where iodine was applied during fertilization, round tomato showed higher calcium levels following a series of summer heatwaves. This suggests that the presence of iodine during extreme weather is influencing nutrient movement during fruit development in ways we are only beginning to understand.

In Spain, meanwhile, researchers observed elevated calcium concentrations in the fruit and leaves of cherry tomatoes grown during the darker, colder months of the season.

These European findings highlight the potential of beneficial nutrients such as iodine to fine-tune nutrient programmes and help fruit plants respond to shifting climate conditions.

Improving growth, yield and resilience

With this in mind, researchers are looking to improve fertilizer strategies for blueberries, with a focus on two promising elements: nitrate (NO_3^-) and iodine. This includes a recent two-year randomised complete block (RCB) trial carried out in Poland on soil-grown 'Bluecrop' bushes, originally transplanted in 2006 and inoculated with mycorrhizae.

These mature, commercially productive blueberry plants provided an ideal setting to evaluate how subtle but strategic nutritional adjustments could translate into better crop growth, yield, and resilience. The Polish trial explored three key improvements to the prevailing local practice:

- Enhancing acidification of the drip solution by replacing monoammonium phosphate (MAP) with urea phosphate as the phosphorus source. This should create more favourable rhizosphere pH for better nutrient availability.
- Rebalancing the nitrogen ratio by increasing the proportion of NO_3^- from 22% to 56% of total N. This was accomplished by shifting from

Table 1: **The nutrient balance of three fertilizer programmes (treatments 1, 2 and 3) in a blueberry 'Bluecrop' blueberry trial in Poland (total kg/ha/crop cycle).**

Treatment	N total	N-NO_3 (% of N total)	N-NH_4	N-NH_2	P_2O_5	K_2O	MgO	CaO	SO_3	I	other micros
1. FP:SOP/NH_4	116	**26** (22%)	**90**	0	77	182	20	33	**388**	0	Not added
2. KNO_3		**64** (56%)	**18**	34	78				**81**	0	Fe, Mn, Zn, Cu, B, Mo
3. KNO_3+I										0.28	

Source: SQM

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potassium sulphate (SOP, K_2SO_4) to potassium nitrate (NOP, KNO_3) as the primary K source. The aim was to support stronger nutrient uptake and fruit quality and prevent accumulation of excess sulphate in the root zone.

- Introducing iodine into the nutrient solution in proportion to the applied KNO_3, with the aim of strengthening root development, improving fruit calcium and boosting plant resilience to abiotic stress.

By embracing new scientific insights and incorporating these into the reality of commercial fruit production, these refinements offer a forward-looking approach to blueberry nutrition.

The following three fertilizer programmes (treatments 1, 2 and 3) were tested in the two-year Polish trial (Table 1):

- **Treatment 1**: Farm practice with application of potassium sulphate (SOP) with an ammonium nitrogen source.
- **Treatment 2**: Application of potassium nitrate (NOP) plus micronutrients (Fe, Mn, Zn, Cu, B, Mo).
- **Treatment 3**: Application of NOP and iodine (SQM Ultrasol®ine) plus micronutrients (Fe, Mn, Zn, Cu, B, Mo).

In the first year, the total season berry yield was a stunning 29% and 36% higher in treatments 2 and 3, respectively, compared to the farm practice yield of 16 t/ha. In the second year the same plants still gave a higher yield: being 4% and 12% higher in treatments 2 and 3, respectively, compared to the farm practice yield of 16 t/ha. The benefit compared to the farm practice was due to a statistically significant higher number of fruits per plant.

Moreover, the berries showed a better shelf life during 6 days of cold-room storage followed by 10 days of room temperature storage. In the first year, for example, only 22-24% of the berries displayed grey mould in treatments 2 and 3 compared to 34% mouldy fruit found with the farm practice. In the second year, fruit was 21 percentage points less mouldy using treatment 3 – SQM Ultrasol®ine with iodine – compared to 57% mouldy fruit found using farm practice.

'Spectacular' hydroponic results

High density hydroponic cultivation methods, by taking blueberries out of the soil, can eliminate the challenges and complication of blueberry cultivation on unsuitable soil types. This can deliver quite spectacular increases in yield potential.

Fig. 1: **Trial results for blueberry (var. *Kirra*) grown in cocoa-peat substrate in Peru. The applicaGon of SQM Ultrasol®ine (potassium nitrate enriched with iodine) delivered a 13% higher yield and more berries in the largest class size (>19mm), versus the control.**

Source: SQM

While only about 5% of the total blueberry hectares in Peru were grown hydroponically ('in pots') in 2016, this share had grown to 19% by 2022. The cocoa-fibre based substrates used in Peru offer an excellent growing medium that can realise the high production potential of modern cultivars. Nutrients can also be regulated hydroponically at a precise pH and balanced to optimally match the ancestral root zone solution of blueberries. Additionally, hydroponic technology, if managed well, can reduce nitrogen leaching and improve water use efficiency.

It is standard practice to combine the application of nitric nitrogen with ammonium nitrogen in substrate-grown blueberries in both Peru and Mexico. The addition of iodine with potassium nitrate has also been evaluated.

An on-farm trial was carried out in Mexico on blueberries (var. *Biloxi*) grown in a cocoa-chip substrate. The addition of iodine to the nutrient solution (9.5 Meq./L NO_3^- vs 4 Meq./L NH_4^+) resulted in 1 degree C Brix increase (from 6.1 to 7.1) and extra fruit calcium (1.2 mg/100 g) in the tunnels, where this was applied with potassium nitrate (SQM Ultrasol®ine).

Highly positive results were also recorded in a trial on blueberry (var. *Kirra*) grown in cocoa-peat substrate in Peru. The of iodine with potassium nitrate (SQM Ultrasol®ine) in a nutrient solution delivered a 13% yield increase, as well as bigger berries with more in the largest >19 mm size class (Figure 1).

Summing up

Blueberry cultivation still holds many secrets and unlocking these requires nutrient strategies that are attuned to every growing region, cultivar and substrate. In practice, that means leaving behind old beliefs and approaching blueberry crop nutrition with curiosity, innovation, and an open mind. The rewards? Consistently delicious berries that will delight consumers season after season. ■

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