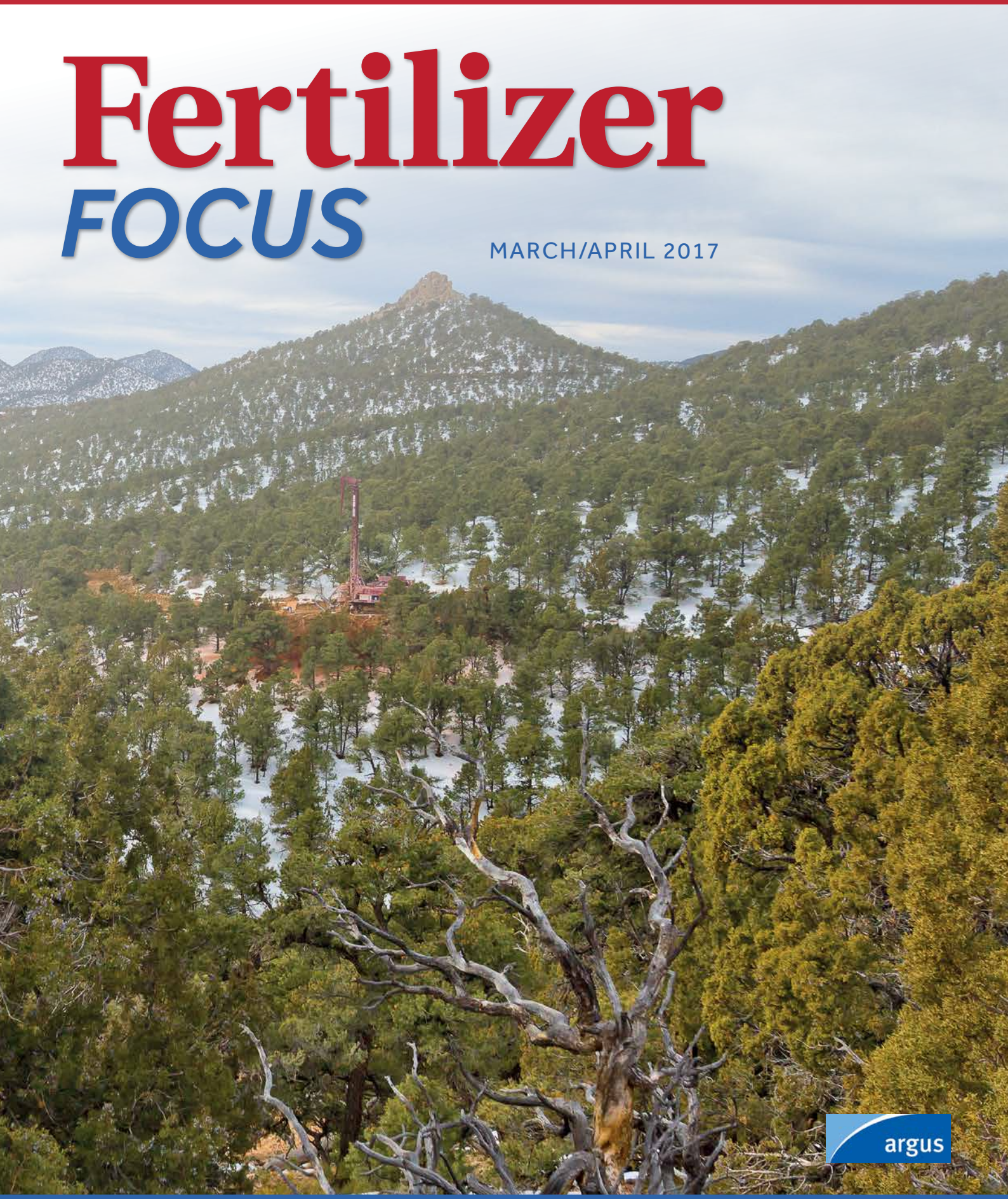
Fertilizer FOCUS

MARCH/APRIL 2017



Potash Ridge

Blawn Mountain project

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Fertilizer FOCUS

CONTENTS

Fertilizer Focus
Argus
175 St John Street,
London, EC1V 4LW
Tel: +44 (0)20 7780 4340
Email: fertilizer@argusmedia.com
www.argusmedia.com/fertilizer

Front cover image: Courtesy of Potash Ridge

Potash Ridge:

Blawn Mountain project update

Fertilizer Focus speaks with Potash Ridge President, Guy Bentinck

Fertilizer Focus (FF): Could you give some background on the Blawn Mountain project from its inception to the progress to date?

Guy Bentinck (GB): Blawn Mountain has been considered as a potential project since the 1970s mainly by the alumina industry and a considerable amount of work was completed in terms of metallurgical test work, drilling, engineering and permitting. The economic stagnation during the 1980s meant that the project was abandoned due to a lack of funding. The US simply bought their alumina elsewhere.

Potash Ridge began to re-look at it as an SOP project in 2011.

Guy Bentinck, Potash Ridge President

> *"There is material in the ground, the mining and processing is straightforward*

We took control of the property and we began drilling as soon as once we received an exploration permit. We also obtained all of the historical drilling, test data and engineering work that was performed extensively on the property. Blawn Mountain is on state-owned land, and as such there were no objections once we had demonstrated the economic advantages of the operation to the State of Utah.

More recently in January of this year, we decided to move forward with a initial phase of the project one-third of the size of the original project in order to facilitate prompt funding. Blawn has the potential to be the lowest cost producer of soluble grade SOP in North America, at USD172/ton based on our January prefeasibility study.

We have begun discussions on the financing side and are looking at innovative financing structures that minimise dilution to existing shareholders.

The next stage is to complete detailed engineering before we put a shovel in the ground. We are looking to secure an Engineering Procurement and Construction (EPC) contract for a fixed lump sum. We can then lock in this capital cost and engage engineering companies to carry out the work that is required. We can then begin construction later this year, with a two to three year execution phase.

FF: What, if any, have been the main obstacles you have faced so far? And how were these overcome?

GB: There have not been any obstacles of significance. The drilling and engineering work revealed everything we needed to know: There is material in the ground, the mining and processing is straightforward, the permitting is completed, the water rights are secured, and the market for the product is strong.

The state of the financial markets in 2013-2015 was the only road-bump we encountered. The market was effectively closed to resource projects of this magnitude during that time period.

FF: What were the results of your economic impact analysis?

GB: We engaged a third party to take a look at the impact on the local economy. The nearest town is Milford with 1 500 people. The first phase if the project will provide 240 direct jobs - so there is a huge job impact to this rural community, and potentially over 1 300 jobs in total in Utah. The project will also have secondary benefits in the region through through creation of supporting industry and infrastructure.

The owner of the land is the Utah School and Institutional Trust Lands Administration (SITLA) so royalties will be delivered directly into the education system. During the first phase we will contribute over USD12 million per year in royalties to SITLA, making us potentially their largest source.

FF: Which other organisations are involved in the project?

GB: Establishing key relationships with third parties has been paramount to the project. We have a buyer for the by-product sulphuric acid and we're already in discussions with the local electric utility and gas suppliers. We are also in the process of engaging companies interested in the offtake of SOP.

Drilling Blawn Mountain

FF: What logistical/commercial arrangements need to be organised before mining begins?

GB: Most of that was taken care of well in advance, but as mentioned, we need to enter into supply agreements for electricity and gas and the SOP offtake, none of which we see as a difficult process.

Engineering procurement is key

FF: When do you expect to begin mining?

GB: Subject to financing we hope to begin construction on the site later this year. It will be a two-year build, so the pre-stripping should begin mid-2019 and mining would follow later that year.

FF: You have recently reduced the annual estimated output of SOP from the project – why was this?

GB: This is a reflection of market conditions. Perception of financing a billion-dollar project was too tough, so we scaled down. This was a good idea because the economics have not changed as a result of the decision. We were able to maintain an IRR in excess of 20pc, which is very robust for fertilizer processing facility in North America.

All of the SOP we will produce can easily be absorbed into the North American market, especially into California where demand for soluble SOP is increasing considerably. This doesn't mean we can't expand in the future though and will look to do so once phase 1 is ramped up.

FF: What are the current estimations on SOP production and which method will you use to produce it?

GB: We'll be producing 230,000 tonnes of SOP annually in the first phase. The production method is fairly straight forward – it's common technology: mine it, crush it, roast it, leach it and then crystallise it. This gives us a very clean SOP, either in soluble or granular form.

FF: How do you see demand for SOP evolving in the coming years?

GB: We spend a lot of time educating people about exactly this. You read reports that global production of SOP is around 7 to 8 million tonnes and that consumption is growing by 4-5pc per year. But what these reports don't address is that there is a huge deficit of SOP. Global demand is estimated to be around 10 million. Growers simply cannot get enough SOP. Consumption in the U.S. is pegged at 400 000 tonnes, but our studies show that US demand could be at as high as one million tonnes, were there enough SOP available. Plantations in California alone could easily use an additional 200 000 tonnes. Current production facilities in North America are not able to expand to meet this shortfall so we will hopefully fill that gap.

When you look at regions such as California – the arid conditions

The project will produce 230 000 tonnes of SOP annually

Blawn mountain mining zones

means growers are employing more underground irrigation systems through which they will run fertilizers with water. The best thing about our SOP is that it is water soluble, making it ideal for irrigation systems.

FF: What do you see as the drivers for increasing SOP demand?

GB: SOP works well on high value crops such as vegetables, fruits and nuts – so as populations become richer their diets migrate from staple crops such as grains and corn to these high value crops. Therefore, the growth profile of SOP could be higher than the accepted figure of 4pc that analysts forecast.

FF: Which destination markets are you targeting?

GB: In the first phase, western USA will absorb the majority of our production from Blawn Mountain. SOP is perfect for the almonds, grapes and other fruits and vegetables grown there. In the second phase we will probably take a look at Mexico and Brazil for the citrus and coffee crops there. The demand potential in Brazil could be 1.0-1.5 million tonnes. At present, Brazil uses just 40 000 tonnes. There is no domestic production in Brazil and they mainly import from Europe.

In China, all of the SOP is produced locally and demand is much higher than the local industry can supply.

FF: Potash Ridge proposes to extract alunite from the project. Could you outline the methods you expect to use?

GB: Mining is a simple truck and shovel operation. With the ore, we crush it, roast it, extract the SOP through a hot water leach process and then crystalize out the SOP. This is all commonly used technology. In our economics, the waste material, which is high in alumina goes to tailings. Given the high alumina content, however, this product has value and could be used either in the alumina industry or for the production of other products such as cement. We are in discussion right now with a number of potential buyers.

FF: What other projects, if any, is Potash Ridge looking at?

GB: We own another project in Quebec called Valleyfield. It will also produce SOP, around 40 000 tonnes per annum, but uses a widely-used conversion process. We can put a shovel in the ground in the first half of this year, after we raise the USD50 million construction capex, and begin production just 9-12 months after this.

So Valleyfield brings revenue in the short-term at a low capex, while Blawn Mountain brings scale at 230 000 tonnes per annum, and we expect it will be lowest cost producer in North America, if not the world. And both projects have room to expand. ■

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Efficient nitrogen:

Crucial for crop production success in Africa

by By Brian Wade, PhD, **Innovation Director, Koch Agronomic Services**

Nitrogen losses after fertilizer application quickly diminish the value of fertilizer expenditures and can limit expected returns. Fortunately, there is an effective and economical way to stabilize nitrogen fertilizer and thereby retain applied nitrogen in the soil to fuel the crop to optimal yield and return on investment. Koch Agronomic Services believe the benefits from stabilizing nitrogen are frequently manifested in four key criteria: agronomic, logistical, economic and environmental efficiencies and that these benefits elevate stabilized nitrogen to a unique category of nitrogen fertilizer. These benefits have been validated through African research and farmer adoption of the fertilizer products.

Aerial photo of sugar cane in KawZulu-Natal, South Africa, looking toward the coast

Urea is the key to African crop production – but nitrogen loss is a risk

There is no doubt about the value of nitrogen fertilizer to crop production. The addition of nitrogen fertilizer can significantly increase crop yields when nitrogen is the yield-limiting factor. Nitrogen fertilizer directly creates value through yield gains and therefore indirectly enables more value from the other crop inputs.

Both commercial and smallholder farming systems across Africa benefit from nitrogen fertilizer investments, although their investment strategies may slightly differ. Smallholder farmers with limited capital generally prioritize fertilizer affordability over achieving maximum yield. Commercial farms with more access to capital generally prioritize achieving maximum yield to lower the unit cost of production. In both production strategies, nitrogen fertilizer efficiency is crucial for operational success.

Urea is a popular form of nitrogen fertilizer – but with inherent risk.

Approximately 70pc of the global consumption of 'straight nitrogen' (e.g. not compound) fertilizer is based on urea. Throughout Africa, urea has the benefits of ready access, high nutrient concentration and simple transport. However, urea also has an Achilles' heel – the inherent risk of up to 40pc nitrogen loss within days after applying to the soil.

Technological solutions to increase nitrogen efficiency

The efficiency of urea fertilizer is undermined by extensive nitrogen losses that can occur long before utilization by the crop. The primary nitrogen loss mechanism from urea is caused by a chemical reaction that occurs in all soils.

The transformation (chemically known as 'hydrolysis') of urea into two free ammonium ions occurs within days and can overwhelm the soil's normal, static pH conditions. Figure 1 illustrates the chemistry involved. Urea hydrolysis can induce a spike in pH level around the urea application site – and when soil pH is pushed up by hydrolysis, stable ammonium (NH_{4^+}) is shifted to unstable ammonia gas ($NH_3\uparrow$) leading to loss of ammonia into the air. The entire process is known as volatilization loss. Fortunately, technology is available to increase nitrogen efficiency by limiting this loss process.

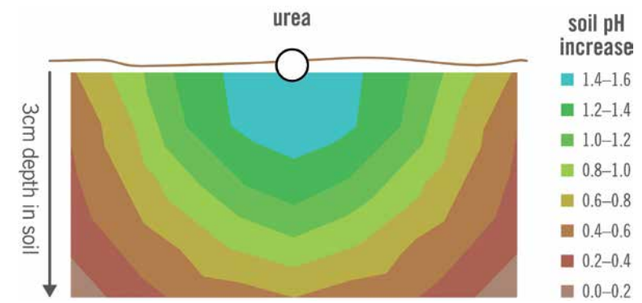
Stabilizing hydrolysis rate retains more nitrogen in soil

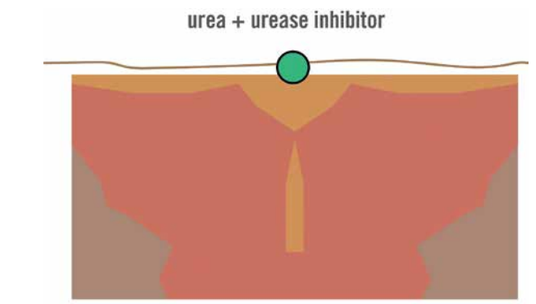
Figure 1 illustrates how unstabilized urea substantially increases soil pH while urea stabilized with a urease inhibitor maintains near-normal conditions. Urease inhibitor technology stabilizes the rate of hydrolysis which avoids the pH spike near the site of application. Preventing the pH spike prevents shifting stable ammonium to unstable ammonia gas. As a result, more of the stable ammonium is retained in the soil and is available for crop uptake.

Nitrogen stabilized with urease inhibitors reduces nitrogen loss from ammonia volatilization, ensuring more nitrogen is available for crop uptake, maximizing your yield potential. Urease inhibitors stabilize nitrogen from loss but they should not be confused with controlled- or slow-release of nitrogen. Stabilized nitrogen is treated to reduce loss of nitrogen after application. Stabilized nitrogen dissolves and diffuses at the same rate as traditional urea alternative. 'Stable and available' is a common characterization of urea treated with a urease inhibitor. Controlled-release nitrogen is a polymer-coated fertilizer that meters nutrient release based primarily on soil temperature reducing availability of nitrogen after application.

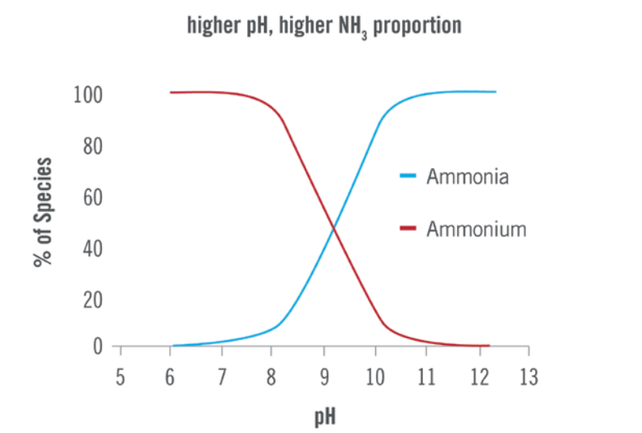
Distinguishing stabilized from controlled-release nitrogen is important for determining how best to utilize the products. Controlled-release nitrogen often requires a change in application timing to utilize the reduced availability effect. Because a stabilized nitrogen fertilizer is readily available, no changes to the application method or use practices are needed to realize the product benefits and, therefore, the adoption by farmers is simple. In fact, stabilized nitrogen may be easier than traditional urea for farmers as they are relieved of managing loss risk from traditional urea through practices such as many splits of the nitrogen dose, applying irrigation, or soil incorporation after urea fertilizer applications.

Figure 1. Visualizing how the chemistry of urea can be stabilized in soil with a urease inhibitor. With urea, the conversion to ammonium is fast which also increases the speed and extent of pH rise (top illustration). Treating urea with a urease inhibitor avoids the pH change by reducing the rate of urea transformation (middle illustration). Avoiding the high pH caused by urea transformation maintains the stable ammonium form (bottom illustration).





Six days after application, pH 5.2 non-calcareous sand



Adapted from Christianson et al. 1993

Table 1. Stabilized nitrogen as a unique category of fertilizer compared to urea based on four key efficiency criteria sought by farmers.

Efficiency criteria	Traditional urea	Stabilized nitrogen	Summary of product efficiency differences
Agronomic	-	+	With untreated urea, 40% nitrogen loss can occur. Stabilized nitrogen reduces loss from ammonia volatilization, ensuring more nitrogen is available for crop uptake
Logistic	-	+	Urea applications can be restricted by weather conditions Stabilized nitrogen applications give flexibility to farm operation
Economic	-	+	Urea volatilization reduces fertilizer value, limits crop returns Stabilized nitrogen investment optimizes returns
Environmental	-	+	Stabilized nitrogen reduces crop carbon intensity up to 15% when compared to untreated urea
More efficient product	-	+	

From technology emerges a unique category of fertilizer

The farmer derives multiple benefits from stabilized nitrogen that elevate it into a unique category. From farmer interactions in many countries and crops, we perceive that there are four product efficiency criteria that farmers seek in nitrogen fertilizer. The efficiency criteria are: agronomic (converting kg N into kg of marketable product), logistic (application flexibility), economic (returns on investment and not only price) and environmental (reduction of crop carbon intensity while maintaining high yields). Stabilizing nitrogen from loss optimizes agronomic efficiency, but the benefits ripple through the other efficiency criteria. Table 1 provides a condensed summary of the traditional urea category and its efficiency compared to stabilized nitrogen utilizing urease inhibitors.

Proven by science – in Africa and worldwide

Urease inhibitors like AGROTAIN nitrogen stabilizer have been studied through research in African countries and around the world.

The Fertilizer Association of South Africa (FERTASA) held a symposium in 2015 where urease inhibitors and other fertilizer technologies and their use were comprehensively detailed by international experts. As one example, Dr. Catherine Watson of the Agri-Food and Biosciences Institute in Northern Ireland explained how nitrogen fertilizer with AGROTAIN stabilizer delivered high crop productivity and reduced emissions of nitrogen gases. Data presented showed that compared with traditional urea, AGROTAIN stabilizer lowered ammonia emissions by 84pc to a level no different to ammonia emissions with calcium ammonium nitrate ('CAN' otherwise known as 'LAN' in South Africa). Furthermore, the data presented indicated nitrous oxide direct and indirect emissions factors averaged 2.37 from CAN, 0.62 from urea, but only 0.39 from AGROTAIN stabilized nitrogen .

In South Africa, other studies on urease inhibitors have been conducted. Guy Thiabud from Cedara Research Station, Petermaritizburg, reviewed the benefits of NBPT, the active ingredient in AGROTAIN stabilizer, under conservation agriculture practices internationally. In addition, the South African Sugarcane Research Institute in Mount Edgecombe in South Africa presented interim results of a project evaluating urease inhibitors and preliminarily indicated urea stabilized with urease inhibitors provides high or highest cost-effectiveness. Both institutions have presented their findings at major symposiums and conferences in South Africa, and the African research is complemented by substantial evidence from universities and institutes around the world.

Additionally, urease and nitrification inhibitors have been reviewed and registered under the Regulation (EC) 2003/2003 of the European Parliament relating to Fertilizers. NBPT is registered within EC 2003/2003 of this legislative framework. The function and benefits of urease inhibitors are also reviewed in the industry reference manual 'Slow- and controlled-release and stabilized fertilizers: An option for enhancing nutrient efficiency in agriculture'.

Adoption of technology ultimately validated by farmers

Ultimately, farmers validate the value of fertilizer technologies in their own operations. Fertilizer products powered by AGROTAIN stabilizer are trusted by thousands of farmers on millions of hectares worldwide. In South Africa, the AGROTAIN stabilizer brand adoption started in 2008 and is widely used in fertilizer products such as KynoPlus produced by Kynoch Fertilizer and YaraVera Amiplus produced by Yara Africa Fertilizer. Adjacent countries also utilize stabilized nitrogen fertilizer as the KynoPlus brand and/or other brands. ■

Brian Wade is an employee and sales representative for affiliates of Koch Agronomic Services that market and distribute AGROTAIN stabilizer and other stabilized nitrogen products worldwide.

Neither the individual researcher referred to, nor their respective universities, endorse the products mentioned herein.

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News in brief

EUROPEAN UNION

Borealis profit at record EUR1.1 bn in 2016

Austrian chemical and fertilizer manufacturer Borealis made a record EUR1.1 bn (USD1.2 bn) profit in 2016, driven by a strong polyolefins market and growing contribution from its Abu Dhabi-based joint venture Borouge.

Profit increased by 12pc compared with 2015, Borealis' previous record year. Profit in the fourth quarter was EUR239 mn, compared with EUR242 mn in the same period of the previous year.

At Borouge — the olefin and polyolefin production site Borealis owns in partnership with Abu Dhabi's state-owned Adnoc — the successful completion of the Borouge 3 expansion project added 2.5mn tn/yr of polyethylene (PE) and polypropylene (PP) capacity.

The contribution from Borealis' base chemicals segment fell compared with 2015 on weak demand and low prices in the fertilizer business.

Borealis' sales volumes in Europe, which exclude Borouge, were higher year-on-year in the polyolefin and fertilizer businesses, but low prices — particularly in urea in the second half of 2016 — weighed on fertilizer revenues.

Chief financial officer Mark Tonkens said the recent increase in DAP and urea prices could help the contribution from fertilizers in the first quarter of 2017, particularly if higher fertilizer prices are sustained despite a decline in gas prices in February.

Chief executive Mark Garrett said focusing on premium products to improve profitability in fertilizers is not necessarily as effective as in polyolefins, because of the cost sensitivity of the end-user markets. He said Borealis had invested in distribution, by setting up local warehousing capacity in a number of places around Europe, to help improve profitability in fertilizers.

Garrett hailed a "very strong year", and said that while the company does not expect to repeat its 2016 result in 2017, it still expects next year to be "very solid". Factors Garrett said could impact 2017 profitability include the fire that hit a propylene unit at the Ruwais 2 refinery in Abu Dhabi on 11 January, which limited propylene supply to some of Borouge's PP units at the site.

Borealis also has planned maintenance at five of its European production sites in 2017, which will reduce profitability because of production time lost and the cost of the maintenance work itself.

OTHER EUROPE

EuroChem acquires Bulgaria's leading fertilizer distribution company

EuroChem Group AG has announced the acquisition of a 100pc interest in Agricola Bulgaria, Bulgaria's leading fertilizer distribution company. It will be renamed EuroChem Agro Bulgaria. The deal has already been approved by Bulgaria's competition regulator.

Agricola Bulgaria, based in Pleven, Northern Bulgaria, was previously owned by Agrium Europe, and has annual fertilizer sales of approximately 70,000-80,000 tns, 9pc of the Bulgarian fertilizer distribution market. The acquisition will help to further develop EuroChem's distribution footprint in Bulgaria and the wider region of Eastern Europe.

Dmitry Strezhnev, EuroChem's CEO, commented: "The acquisition of Agricola Bulgaria, a well-established player in the Bulgarian fertilizer distribution market, is in line with our expansion strategy in Eastern Europe where we see strong demand for fertilizers. This acquisition will contribute to the Group's growth in Bulgaria and its neighbouring countries while providing local farmers with better access to EuroChem's high quality fertilizer products and agricultural solutions."

Ukraine postpones introduction of anti-dumping duties on Russian fertilizers

The Interdepartmental Commission on International Trade has decided to suspend anti-dumping measures on imports to Ukraine of certain nitrogen fertilizers (carbamide and carbamide-ammonium mixture) produced in the Russian Federation, the Ministry of Economic Development and Trade has said in a statement.

"The commission members agreed that to ensure food security there is an urgent need for measures to diversify the supply of fertilizers to Ukraine (from China, the Middle East, the United States and other states)," a press release reads.

The ministry noted on 27 December 2016 the commission after the investigation, which had lasted for the maximally permitted 18 months, decided to impose anti-dumping duties on imports of these types of Russian fertilizers, which should have come into force 60 days from the date of publication of the decision.

The agency said the results of the anti-dumping investigation showed that imports of Russian fertilizers to Ukraine at dumped prices cause injury to domestic producers of chemical fertilizers. However the commission also recognized the need to take into account the current situation in the market – supplies from Russia cover 80-90pc of all deliveries of fertilizers in Ukraine - to prevent the deficit and a sharp rise in fertilizer prices in the country.

RDIF attracted major international investors to SPO of PhosAgro

The Russian Direct Investment Fund (RDIF) formed a consortium of leading investors to participate in the secondary public offering (SPO) of PhosAgro shares. Together with RDIF, the Russia-China Investment Fund (RCIF) which was established by RDIF and the China Investment Corporation, and leading funds from the Middle East participated in the acquisition of a minority equity position in one of the world's largest vertically-integrated producers of mineral fertilizers.

Uralchem's total production exceeded 6 mn tns in 2016

In 2016, Uralchem enterprises produced 6.063 mn tns of finished products, which is a record for the company. This indicator increased by 3pc during 2015. In 2016, total gross production of this product amounted to 2.945 mn tns. Last year, the company significantly increased its production of compound and phosphorus (DAP/MAP) fertilizers, generating 751,000 tns of compound and 129,000 tns of phosphorus fertilizers. Production of these fertilizers increased by 22pc and 24pc respectively over the year 2015. This is a result of Voskresensk Mineral Fertilizers' return to full-scale operation and production rates. Urea production decreased by 2.4pc and amounted to 1.157 mn tns. Uralchem remains the second largest manufacturer of this product in Russia. In 2016, the company produced 2,947 mn tns of ammonia, maintaining the previous year's level of output. Production of merchant ammonia slightly decreased and amounted to 804,000 tns. The decrease of nitrogen product output resulted from the extension of the renovation project in Azot Branch and completion of a long-term investment program to upgrade the ammonia unit in Perm Mineral Fertilizers.

KEXIM waits for Azerbaijan's guarantees on a loan to SOCAR for a urea plant project

The State Oil Company of Azerbaijan (SOCAR) is completing the registration of a loan from the Korean Export-Import Bank (Korea Eximbank, KEXIM) in the amount of EUR500 mn for the construction of the Sumgait carbamide plant.

SOCAR vice president Suleyman Gasimov says that SOCAR has already signed the agreement on raising a loan and transferred it to KEXIM, but the Korean side expects the guarantee agreement on the loan with Azerbaijan.

"I think the matter will be resolved before the end of the current month. The Cabinet has already sent a letter to the Presidential Administration for the provision of appropriate powers to the Ministry of Finance. Most likely, the question will be resolved after the return of the head of state from Davos," Gasimov underlined.

According to Gasimov, the loan is given for 15 years at low interest rates. At that, EUR249 mn will be allocated by Deutsche Bank, Unicredit and Societe Generale under the guarantee of KEXIM, and the remaining EUR251 mn directly by the Korean Bank.

"Taking into account the previously raised 6-month interim loans, we have spent EUR201 mn from the allocated EUR500 mn," Gasimov said.

The construction of the "turnkey" plant project is South Korean company Samsung Engineering. Commissioning of the plant is scheduled for early 2018.

Kazakhstan's Atyrau refinery to build new sulphur plant

A combined plant for sulphur production will be constructed at Kazakhstan's Atyrau Refinery by July 2017, the refinery's press service said. Construction work is ongoing. The plant will produce sulphur through the Claus process. Its capacity will reach 58 tns of solid sulphur per day. KazStroyService and 17 subcontractors are engaged in the plant's construction. The Atyrau Refinery is one of the three largest refineries in Kazakhstan.

PhosAgro Fertilizer Production up 9.4pc YoY in 2016

PhosAgro has announced its operational results for 4Q 2016 and full year 2016.

In FY 2016 overall fertilizer production reached 7.4 mn tns (a 9.4pc year-on-year increase), while production of phosphate-based products grew by 10.8pc year-on-year to 5.9 mn tns. The full year results were supported by strong performance in 4Q 2016, during which the Company achieved a 13.4pc year-on-year increase in total production (2.0 mn tns), and a 16.9pc year-on-year rise in production of phosphate-based goods. Production of nitrogen fertilizers grew by 4.3pc year-on-year in 2016, reaching 1.5 mn tns.

Sales in FY 2016 reached 7.2 mn tns (an 8.8pc year-on-year increase), while the sale of phosphate-based products grew by 10.6pc year-on-year to 5.8 mn tns. Total fertilizer sales in 4Q 2016 advanced by 12.7pc year-on-year to 1.7 mn tns, driven by an 18.5pc year-on-year increase in the sale of phosphate-based fertilizers to 1.4 mn tns.

Maire Tecnimont enhances its revamping business with a dedicated company

Maire Tecnimont S.p.A. reinforced its commitment to the revamping segment, as one of the drivers of its current business strategy. To this extent, it has formed and incorporated Vinxia Engineering a.s. in the Czech Republic. This Prague-based company is controlled by Maire Tecnimont's subsidiaries Tecnimont and Stamicarbon and by the minority partner UNIS (20pc stake). Vinxia will work as a customer-focused partner in order to develop new business opportunities for revamping projects in the fertilizer market in the Russian Federation as well as in Eastern Europe and in the Caspian area.

Czech company UNIS with headquarters in Brno is active in EPC contracting and plant services in Oil & Gas processing, with subsidiaries in Russia and former Soviet Union countries.

Revamping (or plant upgrading) has become one of the key drivers of the hydrocarbons value chain, especially in the Russian and Eastern Europe fertilizers markets, where long-running plants would benefit from the latest technology standards in order to increase their production capacity, improve emission control and reduce energy consumption. As an example, Stamicarbon was recently granted three engineering contracts related to the revamping of three urea plants.

NPK: Acron boosts 2016 domestic sales

Russian fertilizer producer Acron Group recorded an almost 20pc year-on-year rise in mineral fertilizer sales to the Russian domestic market for 2016, reaching more than 900,000 tns.

Acron highlighted that NPKs and ammonium nitrate (AN) were the most popular products in the domestic market.

The producer's Veliky Novgorod-based plant, which produces both NPKs and AN, more than doubled its shipments to the domestic market, with the Bryansk, Oryol and Belgorod regions still the major consumers of Acron's products.

Indeed, data from forwarding agents show that domestic NPK sales from Acron's Novgorod and Dorogobuzh plants combined grew by 109pc in 2016 compared to 2015, reaching 328,324 tns. Russian export data also show that 2016 NPK exports from the Novgorod plant declined by 7pc to 976,534 tns from 1.05mn tns in the previous year, suggesting that more product from the plant was shipped to the domestic market.

The rise in domestic sales can be attributed to increased demand from Russia's agroindustrial sector. Alexander Popov, Chair of the Board of Directors, said, "In 2016, Russia's agroindustrial complex significantly increased purchases of mineral fertilizers, due to state support. Domestic fertilizer producers are ready to meet the growing needs of Russia's agroindustrial complex."

Proposed sale of ordinary shares in PJSC PhosAgro

PJSC PhosAgro has announced that it has been informed by Adorabella Limited that Adorbella intends to sell up to 6,475,000 shares (in the form of ordinary shares) in the PJSC PhosAgro, which amounts to up to 5pc of the Company's share capital. The shares are held by a trust, the economic beneficiaries of which are Mr. Andrey G. Guryev, the Deputy Chairman of the Board of Directors, and members of his family. In connection with the Sale, shares in the PJSC PhosAgro are being offered by a syndicate of banks by way of an accelerated bookbuild, which will be launched immediately.

Yara reports strong operational performance but weaker margins

Yara International ASA delivered weaker fourth-quarter results compared with a year earlier. EBITDA excluding special items was 29pc lower, as higher deliveries and lower energy costs were more than offset by lower fertilizer prices. Yara's board will propose to the Annual General Meeting a dividend payment of NOK10 per share for 2016.

"Yara reports a weaker result than a year earlier, reflecting lower fertilizer prices as the global nitrogen price floor was tested during the quarter. But our operational performance improved significantly, with fertilizer sales and production up 15pc and 11pc respectively," said Svein Tore Holsether, President and Chief Executive Officer of Yara.

"The whole Yara organization is working hard to further improve operations, to deliver on the Yara improvement program which we have announced earlier. The program has already delivered approximately USD25 mn of EBITDA improvement in 2016, and will deliver at least USD500 mn of annual EBITDA improvement within 2020," said Holsether.

Yara reports fourth-quarter net income after non-controlling interests of negative NOK333 mn (NOK1.22 per share), compared with a positive NOK434 mn (NOK1.58 per share) a year earlier. Excluding net foreign exchange loss and special items, the result was NOK1.66 per share compared with NOK3.97 per share in fourth quarter 2015. Fourth-quarter EBITDA excluding special items was NOK2,474 mn compared with NOK3,508 mn a year earlier.

Deliveries of Yara-produced fertilizer including blends were 15pc higher than in fourth quarter 2015. In addition, improved reliability and fewer turnarounds in Yara's production plants have enabled higher deliveries compared with a year earlier.

EuroChem Group AG reports 2016 financial information

EuroChem Group AG has reported consolidated sales for the fourth quarter of 2016 of USD1.05 bn, in line with the previous year's result, bringing the Group's sales for the year ended 31 December 2016 to USD4.38 bn, as compared to USD4.54 bn in 2015.

Pressured by lower market prices and currency movements, fourth quarter earnings before interest, taxes, depreciation and amortization (EBITDA) declined 22pc year-on-year to USD283 mn. The final quarter of the year brought the Group's full-year EBITDA to USD1.10 bn, which was 30pc below 2015 EBITDA of USD1.58 bn.

Buoyed by higher production and the expansion of the Group's distribution network, fourth-quarter fertilizer sales volumes grew 16pc year-on-year and amounted to 3.30 mn tns of product. The fourth quarter's strong growth lifted annual fertilizer sales volumes 20pc to 13.61 mn tns, as compared to 11.38 mn tns in 2015. The acquisition and consolidation of distribution assets in the US and Brazil supported a 60pc year-on-year growth in sales of third-party products, which the Group also sells through its network. For the year-ended 31 December 2016, the Group sold 3.41 mn tns of third-party products, including 1.24 mn tns of urea and 1.22 mn tns of ammonium sulphate.

"The expansion of our distribution reach, together with a robust logistics platform, allowed us to channel a considerable amount of additional products through our system", said EuroChem CEO Dmitry Strezhnev. "This effectively optimizes our network as we grow our production volumes and expand our offering ahead of the start of our potash operations later this year."

AFRICA

Ghana Government to distribute 180,000 tns of fertilizer to farmers in 2017

Ghana Finance Minister, Ken Ofori-Atta, has said that as part of measures to modernise and transform the agricultural sector, government will continue with the fertilizer subsidy programme.

news in brief

The programme, he said, will improve productivity, help achieve food security and crop profitability for farmers.

Speaking at his first budget presentation in Parliament, the Minister said "In 2017, the ministry will continue the fertilizer subsidy programme to help increase the productivity of farmers.

"To this effect, we intend to distribute nationwide, an expected 180,000 metric tns of subsidized fertilizer [to farmers]."

The fertilizer subsidy programme was first introduced in June 2008 by the John Kufuor government, covering three types of inorganic fertilizer, Sulphate of Ammonia, Urea and Compound fertilizer.

The programme was designed as in intervention meant to help increase food production at the peak of the global financial, food and energy crisis that was adversely affecting poor countries.

However, this programme, together with the many others introduced to boost the agri-sector, have not exactly achieved expected results.

The sector has witnessed a steady decline and production levels have fallen consistently over the years.

Mr Ofori-Atta said the Akufo-Addo-led administration will, in the medium term, put measures in place to ensure that the sector bounces back.

This will begin with the launch of the planting for food and jobs campaign. The campaign is designed to encourage all citizens, both urban and rural, to take up farming as a full or part-time activity.

It is intended to be structured along the lines of the erstwhile 'Operation Feed Yourself' programme in the 1970s.

The campaign will involve the production of maize, rice, soya beans, sorghum and vegetables, other crops will be adopted in subsequent years.

The Minister said it will be anchored on five pillars; provision of improved seeds, supply of fertilizers, provision of dedicated extension services, marketing and e-agriculture and monitoring.

He added that the initiative is "expected to increase the production of maize by 30pc from the current production levels, rice by 49pc, soya beans by 25pc and sorghum by 28pc. This will create 750,000 both jobs direct and indirect employment."

He indicated that the agriculture ministry would provide improved seeds to augment any shortfall for the planting for food and jobs campaign.

OCP and the Government of Guinea sign phosphate MoU

His Majesty King Mohammed of Morocco presided over a signing ceremony for a Memorandum of Understanding between OCP and the Government of Guinea, to supply Guinea with phosphate fertilizers adapted to the needs of local soils and crops.

This Memorandum of Understanding aims to strengthen the strategic partnership between OCP Group and Guinea for the acceleration of agricultural development in the Republic of Guinea, through the encouragement of rational fertilization of agricultural land and the strengthening of technical cooperation.

OCP's objective is to enable the Government of Guinea to supply the Republic of Guinea with all of its fertilizer needs, estimated at 100 000 t for the year 2017. As a first step, the Group also commits to offering a first-rate promotional deal, including a gift of 20 000 metric t of phosphate fertilizers adapted to the needs of local soils and crops.

The Memorandum of Understanding is a logical continuation of the collaboration initiated in 2014 between OCP Group and Guinea to improve the agricultural techniques of Guinean farmers with the goal to increase their agricultural yields.

The Government of Guinea considers the acceleration of agricultural development in the country to be highly important. The Memorandum of Understanding combines Guinea's efforts to promote the socio-economic development of Guinean farmers with the goal to achieve an 8pc agricultural growth in 2017.

Guinea has decided to multiply its current average fertilizer consumption (20 000 metric tpy) by five times to advocate for better use of fertilizers and to promote the rational fertilization of agricultural land as fundamental to accelerating agricultural development in Guinea.

NORTH AMERICA

Potash Ridge cuts estimated capacity at Blawn Mountain

Canada-based mining company Potash Ridge reduced the estimated SOP production capacity at its Blawn Mountain project in Utah, revising the overall cost of the project.

The latest update reflects data reported in the pre-feasibility study Potash Ridge ordered in July 2016 from engineering firm SNC-Lavalin. The study lowered the annual SOP production capacity from 580,000t/yr to 255,000t/yr. The results also reduced capital costs estimates to USD482mn, down substantially from previous estimates totaling more than USD1 bn.

The pre-feasibility report said the proposed mine contains 153mn t of mineral reserves, which is enough to support a 46-year mining life.

The facility's estimated production cost is expected to be the lowest in North America at USD172/t, which includes a USD40/t transportation fee.

Potash Ridge said it will conduct additional metallurgical testing to determine various options to extract alumina from residual waste material.

Potash Ridge president Guy Bentinck said the completion of the technical report allows the company to secure an engineering, procurement and construction contract and finalize commercial arrangements. Bentinck said the project is expected to begin later this year.

The Mosaic company reports fourth quarter results

The Mosaic Company has reported fourth quarter 2016 net earnings of USD12 mn, down from USD155 mn in the fourth quarter of 2015. Earnings per diluted share were USD0.03, which included a negative USD0.23 impact from notable items. Mosaic's net sales in the fourth quarter of 2016 were USD1.9 bn, down from USD2.2 bn last year, with lower prices more than offsetting higher phosphate volumes. Operating earnings during the quarter were USD74 mn, down from USD204 mn a year ago, driven by lower phosphate and potash prices, partially offset by lower phosphate raw materials costs and effective cost management.

The Company announced a reduction in its targeted annual dividend to USD0.60 per share, effective with the next declaration.

"Our fourth quarter results reflect strong market demand for potash and phosphates driven by improving market sentiment, as well as benefits from significant operational improvements," said Joc O'Rourke, President and Chief Executive Officer. "Our cash production costs in potash and our fourth quarter SG&A were at the lowest level in almost a decade.

"While we are confident the market bottom is behind us, the pace of improvement is expected to be gradual. As a reflection of our commitment to investors to maintain a strong financial position, we have reduced our annual dividend payout to USD0.60 per share."


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MIDDLE-EAST

ICL hit by falling potash prices in 2016

ICL swung to a loss last year compared with 2015, as falling commodity prices offset a 13pc increase in potash sales volumes and higher production.

ICL's potash production rose by 26pc to 5.28mn t last year, compared with 2015, largely as a result of strike action by workers ICL's Bromine Compounds and Dead Sea Works in the first half of 2015. But production was bolstered by processing facility expansion initiatives at ICL Dead Sea, which partially offset lower production in the UK.

The strike was in effect from 19 February 2015 until the end of May 2015, resulting in the loss of around 1 mn tns of MOP production. ICL's 2014 production was 5.14 mn tns, compared with 4.2 mn tns in 2015.

Fourth-quarter potash production — which dipped by nearly 11pc to 1.3 mn tns on the year — was impacted by a flood in its UK Boulby mine tailings tunnel. The company decided to accelerate its transition from extracting potash to producing Polysulphate — a brand name for polyhalite — at Boulby, in light of the testing market conditions. Potash production will wane "over the next couple of years", ICL said in August last year.

Potash sales in Israel dipped by 7pc to 347,000 tns on the year, while sales to customers abroad rose by 15pc to 4.8mn tns. ICL's closing inventory for 2016 was 666,000 tns, compared with 552,000 tns at the end of 2015. Overall potash sales were up by over 13pc on 2015.

ICL's sales increases were largely the result of a rise in demand in Europe and Brazil.

The company's specialty fertilizers operating profit dipped in the fourth quarter as prices dipped in Spain, Israel and the Asia Pacific region. But raw material price falls partially offset the dip in sales and prices. For 2017, ICL said global fertilizer price rises in the fourth quarter, along with the recent recovery of oil palms and sugar prices should support sales. And the African market

has started to adopt "more sophisticated fertilizer application methods and technologies".

Adjusted operating income for 2016 was USD582 mn, down by over 40pc on the year. But ICL swung to losses of USD122 mn last year, from profits of USD509 mn in 2015, largely as a result of falling commodity prices in the period.

ASIA

Restoration of Pakistan fertilizer subsidy

In a welcome move, Prime Minister Nawaz Sharif has restored subsidy on fertilizers in a bid to facilitating farmers to achieve bumper crops for accelerated GDP growth. He took the decision at the insistence of Punjab Chief Minister Mian Shahbaz Sharif who asked him to restore the subsidy as it would benefit 22 mn farmers, as their production cost would be cut down by 8pc.

Agriculture is the backbone of the country and apart from meeting domestic requirements, the sector is also fetching most of the foreign exchange that Pakistan earns. A few days back, the Government provided a hefty package to the industry – mainly textile sector – which depends largely on agriculture. Experts say if proper and adequate subsidies are provided to agriculture, the sector has the potential to address most of the economic and financial woes of the country. There is dire need to bring down the cost of inputs, which have pushed the prices of agricultural commodities to a level where they have become non-competitive in the international market.

China seeks to reduce chemical fertilizer use

China's Ministry of Agriculture has issued a plan to replace chemical with organic fertilizers for some crops this year, as part of its zero fertilizer growth strategy.

The ministry will encourage farmers to use organic fertilizer to replace chemical fertilizer — initially for 100 key counties this year — for apples, oranges, tangerines, greenhouse vegetables, and tea planting. But it is unclear how the ministry will achieve this.

Apple, oranges, tangerines, greenhouse vegetables and tea consume significant amounts of phosphate and potash in China.

China said in 2015 that it intends to achieve zero growth in fertilizer consumption by 2020. The campaign aims to reduce fertilizer demand and raise usage efficiency, following concerns about inefficient use and potential ecological damage.

The ministry is targeting a fertilizer efficiency rate of 40pc, up from 33pc. Fertilizer efficiency refers to the ratio between the amount of fertilizer removed from the soil by the crop and the amount applied, and is a measure of the relative utilisation of fertilizer applied to a crop.

China's domestic fertilizer production has grown significantly since 2000, driven by a desire to attain self-sufficiency and reduce reliance on imports. China has sought to maintain stable domestic pricing to farmers, as well as ensuring agricultural growth and food security.

Deepak commissions new capacity at Taloja plant

India's Deepak Fertilizers and Petrochemicals Company Ltd (DFPCL) has commissioned its new NPK capacity at its Taloja site in the state of Maharashtra, west India and is ready for commercial production following successful trials.

According to a press release issued in May 2016, the new NPK plant will have the capacity to produce 200,000 t/yr of various grades of compound NPKs, and will increase DFPCL's NPK capacity to 800,000 t/yr once it is fully operational.

The capacity expansion will allow the company to produce multiple granulated NPKs and prilled NP grades, rather than only prilled 24-24-0.

Yara becomes top Chinese supplier in January

Chinese NPK imports in January have fallen 28pc year on year to 72,681 tns, according to latest GTIS statistics. Imports from Norway and Finland, representing Yara product, accounted for the majority of imports at 43,947 tns, which is more than four times the volume that Yara supplied in January 2016. Most of this was sourced from Yara's Norwegian facility at 41,350 tns with just 2,597 tns shipped from its Finnish plant.

Yara's strong January deliveries helped it to become the top Chinese NPK importer for the month, booting the Russians from this top spot. Indeed, Russia has slipped to third place following a sharp 82pc year on year decline to 10,534t.

Belgium was the second largest supplier to China with 11,889 tns and down slightly by 2.2pc compared with January last year.

The year-on-year decline of NPK imports may be attributed to the absence of buying during the winter storage programme in the fourth quarter of 2016. Chinese NP/NPS exports for January reached 24,587 tns, falling 43pc year-on-year. Of this, 11,000t were destined for Thailand, compared to the 1,000 tns shipped to Thailand in January last year. The next largest quantities were destined for Mozambique at 6,198 tns and Myanmar at 5,134 tns.

An early Chinese New Year this year – on 28 January - may also have contributed to declines in January import and export numbers as trade activity typically slows in the run up to the festival. Last year, Chinese New Year started in February.

AUSTRALASIA

Danakali appoints Global Potash Solutions to Colluli optimisation team

ASX-listed Danakali has appointed Global Potash Solutions to join the front end engineering design (FEED) and optimisation team for the Colluli potash project.

This latest announcements follows the recent appointment by Danakali of multi-national engineering and construction firm, Fluor, as the lead on the FEED and optimisation process for Colluli.

Global Potash Solutions will work closely with the Fluor process engineering team on process optimisation, equipment selection and commissioning procedures.

Global Potash Solutions oversaw the metallurgical test programme, process flowsheet development and initial optimisation work for the Colluli potash project throughout the prefeasibility and definitive feasibility study phases of the project.

The initial process optimisation work resulted in a reduction in process water requirements of over 70pc between the prefeasibility and definitive feasibility phases.

Global Potash Solutions provides services in potash process plant design, independent technical due diligence, hazard and operability studies, piping and instrumentation diagram reviews, auditing of construction, and commissioning and start-up and has extensive technical and operational experience in the global potash industry.

The company has supported projects in the US, Canada, South America, Middle East, North Africa and Australia, having provided expertise and technical support to Arab Potash Corporation, Potash Corp., BHP Billiton, and Karnalyte Resources, and completed third party due diligence on potash projects for a number of engineering firms.

Danakali MD Paul Donaldson said: "We are delighted to continue our working relationship with Global Potash Solutions and look forward to their continued contribution to the technical and operational elements of the project. Their extensive technical knowledge and operational experience has been of immense value to the project to date, and we look forward building on this as we advance to construction."

Global Potash Solutions CEO Don Larmour said: "Our involvement in the project throughout the prefeasibility and definitive feasibility study phases, has given us an excellent understanding of the Colluli project, and we believe we can make a considerable contribution to the optimisation of the process design.

"We are very pleased to be able to continue our long-term contribution to the Colluli potash project, as we believe this project has very high potential, given its simplicity, ideal combination of potassium salts and the capability of the teams we have worked with."

Kore signs deal on DFS study

Kore Potash Limited has announced that it has signed a contract with TechnipFMC, VINCI Construction Grands Projets, Egis and Louis Dreyfus Armateur for the implementation of the Kola 2 Mtpa Definitive Feasibility Study (DFS). The DFS contract is scheduled to be completed within 14 months including significant Front End Engineering Design work. In addition, the DFS contract provides a commitment that the French Consortium will provide a Fixed Price Binding EPC proposal, for Kola, within three months of the completion of the DFS.

The signing of the DFS Contract is a key step in Kore's development plans for the Kola Potash Project in the Republic of Congo following the USD45 mn fund raise and the introduction of two new major investors, and future offtake partners, in NYSE global agricultural minerals group SQM and SGRF, the Sovereign Wealth Fund of Oman. ■

Argus FMB Asia Fertilizer 2017

Sponsor & Exhibitor profiles

Sponsor profiles

Kingenta Ecological Engineering Group Co., Ltd.,

Founded in 1998, Kingenta Ecological Engineering Group Co., Ltd. (Kingenta) is a key Chinese hi-tech enterprise devoted to R&D, production and marketing of slow/controlled-release fertilizers (SCRF), water-soluble fertilizers (WSF), compound fertilizers, phosphorous chemicals and other specialty fertilizers. The company is a national innovative enterprise with RMB 11 billion of total assets and 7 million tonnes of annual capacity, including 1.8 million tonnes of SCRF, 100,000 tonnes of WSF, 1.6 million tonnes of nitrate-based compound fertilizers and 3.5 million tonnes of conventional NPK compound fertilizers.

Kingenta has 10 production subsidiary companies located in 8 provinces and an extensive sales network of more than 1,500 sales people. The company offers a complete service in order to meet the demands of the clients in China. The marketing and sales network covers over 30 provinces and autonomous regions in China. Kingenta's products have been exported to South Korea, Japan, Australia and Malaysia etc. In 2014, the company generated sales revenues of over $2.2 billion.

Since its inception, Kingenta has valued its collaboration with external scientists and research institutes as part of establishing its position as a leading scientific research platform and R&D system. The company has many patents (more than 183 patents) and has won two of the highest prizes within the fertilizer industry. It is the only company in China to support two National Engineering Centres within China.

As the world's largest manufacturer of SCRF, Kingenta was involved in the drafting and revising of three national and four industrial standards for China's SCRF industry, ensuring the high quality of these products. Kingenta has also established several strategic alliances within the SCRF industry in China.

As Asia's largest manufacturer of nitrate-based CF, Kingenta has developed advanced technologies protected by independent intellectual property rights covering the entire process from dissolution of phosphate rock to production of nitrate fertilizers using Distributed Control Systems (DCS) to ensure stable quality.

KINGENTA Headquarters in Linshu, Shandong

As China's largest manufacturer of WSF, Kingenta has adopted unique double decomposition reaction and crystallization technology to produce the materials mono-potassium phosphate (MKP) and nitrate of potassium (NOP) with a high water solubility.

Kingenta is a public company listed on Shenzhen Stock Exchange (002470) and is proud to sponsor the 2017 Argus FMB Asia Fertilizer Conference.

Kingenta Ecological Engineering Group Co., Ltd.,
19 Xingda West Road,
Linshu County, Linyi City,
Shandong Province, P.R. China 276700.
Telephone/telefax: +86 539 6219688.
Web Site: www.kingenta.com
COO - Mr. Zhai Jidong.
E- Mail: zhaijidong@kingenta.com

YUNTIANHUA

Yuntianhua

Yunnan Yuntianhua Co., Ltd (YTH) is a comprehensive chemical enterprise which is prominent in the phosphate industry due to its advantage of resources. The Company is one of the most outstanding manufacturers for phosphate fertilizers, nitrogen fertilizers and compound fertilizers in the world and it ranks the first among China Chemical Listed Companies.

YTH has more than 50 locations of production, technology and logistics domestically and has its own branches in North America, South America, Middle East, South Asia, and Southeast Asia with sales networks worldwide.

YTH is one of the largest chemical fertilizer enterprises in the world. With its high-level production, R&D, international trade and logistics teams, YTH has the ability to supply more qualified, more suitable, more economical fertilizers to the countries worldwide. YTH wishes that a good cooperation lead us a bright future.

Yunnan Yuntianhua Co., Ltd., 1417 Dianchi Rd, Xishan Qu, Kunming Shi, Yunnan Sheng, China, 650228

Exhibitor profiles

COTECNA INSPECTION S.A.

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To learn more details about the organization, please visit www.cotecna.com.

COTECNA INSPECTION S.A.
Rue de la Terrassiere 58,
P.O. Box 6155, 1211 Geneva 6,
Switzerland.

SINGAPORE:
Ashan Weeresinghe,
Product Manager, Fertilizer.
E-Mail:
ashan.weeresinghe@cotecna.com.sg
Telephone: +65 9656 2778.

CHINA:
Tack Zhou
Commodities Manager, China
E-Mail: tack.zhou@sinoswiss.com.cn
Telephone: +86 139 063 903 12

Jenny Lv
Business Development Manager, China
E-Mail: jenny.lv@sinoswiss.com.cn
Telephone: +86 132 6903 1845

Donghai Yueyang Fertilizer Co

Donghai Yueyang Fertilizer Co., Ltd is located in Donghai, by the new Eurasian Continental Bridge and was established by the Hong Kong company - SUNSHINE SHARE Co., Limited. Our company has geographical advantages, due to our convenient location. LianXu highway passes nearby and we have direct links to Beijing, Shanghai, Nanjing and Qingdao. Access by air, land and sea is very convenient, as we are 40KM away from the Lianyungang Sea Port, 5 KM from the county town of Donghai and 2 km from Lianyungang airport

Our factory is located in Lianyungang Donghai Tuofeng Industrial Park, covering an area of 60 acres, and is close to the deep-water port in Lianyungang. The annual production capacity of the company is 200,000 MT; the main products are granular ammonium chloride (GAC), ammonium sulphate (GAS), powdery ammonium chloride and ammonium sulphate (AS) of different sizes. Also we deal in other chemicals and fertilizers, such as NPK, NP, urea, MAP, DAP, etc.

We focus on providing quality fertilizers to the worldwide market and we sincerely wish to establish long-term partnership with domestic and foreign friends.

Donghai Yueyang Fertilizer Co., Ltd.
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EIRICH

EIRICH offers innovative system solutions for the production of fertilizers and soil improvers. Many product developments in the field of fertilizers were only ever possible because of technology from EIRICH. The particular focus here revolves around the basic operations of mixing, granulating and reacting. The EIRICH mixing principle enables a wide range of consistencies such as dusts, sludges and filter cakes to be processed. Thanks to the unique mixing technology it is possible to produce granules with the desired specification that are stable when stored.

EIRICH regards itself as the partner of choice for the fertilizer industry. Regardless of the size of the project, EIRICH can supply everything from stand-alone granulation systems to turnkey fertilizer systems. No matter what raw materials you aim to use for the production of fertilizers or soil improvers, the key to your success is an economic preparation process.

The highlights of EIRICH preparation technology:

- Mixing, granulating and coating in a single machine
- Optimum distribution of trace elements and additives
- Use of secondary raw materials in the form of filter cakes, sludges and nutrient salt solutions
- Environmentally friendly granulating process, no escaping fine dust or aerosol
- Systematic production of long-term fertilizers

The family enterprise has been operating in industrial mixing technology for over 100 years and offers its customers stand-alone machines with process peripherals right through to turnkey processing plants. The portfolio includes mixers for industrial applications with a volume of 1 to 12,000 l as well as lab mixers. The company's history began in 1863 with a mill workshop. Today approx. 600 employees work at the company headquarters in Hardheim. The Eirich Group has approx. 1,200 employees worldwide. There are manufacturing subsidiaries in China, the USA, India, Japan, Brazil and South Africa. Service and distribution companies operate in France, Russia, Ukraine and South Korea.

MASCHINENFABRIK GUSTAV EIRICH GMBH & Co KG
Walldürner Str. 50, 74736 HARDHEIM, GERMANY

Hebei Shengyi Fertilizer Co., Ltd

Hebei Shengyi Fertilizer Co., Ltd (Shengyi) is specialized in production of Ammonium Sulphate (AS), Potassium Sulphate (SOP) and so on. Our factory covers an area 6 hectare, we have over 10 years experience for production. The annual production capacity is around 300,000 Tons, all produced for export.

EIRICH: Modern production of NPK fertilizer in Germany 2016

Business Scope:

Shengyi's products have been exported to South America, Africa, Oceania, Southeast Asia, and Europe etc. The marketing and sales network covers over 50 countries and 70ports. Export volume in 2016 (up to end of Nov) reaches more than 200,000 Tons.

TOP Ammonium Sulphate Granular producer and exporter among the private companies in the whole China.

- Mainly produce: AS Compacted Granular, Caprolactam AS Granular, SOP Granular
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- Have our own logistic company

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Five Principles: People Oriented, Quality First, Honesty Management, adhere to Fertilizers cause and Focus on Service

Hebei Shengyi Fertilizer Co., Ltd is proud to support 2017 Argus FMB Beijing Fertilizer Conference, and welcome you visit us
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Website: www.hebswl.com and http://hebswl.en.alibaba.com/
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Email:swlvicky@hebswl.com

Koch Agronomic Services, LLC

Koch Agronomic Services, LLC and its affiliates produce and market a proven and expanding global portfolio of plant performance technologies for agriculture producers and turf and ornamental professionals. Our product portfolio includes nitrogen stabilizers and fertilizers that improve efficiencies and protect our customers' nitrogen investment. They are currently distributed in more than 50 countries. With a commitment to creating real, sustainable, long-term value for customers and society, Koch Agronomic Services is focused on developing customer-driven solutions to improve plant performance and minimize environmental impact.

www.kochagronomicservices.com

LUXI Group Co., Ltd.,

LUXI Group is a large state-owned enterprise established in 1992 with its origin as Luxi Fertilizer Plant. In 1998, Luxi Chemical Group Co., Ltd. was founded and went public at Shenzhen Stock Exchange with the stock code 000830.

With a total asset of 22 billion RMB and over 13,000 employees, LUXI Group is involved in many industrial fields such as Chemical, Fertilizer, Chemical Equipment, New Energy Equipment, Chemical Engineering Design, R&D and Finance. It has established a state-level technical center and got dozens of honors like China Labor Award and China Chemical Technology Innovation Model Enterprise.

Upholding the concept of safe, green and cyclic development, LUXI Group endeavors to build a new material industrial park with LUXI features: integration, intensification and clusterization. At present, the chemical industrial park covers an area of 7 square kilometers. Complete product chains of coal chemical, salt chemical, fluorine and silicon chemical, as well as petrochemical are established. The park is currently named as China New Chemical Material Industrial Park (Liaocheng) by China Petroleum & Chemical Industry Federation (CPCIF).

In the next decade, we are committed to the construction and development of the park. We insist on upgrading the devices, products and industrial chains, improving safety and environmental protection facilities, and the overall operational quality and profitability. In the planning area of 11 square kilometers, around the state-level academic exchange center we are going to construct six industrial zones: polyurethane materials industry zone, chemical fiber materials industry zone, fluorine-silicon materials industry zone, household-electronics-pharmaceutical chemicals industry zone, equipment manufacturing industry zone, storage and logistics zone.

Luxi Group will always insist on the foundation of fine management and technology innovation, actively develop international cooperation and overseas branches, in order to construct a large modern international enterprise.

LUXI Group Co., Ltd.,
Num6, LuHua Road, LiaoCheng City, Shandong Province,P.R. China.
Telephone/fax: +86 635 3487772/3481267.
Web Site: www.luxichemical.com and http://en.luxichemical.com/
Vice President- Mr. Zhang Wen.
E- Mail: zhangwen@lxhg.com

Migao Corporation

Migao Corporation, based in China, produces specialty potash-based fertilizers for the high-value agricultural Chinese market. The Company was established in 2003 and has increased its production capacity from 320,000 tonnes in year 2010 to 920,000 tonnes in year 2016.

SHANDONG VOAVO AGRICULTURAL AND TECHNOLOGY LTD

Migao is positioned to become the leading producer of specialty potash fertilizer for the Chinese market. The Company is currently producing its three core products -- potassium nitrate, potassium sulphate and compound fertilizer, at nine operating locations in China.

China is the largest consumer of fertilizers in the world. Demand for improved crop yield, higher quality food, and more variety is fueling the growth of the fertilizer market in China. There is very little naturally occurring potash in China. Of the three principal fertilizer nutrients (nitrogen, phosphate, and potash), potash is the least readily available in the country. Migao's patented technology allows the Company to offer a consistent and reliable supply of high quality fertilizers which are ideal for high-value crops such as fruits and vegetables, tobacco, and cotton.

Migao Locations in China

Migao's plants are strategically located based on a number of criteria including access to sea and/or rail ports, proximity to customers and local infrastructure.

Migao Corporation,
16A Office Building,
Dong Fang Yin Zuo,
No. 48 Dongzhimenwai Street,
Dongcheng District,
Beijing, P.R.China 100027
Telephone: + 8610 84477526
Telefax: + 8610 84477206
E-Mail: bjredhero@aliyun.com
Web Site: www.migaocorp.com
www.migaogroup.com

Neelam Aqua & Speciality Chem

Neelam Aqua & Speciality Chem, (ISO 9001: 2008) is a manufacturer of fertilizer quality improvement chemicals. Products offered by Neelam Aqua are for dust control, anticaking, colouring, micronutrient binder, hardness improvement-granulation agent, defoamer or anti foaming agent, filtration aid for phosphoric acid, sodium hexa meta phosphate, diatomceous earth, neem oil, flocculants and cooling water treatment packages.

These additives are being supplied to a number of fertilizer industries worldwide through its strategically located plants worldwide.

To keep fertilizer free flowing we offer a wide range of anti-caking agents for NPK, DAP, MAP, CAN, ANP, Urea, ANP, CAN, AN, AS SSP and other phosphatic /complex fertilizers. Fertilizers coated with these agents remain free flowing even after long duration of storage under high temperature, pressure and in adverse climatic conditions. These formulations can be conveniently sprayed on granules. These coating agents also function as dust suppressors. They check the crystal bridging, caking and dust generation.

We firmly believe in supplying quality products and services. Some of the products manufactured by us are:

1. Controlling dust generation in fertilizer—Neelcoat DS
2. Controlling caking of fertilizer—Neelcoat 2000
3. Granule strength improvement--Neelofix
4. Uniform colouration of fertilizer granules--- Neelcoat CL
5. Defoaming in phosphoric acid, complex fertilizer plant—Neelco 8050
6. Slow release of nitrogen from urea—Power Urea 100
7. Neem based coatings for urea-NEELCOAT NM L
8. Anticaking for urea -- URECOAT
9. Water treatment in cooling towers, boilers, effluent etc-- Descophos

NeelamAqua & Speciality Chem (P) Ltd.
H-337 (D) Road No. 17, VKI Area,
Jaipur - 302013, INDIA

Noberfun (China) Chemical Co., Ltd

Noberfun (China) Chemical Co., Ltd, as a Sino-Israel joint venture, owns the registered capital of RMB 700 million and is founded in 2013. Focusing on the promotion of soluble fertilizer with world-class quality, supply of whole-course nutrition product for crop and exchanging of promoting the Israeli agricultural technology, the enterprise provides advanced integrated fertigation solution for modern agriculture in China.

A Golden Promise, A lifetime Prosperity

Noberfun Chemical Co., Ltd
32/F, Block C,
Central World Trade Center
No. 6 Jianguomenwai Avenue
China

Shandong Voavo Agricultural and Technology Ltd,

Shandong Voavo Agricultural and Technology Ltd, founded in 2002 and located at Yanzhou City, Shandong Province. The company is specialises in design and produce Fertilizer Extrusion Granulation Facility and all kinds of chemical grain material: potash fertilizer, muriate of ammonia, potassium sulphate. The company equiped great knowledge and experience on fertilizer Extrusion Granulation Facility's research and production. To achieve the best customer experiences, all Facility's analysis, design and produce can be flexible change according to the customers requirements.

We are the first and only company that can produce granular fertilizer and facility within China. Now we designed and produced diameters 1160mm-750mm Extrusion and granulation machine. It can produce 20 million tons production line. The Extrusion and Granulation machine reduced the investment of infrastructure and shorted the period of construction. It is ideal for labour - saving, energy conservation, environmental protection.

For many years development and expand, our product are sold mainly over the mainland such as Anhui, Jilin, Linsu, Guizhou and Xinjiang etc. The company has current first-class production line and advanced testing equipment and strong research team, for the production of high quality products to provide a reliable guarantee. It is our goal to seek the excellent quality. The technical power is our base of development.

Shangdong Voavo Agricultural and Technology Ltd
North Station Yanzhou
Shandong, 272100, China

Stanley Agricultural Group Co., Ltd

Striding to the world of STANLEY Company

The company was founded in 1992; the existing total assets of 4,363,000,000 yuan, covers an area of 3,500 mu, the production capacity of 5,200,000 tons, is the high tower compound fertilizer production base

Established in 1992, Stanley Fertilizer Co., Ltd. is a national key high-tech enterprise engaged in R&D, production and sales of high-tower compound fertilizers, high-concentration compound fertilizers, nitro-compound fertilizers, bio-fertilizers, slow controlled/released fertilizers, seaweed fertilizers and other new-type fertilizers, and also the national demonstration enterprise for technological innovation and domestic largest production base for high-tower compound fertilizers, with total assets of 4.36 billion Yuan, more than 8000 employees and annual production capacity of 5.2 million tons. In 2011, A-share of Stanley was successfully listed on Shenzhen Stock Exchange. In 2013, Stanley achieved the sales revenue of 5.88 billion Yuan and the profits-taxes of 520 million Yuan; in 2014, Stanley achieved the profits-taxes of 350 million Yuan in January to June, with a year-on-year increase of 31%. So far Stanley has successively established 10 major production bases in such provinces as Shandong, Jilin, Guangxi, Hubei, Henan and Jiangxi, and set up more than 2000 county-level sales & service outlets in domestic 31 provinces, municipalities and autonomous regions, realizing the overall layout of R&D, production, sales and service nationwide.

The Company has always adhered to independent innovation, focusing on introduction and the research and development of core technologies and has created "two firsts of China": China's first high-tower urine-based compound fertilizer production line and China's first generation of new compound fertilizer of maximum content of 54%, of which four kinds of leading products have been jointly identified as the "National Key New Product" by the Ministry of Science and Technology, Ministry of Environmental Protection, the Ministry

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of Commerce and the Administration of Quality Supervision, Inspection and Quarantine of the PRC. The Company is of R&D platforms of national levels including "National Compound fertilizer Project Research Center", "National Post-Doctoral Scientific Research Station" and "Academician Workstation", etc. and has carried out in-depth cooperation with more than thirty domestic and international advanced research institutes including National Hybrid Rice, National Corn, National Wheat, National Vegetables and National Cotton Project Research Centers, Tsinghua University, Chinese Academy of Agricultural Sciences, Shanghai Research Institute of Chemical Industry and established a long-term cooperative relationship with the U.S. Department of Agriculture and Purdue University, actively carrying out international exchanges and cooperation. The Company has successively undertaken more than 30 science and technology national and provincial projects and has declared 109 patents so far with 56 invention patents authorized.

Meanwhile, the Company was the first in the industry to introduce the international advanced SAP information management system while achieving the "four in one" incorporating information, capital, materials and personnel flows and has realized the optimization of business operations.

The strong brand advantage, continued innovation abilities, meticulous agricultural services of Stanley will boost Stanley to reach new heights and create new wonders. We will continue to build our brand with good faith, create the future with innovation and shape a better agriculture with excellence!

Stanley Agricultural Group Co., Ltd, Stanley Road Linshu, Shandong, 276700 P. P. China

Yantai ZhongDe Group Co., Ltd.

Yantai ZhongDe Group Co., Ltd., is a joint-stock company with the activities of R&D, manufacturing, sales and services, and the annual output is more than 1 million tonnes. We formed an integrated production-supply-marketing strategic layout, under the support of our five factories respectively in Yantai, Heze, Dezhou, Changchun and Taocun. Our main products include compound fertilizer, BB fertilizer, organic-inorganic fertilizer, slow-release fertilizer, biological organic fertilizer, water soluble fertilizer and so on, and we also export Sulphate of Potash, Granular ammonium Sulphate, Water soluble NPK, Seaweed fertilizer and NPK fertilizer to other countries frequently. Nowadays, we are running businesses with well-known companies in the world such as K+S Kali GmbH, Eurochem, Tessenderlo, Biolchim and Compo with a long-term friendly cooperation relations.

Yantai Zhongde No.20, East Of Zhuji West Rd., Zhifu Dist., Yantai, Shandong, China

Yunnan Yingfu Trading Co., Ltd.

Yunnan Yingfu Trading Co., Ltd., founded in 2009, is a Chinese privately owned Company dealing with granular production and fertilizer trading.

Yunnan Yingfu owns a Granular processing factory nearby Tianjin Port of China and a sales office in Ho Chi Minh City of Vietnam. In 2016, we exported about 400,000mt fertilizers, including Ammonium Sulfate, Ammonium Chloride, Prill Urea, MAP, DAP and other NPK fertilizers, via main ports of China.

Our factory mainly presses ammonium sulphate (AS) and ammonium chloride (AC) in the type of granular. And the annual production capacity is about 200,000mt, most of which are exported to the market of South East Asia. Because of our production plant equipped with dry system, we can provide granular AS with very good hardness (more than 30 N). The quality of the dry GAS have been highly appreciated by the customers and end-users in the market of South America and Europe in 2016.

We also have a warehouse near the port, where we always keep some stock, this why we can assure the customers of our prompt shipment in a competitive price. In order to provide a better service to the customers, a production line have been established to change the package into small bags while exporting SOP or other fertilizer in small bag.

As a producer and trader, we have maintained a good long-term relationship with several big fertilizer manufacturers, such as Fujian Tianchen and Hebei Risun. Nomally, we can obtain about 20,000mt Capro grade AS per month from the capro grade plants based on a long term contract.

After many years of professional operation, we have occupied a large market share in the South East Asia. And now we are working hard to develop other markets. >>

YunNan Yingfu Trading Co., Ltd., #1410, YongAn, GuoJi, ChuanJin Road, PanLong Area, Kunming City, Yunnan Province, China.

YUNNAN YINGFU: Product

Price watch

NITROGEN

Urea market continues to soften

Lack of demand and surprising weakness in the US and China have combined to pull urea prices down. Interest from buyers is becoming evident for April shipment in several countries, but this is leaving a void in March and making it hard for suppliers to place their tonnage.

Urea prices peaked in January at USD285-287/t fob in Egypt and USD275-278/t fob Arabian Gulf. On current trends, January is likely to have seen the highest prices of the year: fob levels have dropped to USD260/t fob in Egypt in late February; and netbacks on sales of AG urea have fallen into the USD240s/t fob from Brazil, much lower from the US.

The fall in Egyptian prices would have been greater had not all three Algerian factories shut down over in mid-February. AOA's two plants, with a combined capacity of about 200,000t/month, may be down for some time. This sowed uncertainty in traders' minds and sent some into the market to cover from Egypt.

But the most surprising developments have taken place in the US and China. Early in 2017, some observers were forecasting prices up to USD300/st fob Nola and shortages of urea in China due to inadequate production levels.

Granular urea traded as low as USD219/st fob Nola on 22 February, equivalent to USD236/t cfr, while Chinese prices decreased and export offers increased as February progressed. Operating rates at Chinese urea plants have risen from 50-52pc on average in January to 63-64pc at the time of writing.

Combined with a late spring this appears to have been sufficient to push prices down.

The continued fall in US prices was more of a mystery, deriving partly from a heavy line of vessels arriving in February, concerns over a possible decrease in demand, as well as a large dose of sentiment. US suppliers are forecasting a drop of about 4mn acres in corn plantings in 2017 due to a more favourable soyabean price and reckon that the wheat area is down by up to 3mn acres this year.

Production levels in the US are also gradually rising. CF's Port Neal plant is producing urea, albeit at less than full capacity of 100,000t/month, while Agrium's expansion at Borger, Texas, has started up and can produce about 60,000t/month of urea at capacity.

Ukrainian exports have been at a very low level in the first quarter, with only one factory – DniproAzot – continuing to ship. Supply of urea to Turkey, the largest destination for Ukrainian exports, has been switched to Egypt and Iran. Ukrainian exports may revive in the second quarter once the domestic season is over, but production economics there are not favourable.

Looking forward, low demand for March shipment appears set to keep prices under pressure in the short term. Prices will fall closer to the levels at which buyers feel comfortable, but it appears that they will only stabilise when selling for April begins. At that stage, a stronger pull from large markets such as Thailand, Australia and southern Europe will be evident.

PHOSPHATES

Price rises across the board in the phosphates market

The phosphates market has seen supply-demand imbalances and an accelerated price index, as countries look to fulfil their domestic demand.

China eradicated export duty on MAP and DAP for 2017, a move which should have seen prices fall. Suppliers have maintained low operating rates of between 60-65pc and have kept offers high. DAP asking prices were USD330-335/t fob at the start of January, despite the duty cut and have continued to rise, now believed to be in the range of USD360-370/t fob. The domestic season is a key priority for the suppliers in 1Q and they appear content to eschew exports in favour of the strengthening domestic prices during January leading to much of the supply imbalances during the month.

On the Indian subcontinent, Indian DAP demand has remained comparatively soft in 2017 due to burgeoning official stocks and increased domestic. Indian imports from April 2016-January 2017 were down more than 1.5mn t compared with the 2015-16 fertilizer year as demand was soft at the start of 2017. At the end of January Indian buyers did come to the market as a series of tenders totaling 200,000t were issued as well as a long-term 200,000t DAP contract for 2017-18.

In Pakistan, confusion was the order of the day as the government wavered on the subsidy scheme. The Pakistani government initially announced that it was withdrawing the fertilizer subsidy and then promptly reinstated it a week later. At the start of February, DAP importers then declared that there would be no further imports until the government repaid the subsidies on DAP sold from September to December – the importers claimed that the federal government has withheld 5.1bn Pakistani rupees (USD50mn). The situation appears to have been resolved, with Engro having bought a Saudi cargo and Fauji tendering for 40,000t of DAP on 22 February.

Saudi Arabia has benefited from the lack of Chinese supply and the Argus Saudi Arabia DAP index has moved to USD355-364/t fob. Apart from sales to Pakistan, strong demand from East Africa as well as sales into India and Australia has seen the producer, Ma'aden, sold out for the 1Q. The marketer, Sabic, has also benefited from China's introspection, sales into East Asia total 30,000t for February.

Russian and Lithuanian DAP has picked up as tight supply has resulted in producers largely selling out early for most part of the first quarter. Strong European spring demand in February drove prices up rapidly in some markets, Russian

producer EuroChem sold a small volume into France at USD425/t fca (understood to cover delayed shipment from another supplier). DAP Lithuania Baltic is now priced at USD375-380/t fob, driven by the European demand, up from USD320-330/t fob at the start of the year. The Moroccan DAP price has also eased upwards in the 1Q, beginning at USD335-345 and rising steadily to USD352-358/t fob by mid-February. Delays at the producer OCP's port were linked to the spiking European DAP price in February. OCP has been sold out for January and February, focusing largely on the African continent, Europe and the US.

West of Suez, Brazilian demand started off as comparatively soft in 1Q but it is gaining traction of late. The Brazilian market has been a mixed-bag of activity this year. On the one hand, we have a reluctant buy-side, who do not want to purchase fertilizer stocks so soon, as harvesting activities continue for the soybean summer crop, while on the other hand, there isn't much MAP being offered into the market for February/March discharge. The product that is on offer has pushed up price quotations to USD375-393/t cfr levels.

DAP Tampa prices began the year at USD315-320/t fob and have risen gradually to USD335/t fob at the end of January. Mosaic's gradual string of sales into Latin America each week has driven the price up to USD367/t fob by mid-February.

Following DAP barge prices' 7-year low of USD290-295/t fob Nola at the beginning of December, prices had rebounded to USD305-308/t by the start of January. Tight supply from Mosaic, delays out of Morocco and unseasonably warm weather have driven prices up in February. The warm weather has boosted demand in the southern states, resulting in warehouses emptying and the central Florida rail price jumping up USD20/st fob to USD350/st fob by mid-February – the largest weekly increase in two years. Domestic barge prices reached USD335-339/st fob Nola in February, driven high by speculation of an early spring in northern regions.

As for phosphoric acid, negotiations in 1Q had remained deadlocked until late February. There was a sale in late January; 17,000t of Mexican acid was bought in the mid-USD520s/t P2O5 cfr by a trader. It has now been reported that a provisional price of USD515/t P2O5 cfr has been agreed between IFFCO and two of its JV partners. Negotiations between OCP and its partners are still on-going for 1Q, the 4Q 2016 agreed price was USD580/t P2O5 cfr.

AMMONIA

Prices soar as supply tightens in the ammonia market

Supply levels at the start of the year were reduced further out of the Black Sea where no vessels loaded in Yuzhny. The Togliatti-Odessa pipeline had been shut since 23 December due to the ongoing dispute between Ukhta and Togliatti over pipeline tariffs, so no ammonia was being delivered to the port by Togliatti and Rossosh was also not pumping any ammonia to the port. Meanwhile, Odessa Port Plant (OPZ) shut down its entire ammonia and urea facility on 30 December and the producer expected to remain absent from the market for at least 1-2 months, if not longer.

There was no conclusion to the negotiations between Togliatti and Ukrainian pipeline operator Ukrkhimtransammiak (UKHTA) until 3 February, when TogliattiAzot started pumping around 215t of ammonia an hour down the Togliatti-Odessa pipeline, following a 6- week shutdown. The Clipper Mars was expected to load the first Yuzhny cargo, carrying 40,000t of ammonia to India. Argus' Yuzhny price range has shot up from 260/t fob in the beginning of January, to USD305/t fob in the most recent assessment.

However, as of 8 February, pumping rates down the pipeline have again fallen from 215t / hour to 100t/ hour, due to electric power problems understood to be linked to payment issues. As a result, the accumulation of product at the port is only building at a rate of around 2,400t /day, so the overall supply situation in the Black Sea looks set to remain extremely tight for the next few weeks, at least. It is not known when pumping rates will be raised for the time being as the issue, unsurprisingly, appears to be a financial one and it is unclear how quickly it will be resolved.

In the US, supply tightness internationally supported a USD70/t price increase in the February Tampa settlement to USD320/t cfr, marking the third consecutive monthly rise. The February settlement boosted the contract price to a level last seen in May 2016. The settlement endured several headwinds during 2016, which pressured the contract to eventually touch seven-year lows in November 2016. The contract settled on 26 January.

Meanwhile, a temporary technical issue at its downstream units in Donaldsonville, resulted in CF Industries having significant ammonia surplus availability in late-December and Trammo subsequently loaded the Sombeke from the plant for delivery to Morocco and the Navigator Eclipse for delivery to Mexico. It is understood that both cargoes, which totalled around 45-48,000t, were priced at around USD210/t fob Donaldsonville.

Out of Saudi Arabia, news of accelerated prices continues to do the rounds. In early January, Ma'aden reported that it was looking to achieve around USD240/t fob on its next spot sales. By mid-February, Trammo was reporting that it bought a cargo from Ma'aden at USD345/t fob, for delivery intended in India. The al- Jabirah will load in early-March for IFFCO.

Ma'aden confirmed in early February in an official statement that with the ammonia plant at Waad al-Shamal now running at commercial rates, it is expected that construction will be predominantly completed and trial operations will begin on the other facilities of Maaden Waad Al Shamal Phosphate Company (MWSPC) during the first half of 2017. Ma'aden said this week that a phosphoric acid plant was 91pc complete as of 31 December and a DAP plant is 78pc ready, compared with 13pc and 8pc as of 30 October, respectively. The plants are integral to the MWSPC venture that includes US producer Mosaic and Saudi fertilizer marketer Sabic. MWSPC's nameplate capacity will be 3mn t/yr of DAP/MAP/NPS/NPKs and the phosphoric acid plant will have capacity of 1.5mn t/yr. The start-up of the phosphates and fertilizer units will sharply reduce Ma'aden's surplus ammonia availability.

In Israel, the Municipal Court of Haifa has ordered Haifa Chemicals to empty the ammonia storage tank at Haifa. Mayor of Haifa Yona Yahave had welcomed the court's decision and vowed to keep exerting political pressure until the tank is removed from Haifa bay. Haifa Chemicals has said that it is honouring the court's order, which will result in no seaborne ammonia imports into Israel at least in the short-term. Haifa Chemicals has a supply contract with Trammo. Israel imports all of its ammonia requirements and in 2015, the country imported 106,00t.

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POTASH

Potash market firms as suppliers report supply limits

The potash market has seen prices firm over the past couple of months, as distributors Canpotex and BPC both reported being fully committed in the first quarter and other suppliers observed a shortage in supply on a period of strong demand at the end of last year.

China potash suppliers tried to fulfil their contract obligations by shipping MOP before the end of the year, which — along with a strong period of shipments to Brazil — has led to some supply bottlenecking, resulting in a rise in prices elsewhere.

European and Brazilian MOP cfr prices have increased by 2.1pc since the beginning of this year, while prices in southeast Asia are up by 0.4pc as of 22 February.

The European granular MOP price started the year at an assessed price midpoint of EUR237.50/t cfr, having seen price increases in early November. But price momentum continued in the region into the first quarter and the granular MOP price had risen to EUR242.50/t cfr on 12 January, where it has stayed since.

Demand for MOP rose slowly in Europe in January and February — buyers stepped into the market ahead of the anticipated colder weather, although the Canpotex and BPC supply positions may have added to a perceived urgency for purchasing. Several suppliers reported tight supply levels in Europe, although some buyers said they could secure their MOP requirements as usual and did not view suppliers' indications of supply concerns as an issue, but more of a bargaining device.

The market also noted K+S enduring issues with water flow rates on the Werra river, which restrict the amount of wastewater that can be disposed of in the river and, in turn, limit potash production. K+S has suffered production problems at its Werra plant since late 2015. Output at its 850,000 t/yr Hattorf site in Germany initially resumed on 2 January, after a stoppage lasting a number of months. Production shut again on 21 January, only to restart on 15 February, although K+S said it would be for a limited time. K+S said it could not "rule out limited availability across the whole range of our standard and special products temporarily". The other two sites at K+S' Werra plant — Wintershall and Unterbreizbach — are running at full production levels.

In the US, fob Nola prices for granular MOP started the year at USD209/st, equivalent to USD230/t and have risen steadily since. The price was assessed at a midpoint of USD218.5/st — equivalent to around USD241/t — as of 22 February, having risen by nearly 5pc since the start of the year, a steeper increase than any of the cfr MOP assessments. Fob Nola prices came from a particularly low base in July 2016 though, when granular MOP was at the equivalent of just USD190.10/t before

rates realigned with the rest of the world following the annual China contract settlement.

In southeast Asia, prices have firmed by USD1/t to a midpoint of USD246/t cfr for standard MOP so far this year. Tender season in Indonesia and Malaysia contributed to most of the buying activity in January and firm crude palm oil (CPO) prices have provided optimism to farmers in the region. But rather than buying in the more traditional half-yearly manner, some small- to medium-sized plantations are buying lesser amounts of MOP on a quarterly basis to minimise risk. Currency fluctuations — particularly in Malaysia — led to uncertainty on the buyer side in January and suppliers reported a negative impact on demand levels as a result for January.

The Indonesian and Malaysian markets are still quiet following the Lunar New Year holiday and the end of tender season. Deliveries to plantations are behind schedule because of supply limitations. And local prices are heard to have been lifting on news of tight supply levels and lower-than-normal inventories across the region. Trade is expected to be largely confined to small-volume retail trade until end-April or May, when the plantations traditionally return for second-half quantities.

In Thailand, the secondary rice season was in full swing in the centre and northeast of the country in January and early February and is now coming to a close. The market is out of season in Vietnam and the next round of buying will commence at the end of March.

Brazilian potash demand is typically low in January and February, as buyers have usually secured their needs for safrinha and do not usually pick up buying activity until March or even April, with deliveries in July and August. But news of fully committed suppliers may have spurred demand increases, as distributors reported a sharp increase in enquiries ahead of the usual buying season.

Granular MOP prices rose to USD240-245/t cfr in early February — from USD235-245/t cfr for most of January — as lower-priced product from smaller suppliers dried up.

The region is reported to be well supplied at present, following a jump in deliveries in January and a strong period in December. Brazil imported 742,236t of MOP in January, up by 532,551t on the same month of last year

Market reports indicate that granular MOP prices across Latin America — excluding Brazil — have reached parity with Brazilian granular MOP cfr prices. The rest of the region typically pays a USD10/t premium to Brazilian granular MOP prices, as a rule. But this premium has eroded to nothing, as suppliers attempt to offload granular product into the rest of Latin America while Brazil is in low season. Expectations are that the fall in the premium relative to Brazilian prices is temporary though and will return to USD10/t once demand in Brazil ramps up in earnest and suppliers see tighter supply.

SULPHUR

Prices hold flat-to-firm as 2017 commences

The New Year started off with more spot activity than anticipated. In the first week on the sell-side there were spot tenders from Qatar Petroleum, formally Tasweeq, Iran's KHIPC, another Iranian cargo via Raintrade and a Yasref refinery load from Sinopec. On the buy-side Egypt's Polyserve Group was seeking a cargo for Abu Zaabal and Turkey's Toros was continuing its search to fulfil demand for 25,000t of granular product. All conclusions drawn on these deals kept prices flat-to-firm and set the tone for the story of the January spot market.

While spot pricing across the board either edged up or sat in a steady range in January, contract negotiations drew most of the attention. Following initial expectations in the market for price rollovers, increases were achieved across the board with Europe as the only exception where the rollover was agreed. Initially, the buy-side was targeting a drop but would have accepted a rollover because the phosphate fertilizer market was considered weak with little sign of improvement. But, as negotiations continued, supply from the Middle East leaned towards tightness and Russia's GazpromExport confirmed that it would have nothing to offer the market at all for spot or contract in 1Q and prices firmed.

In February, prices kept the trend of flat-to-firm pricing movements. But the market has been watching China in search of guidance as to where prices will go next. China's Lunar New Year holiday started on 27 January and ended on 3 February. When the holiday comes around end-users usually exit the market about 10 days before and return in force around two weeks after. This inevitably leads to China cfr prices softening on the build up to the holiday and until the buyers return. And this in turn leads to prices edging downwards in other markets as tonnes usually sold to China, the world's biggest sulphur buyer, seek a home. This year, things went a little differently.

Prices in China spanned the low/mid-USD70s/t cfr to low-USD100s/t cfr at the start of 2017 and remained in this bracket to the end of February. Buyers continued to lift product up until the very start of the holiday week, keeping prices steady. Over the holiday period, prices elsewhere in the market held steady or firmed and this has been attributed to the tight supply-side currently being experienced with no sign of letting up until 2Q. Two weeks after the holiday and Chinese end-users are yet to return and no confirmed concluded business between sellers and end-users was reported. Offers in to China for granular product is as high as USD110/t cfr as of end of February, with counter bids/offers still in the low-USD100s/t cfr. So, it seems that the Chinese market is now at an impasse with a game of who blinks first in motion. What some expect is for buyers to stay absent until March, after two domestic trade conferences are concluded at the end of February. But only time will tell.

The other region of interest has been the Mediterranean. Traditionally the market is insular and deals within itself supporting both a Mediterranean fob and cfr price with some small cargoes shipped to North Africa and parts of Latin America. But, with the absenteeism of Russian tonnes from the 1Q spot and contract markets, demand from North Africa has had a big influence on the price as buyers seek to fill the gap left by GazpromExport. The demand from the region, in hand with the traditional demand from frequent buyers in Turkey for example, pushed the Mediterranean cfr and fob prices up from USD90-92/t and USD72-75/t, respectively in early January to USD90-97/t cfr and USD70-77/t fob by end-February. This market level is anticipated to be the new norm for 1Q, but there are predictions in the market that it will soon move back down, maybe even by USD10/t when 2Q commences and normal supply operations resume. ■

Outlook for the fertilizer industry in Colombia

by Olaf Hektoen, **Vice-President, Head of Latin America, Yara**

Colombia's agricultural sector is spread across 26.5 million hectares. Between 2000-2007 the sector had an annual growth average of 3.1% and in 2015 represented approximately 6.1% of the country's GDP, compared with the Latin America average of 5.1%.

However, over the last two decades the agricultural sector's share of GDP decreased from 7.5% to 6.1%

Development of agricultural activity has been achieved in spite of large social and productive lags; poverty in rural areas is 2.5 times higher than in urban areas. The multi-dimensional poverty rate in rural areas is 45.9% versus 18.5% in urban areas.

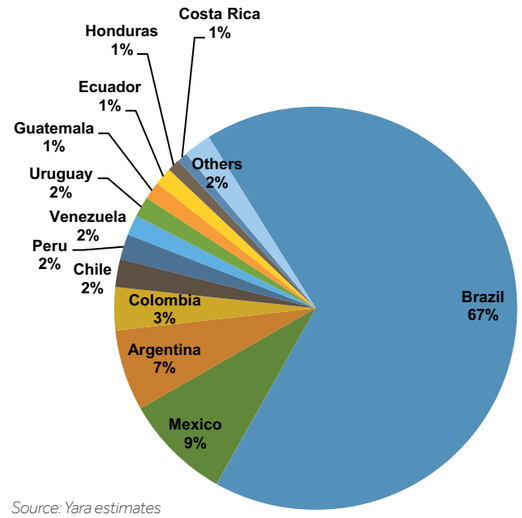
Supply

The total market for fertilizers in Colombia is 1.7 million tonnes and the domestic industry supplies 730 000 tonnes of these volumes.

Natural gas prices are high compared with the lowest-cost markets and supply/demand ratio is expected to tighten over the coming years.

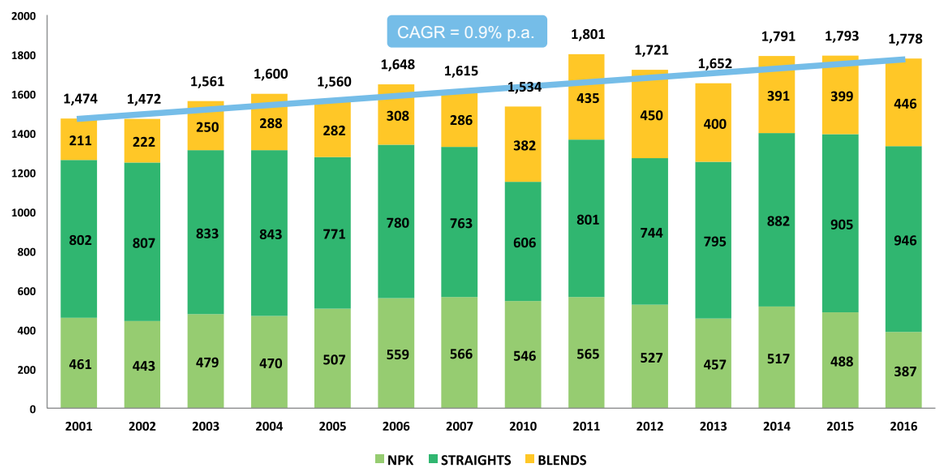
Colombian gas reserve forecasts do not support investment in industrial projects that depend on natural gas. In addition, the new carbon tax applying to natural gas for petrochemical use puts further pressure on the competitiveness of the Colombian fertilizer producers.

Figure 1. Total fertilizer market - approx 50 mn tns



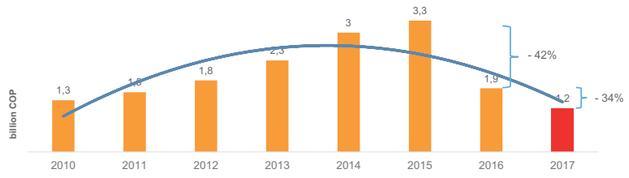
Source: Yara estimates

Figure 2. The Colombian fertilizer market has grown slowly over the last 15 years and has stagnated in the last 5



In terms of logistics, the under-developed transport infrastructure is one of the principal limitations to the competitiveness of Colombian agriculture industry. Colombia is lagging behind in ground infrastructure compared with other countries of a similar level of development in Latin America and China. Consequently, Colombia's internal transport costs are expensive.

Figure 3. Government investment in agricultural sector for 2016 only a fraction of the COP13 bn (USD4.5 bn) recommended by independent experts



Source: Planning and Prospective Advisory Office; Directorate of Investments and Public Finance - DNP; Ministry of Finance and Public Credit

Demand

Eight crops represent 79% of Colombia's agricultural production: Coffee, sugar cane, rice, potato, Yucca, African palm, banana and maize. Coffee accounts for 25% of the country's consumption of fertilizers.

However, the agricultural productivity gap is still significant between Colombia and comparable markets.

Peace process

In spite of FARC peace process, several armed and delinquent groups remain present across the country. There is high risk that areas of illegal economies, where guerrillas operate, will be seized by third-party armed forces once FARC hands over weapons.

Nevertheless, there are two projects of agricultural importance in Colombia which are expected to promote growth:

- Colombia Siembra Program
- Development of the Colombian Altillanura

The Colombia Siembra program estimates a growth in the next three years of 1 million additional hectares in various crops. Around 25% of available land is in the Orinoquía/Altillanura reagion. Two main challenges reduce the likelihood of reaching the million hectare target; the risk of continued insecurity and unclear property rights.

Government investment in the agricultural sector for 2016 is only a fraction of the COP13 billion (USD4.5 billion) recommended by independent experts. ■

The total fertilizer market in Latin America is approximately 50 million tonnes, with Brazil commanding 67% of the market. Yara is present in all of the most important markets in Latin America and has an overall market share of 21%.
This article was adapted from a presentation delivered at the Argus FMB fertilizer Latin America 2016 conference.

Consolidation of the fertilizer industry is inevitable

Near Corning, Saskatchewan, Canola field using Optimize RX variable rate application.

by Remi Schmaltz, **CEO, Decisive Farming**

By most accounts, 2016 was the year for consolidation of the agricultural industry. It seemed like every time we thumbed through a newspaper or turned on the television we were inundated with news of yet another merger or takeover in the agribusiness world.

Most of these deals were worth hundreds of millions of dollars and impacted everyone connected to the supply chain; from small, independent farmers to CEOs of Fortune 500 companies. That was certainly true in the fertilizer business, where manufacturers, distributors, retailers and their customers saw first-hand the impact consolidation has had.

Remi Schmaltz, CEO, Decisive Farming

> *"Over the past decade, the number of fertilizer manufacturers has continued to shrink*

Of course, consolidation is nothing new when it comes to the fertilizer industry. One such notable deal is PotashCorp and Agrium's plan to merge the two companies that was first announced last year. Over the past decade, the number of fertilizer manufacturers has continued to shrink following several high-profile mergers and acquisitions. Where once the number of manufacturers was plentiful, there now remains only a handful.

Substantial deals

The reasons for these consolidations are simple – a general slowdown in the global agricultural economy and uncertainty in the marketplace caused by several years of low fertilizer prices. In the fertilizer industry, these mergers have been driven by companies looking to expand their retail distribution capabilities or simply add capacity and boost profits.

Manufacturing isn't the only segment of the fertilizer industry that has been affected by consolidation. It's also had a major impact on the distribution sector. This past year saw several major players join forces. Univar Canada acquired the assets of Saskatchewan-based wholesale fertilizer distributor Nexus Ag Business. Univar also acquired Future Transfer and BlueStar Distribution as part of its ongoing

efforts to expand its capabilities in the Canadian marketplace.

Perhaps the biggest deal in the distribution sector was Land O' Lakes and United Suppliers agreeing to merge their crop input units to form a new business division worth an estimated USD7 bn in annual sales. The two merged units will do business as Winfield US.

Agriculture retail has undergone a similar transformation as the number of players has likewise shrunk. One of the more significant developments in this area has been Cargill's efforts to divest itself of its retail holdings in the US. Last summer the company agreed to sell its ag-retail business in the US to Calgary-based Agrium, North America's largest retail seller of crop inputs. Agrium has been in acquisition mode for some time when it comes to the American market as it works to increase its footprint south of the border.

Multiple sectors

Consolidation has by no means been restricted to the fertilizer industry. Buyouts and mergers have also been the order of the day for chemical and seed companies. One of the biggest deals in this sector is state-owned ChemChina's offer to purchase Swiss-based pesticide and seeds group Syngenta for a reported USD43 bn. The deal must still receive regulatory approval including from the European Commission. While the tentative deal has raised concerns about decreased competition and higher prices, Syngenta CEO Davor Pisk says it will be good for growers because it will help preserve the number of choices available people here in the North American market.

Another proposed merger on the seed and chemical side of the business is Dow Chemical and DuPont's plan to join forces, a deal first announced in late 2015. The new company would be split into three smaller, independent units: specialty chemicals, advanced materials and agriculture. The amalgamated companies would be worth a combined USD130 bn if the deal receives regulatory approval. President Donald Trump has already

CASE IH Fertilizer applicator

> *Critics argue it will ultimately lead to less competition and drive up prices for farmers and consumers*

indicated he won't block the deal, which Dow chairman and CEO Andrew Liveris has called a 'game-changer' for the agriculture industry.

A third deal generating plenty of discussion is German-based Bayer's bid last September to acquire Monsanto, a deal that is expected to close by the end of this year. Executives say it would be a win-win deal for both companies and would add up to USD500 mn to their collective bottom lines over the next three years.

Reduced competition

Farming technology hasn't been immune to consolidation either. In 2015, John Deere spent a reported USD190 mn to acquire two of the top planting technology companies: Precision Planting in the US and Monosem of France. Precision Planting was a subsidiary of Monsanto's Climate Corporation.

Naturally, all this consolidation talk has generated plenty of debate, both for and against.

Critics argue it will ultimately lead to less competition and could drive up prices for farmers and consumers. They also contend that with fewer players in the game – both in the fertilizer industry and the agriculture sector in general – there will be less incentive for companies to invest in innovation. The reality is it's cheaper for a company to buy existing assets than having to build them from scratch. You can find numerous recent examples of this in the agri-tech sector.

Conversely, proponents of such mergers say that the acquisition of smaller, struggling companies by larger, more powerful ones will provide stability for the industry. Larger companies also have more resources, some of which could end up being devoted to R&D.

Opportunities

One fact often overlooked when it comes to talk of mergers and acquisitions is that smaller businesses and entrepreneurial-minded start-ups can, and often do, move in when they see an opportunity in the marketplace and pick away at the market share these giants are determined to hold on to. This is something that has happened many times in the past as agribusinesses consolidated and became so large it was difficult for them to remain as innovative as they once were. The good news is that as we get more and more of these industry giants, opportunities open up for smaller, more nimble enterprises to move in and do the things these business behemoths don't do very well – move quickly, come up with new ideas and tailor their products and services to the specific needs of customers on a regional basis. These so-called niche companies can carve out their own value proposition in an industry so long as they employ strategies that are forward-thinking and geared towards anticipating new trends.

Of course, this doesn't mean that larger companies can't be innovative. Bigger can sometimes mean better when it comes to innovation, according to a 2011 paper issued by the Progressive Policy Institute. The paper's author says consolidation can increase a company's ability to be innovative. The key is ensuring these larger corporations have the necessary talent, properly deployed resources and an organization-wide focus on innovation.

Regulations

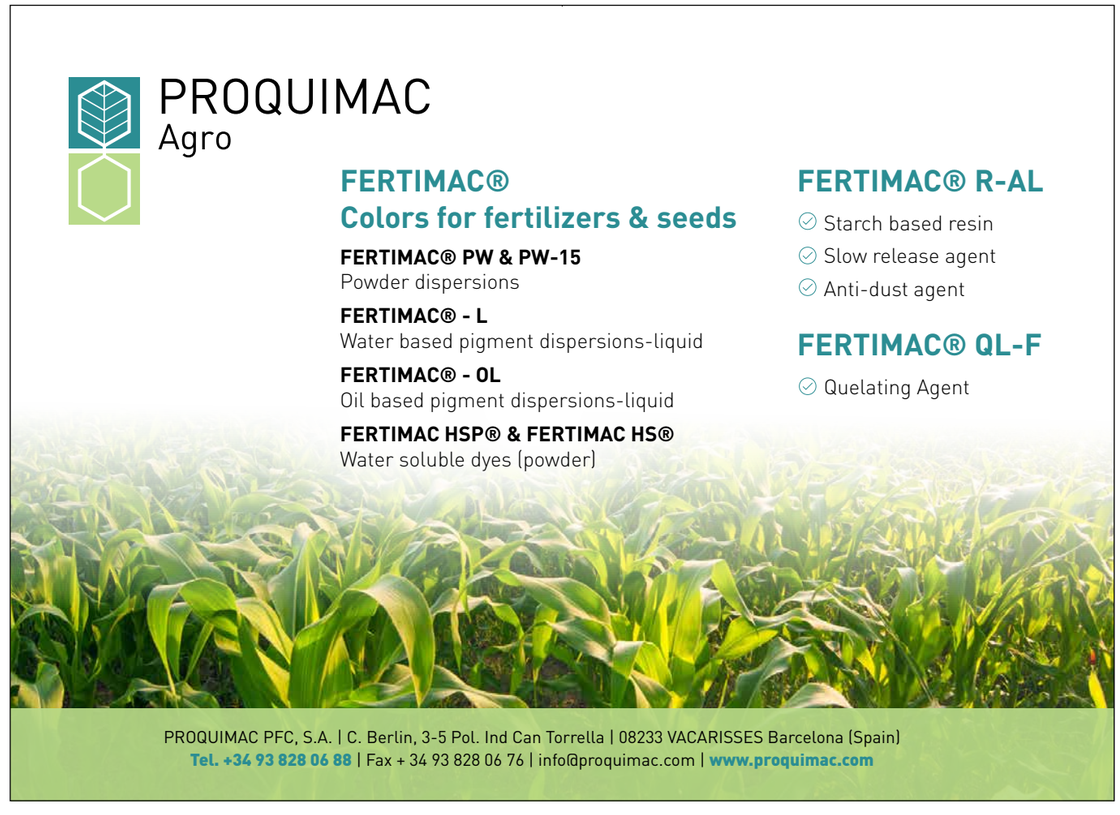
One of the wildcards when it comes to any merger or buyout is government. Because virtually all of these deals require some form of regulatory approval, governments often have the final say in whether or not they are approved. How these deals I've already mentioned play out could depend largely on where companies are based.

Here in Canada, the new Liberal government has promised to unveil its innovation agenda, which is likely to address some of the concerns that have been raised about consolidation. Whatever this agenda ends up looking like, it will need to look at existing regulatory processes and examine ways of making them more affordable to attract new players to our industry and encourage companies to create more new products.

What ends up happening south of the Canadian border is even more difficult to predict. Despite initial opposition to several of these so-called mega mergers, some of President Trump's recent appointments seem to indicate his administration may look more favourably upon big corporate deals than originally expected.

As for what kind of year 2017 is shaping up to be it's too early to say. One thing is for sure, though: more consolidation seems inevitable in the short-term. ■

Remi Schmaltz is the CEO of Decisive Farming Corp, one of the leading precision agriculture companies in North America.



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Drone mapping

to identify nutrient deficiencies

by Steve Coulson, **Chief Drone Evangelist, Coptrz**

Unmanned aerial vehicles are growing in popularity as a means for farmers and agriculture professionals to monitor problems with their crops. The use of drones can help farmers detect problems and react to them more quickly, often saving thousands of pounds in crop losses.

Drones generate data that helps create a more accurate, detailed picture of how the crops are faring, leading to improved management strategies and more effective use of resources.

Steve Coulson,
Chief Drone Evangelist, Coptrz

Common crop problems

A number of issues can detrimentally affect crop growth. A major cause is water stress, caused as a result of the water supply to the roots being limited, or due to the transpiration rate - the evaporation of the water - being too intense. The causes can include high soil salinity or drought.

Another problem is nutrient deficiencies. The symptoms include reddish or yellow leaves and poor growth. These can indicate magnesium, nitrogen or potassium deficiency. Vegetables are particularly vulnerable to nutrient deficiencies, as are those crops in extremely alkaline or acid soil.

A number of pests are also responsible for ruining field crops. Among the most damaging are weevils, slugs, aphids, beetles and certain types of moth. One of the most serious pests in the UK is the wheat bulb fly. When the wheat crops are at the single shoot stage, in February, they are at their most vulnerable and may be completely destroyed.

Soil-borne diseases, such as fungi, can cause crop yields to diminish. Fungi can survive for long periods because of its ability to produce resistant chemical structures.

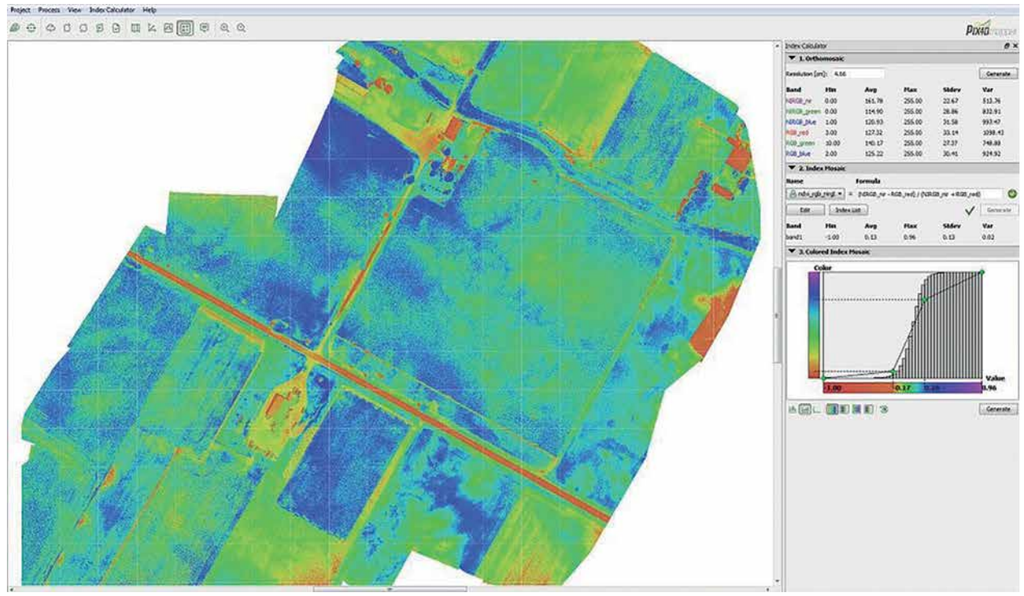
Increasing crop yield

The challenge facing farmers is how to increase crop yield and counter the problems caused by such factors as water stress, nutrient deficiencies, pests and disease. There are many traditional methods employed by farmers to increase crop yield in open fields, such as using pesticides, fertilizer and biological control.

However, a careful balance must be struck with the use of pesticides, as studies have revealed some can have a detrimental effect on soil fertility, due to their interfering with nitrification, a crucial step in the nitrogen cycle in soil.

Agricultural experts advise that to increase crop yield, you must start from the ground up. The soil must be tested to ascertain the cause of a diminishing crop yield. Once the source of the issue is determined, whether it's a lack of nutrients, disease, or another issue, the soil can be treated with an appropriate product.

It is easier to control the conditions in greenhouses, where the rate of photosynthesis can be artificially increased using more lighting and heating and appropriate watering. The use of artificial lighting allows photosynthesis to carry on after daylight hours.



A Index calculator interface allows the user to create meaningful maps from any multi-spectral sensor and customize your NDVI as well as any vegetation index map directly

Drone mapping software

An increasingly popular method of dealing with the challenges faced in the agricultural industry today is the use of drone mapping. Drones are used to scout fields and crops, determining the health of the plants and enabling the appropriate action to be taken.

Drone mapping enables farmers to detect and solve problems quickly. This is crucial when time is of the essence, particularly during the growing season. The drone will fly above the appropriate areas, capturing imagery, viewing and analysing maps and sharing the information through software to allow the necessary action to be taken.

The cutting-edge technology for the agricultural industry allows farmers to map fields with precision accuracy and utilise the data effectively.

Precision agriculture

The use of drones is a key part of a farming management concept called precision agriculture. This method is based on observing, monitoring and responding to variability in crops.

> *Drone mapping enables farmers to detect and solve problems quickly*

Precision agriculture's goal is to efficiently utilise a farm's often limited resources to gain the maximum yield. A proven method of doing this is by minimising the variability of crop health across the fields. The applications for drone mapping are almost limitless and are primarily aimed at finding the problem areas of crop.

The drone mapping software can gather a large volume of data, with three main types:

- Geo-tagged images: these are visible, multi-spectral aerial images of the fields that are taken over a period of time
- Equipment performance: real-time feedback, with logs, can be provided by sensor-equipped drones, both manned and unmanned, on equipment such as tractors, seeders, spreaders and combines
- Management data: information on crop yield and other data provided by farm workers can be logged, monitored and acted upon to improve yield.

Crop health monitoring

The number one use for drones is mid-season crop health monitoring, also known as scouting. The crops are inspected from height, using Normalised Difference Vegetative Index (NDVI) sensors. Remote monitoring in agriculture uses NDVI to capture the amount of infrared light that's reflected, compared with visible red.

This differentiates between bare soil, grass and forest, detects plants under stress and recognises different crop stages. In the past, the task of crop monitoring was a laborious one that

involved walking the fields to note the condition of the crops. This left it open to human error.

Using a drone means more acres can be covered quickly, noting data, through NDVI sensors, that can't be seen by the human eye. Once the images have been viewed, it's easier then to physically inspect any areas of concern.

Irrigation equipment monitoring

Managing irrigation pivots manually is time-consuming, especially for farmers who have a large number of fields spread out across a sizeable area. When crops such as corn reach a certain height, it's necessary to carry out a mid-season inspection of the sprinklers and nozzles on irrigation equipment. Using a drone can vastly reduce the amount of time it takes.

The NDVI sensor data, coupled with post-flight image processing, can also create a weed map. This enables farmers to easily identify any areas where high-intensity weed growth exists, differentiating them from healthy crops alongside them. In the past, many farmers had been unable to ascertain how serious a weed problem was until the harvest.

Major benefits of drones

In comparison with other aerial survey methods, drones will generate more frequent and precise data about the crops' condition. This can be used to improve the performance of the farm's operation.

In particular, drone-mapping software can be beneficial for fields of less than 50 hectares, since they are more cost-effective than satellite imaging manual scouting and manned aircraft surveillance.

Drones can gather information quickly and effectively on many aspects of a farm's operation, such as plant count, plant height, the presence of nutrients, crop health, diseases, the amount of weeds, the relative biomass estimates and also 3D and volumetric data on the land, such as hills and holes.

They also enable greater precision, as they can take centimetre-level images that reveal considerably more detail about the crop's condition. Drones survey more frequently, allowing earlier detection of problems such as pests, weeds and other abnormalities. All the fields can be 100% scouted using a drone and no areas are missed.

The 3D and volumetric data that they provide can be used to identify any density problems, such as hot spots in a crowded field, or contour issues, such as shade issues on north-facing slopes. Drones can also monitor crops for indices such as canopy chlorophyll content index, normalised difference vegetation index and crop water stress index.

Fertilising problem areas

Once a complete picture of the farm's operation has been compiled, this makes it easier to target problem areas, fertilising them using precision farming. Prior to the use of drones, satellite imagery or a grid soil sampling programme were widely used to refine phosphorus, nitrogen and potassium applications.

Now, NDVI maps can direct the application of in-season fertilizer applications on crops. Drone-generated, variable-rate application maps can be used to determine the nutrient uptake in a single field. This means the farmer can apply extra fertilizer to the deficient areas and less to the healthy areas, reducing fertilizer costs and boosting the yield.

Spraying drone

A crop spraying drone, using state-of-the-art software, allows the user to precisely map a route, with the drone automatically returning home if the tank is empty, or if the battery pack needs re-charging. One worker can manage several spraying drones simultaneously, as the autonomy enables simple re-fuelling of each one when required.

Detailed reports will be available to the farmer, who can spot potential problems early and analyse plant health. The spraying drone provides a precise, variable rate application of fertilizer, liquid pesticides and herbicides, providing a new level of manageability and efficiency to the agricultural sector.

The focus of precision farming is to vary fertilizers and pesticides across each field in a pre-determined manner. A map of the field will describe how much of each to apply in different areas. The applicator can vary the input rates, while state-of-the-art equipment, such as differential global positioning systems, enables users to know where they are in the field at all times.

Resolve issues quickly

Drone mapping software enables farmers to take action quickly to resolve issues. The orthomosaic images can be fed into an agricultural programme, using software tools to create prescription maps. These will inform the farmer where action is needed and even what specific steps should be taken, highlighting problem areas and indicating if more nitrogen is needed there, for example. The maps can be directly transferred into a precision sprayer. ■

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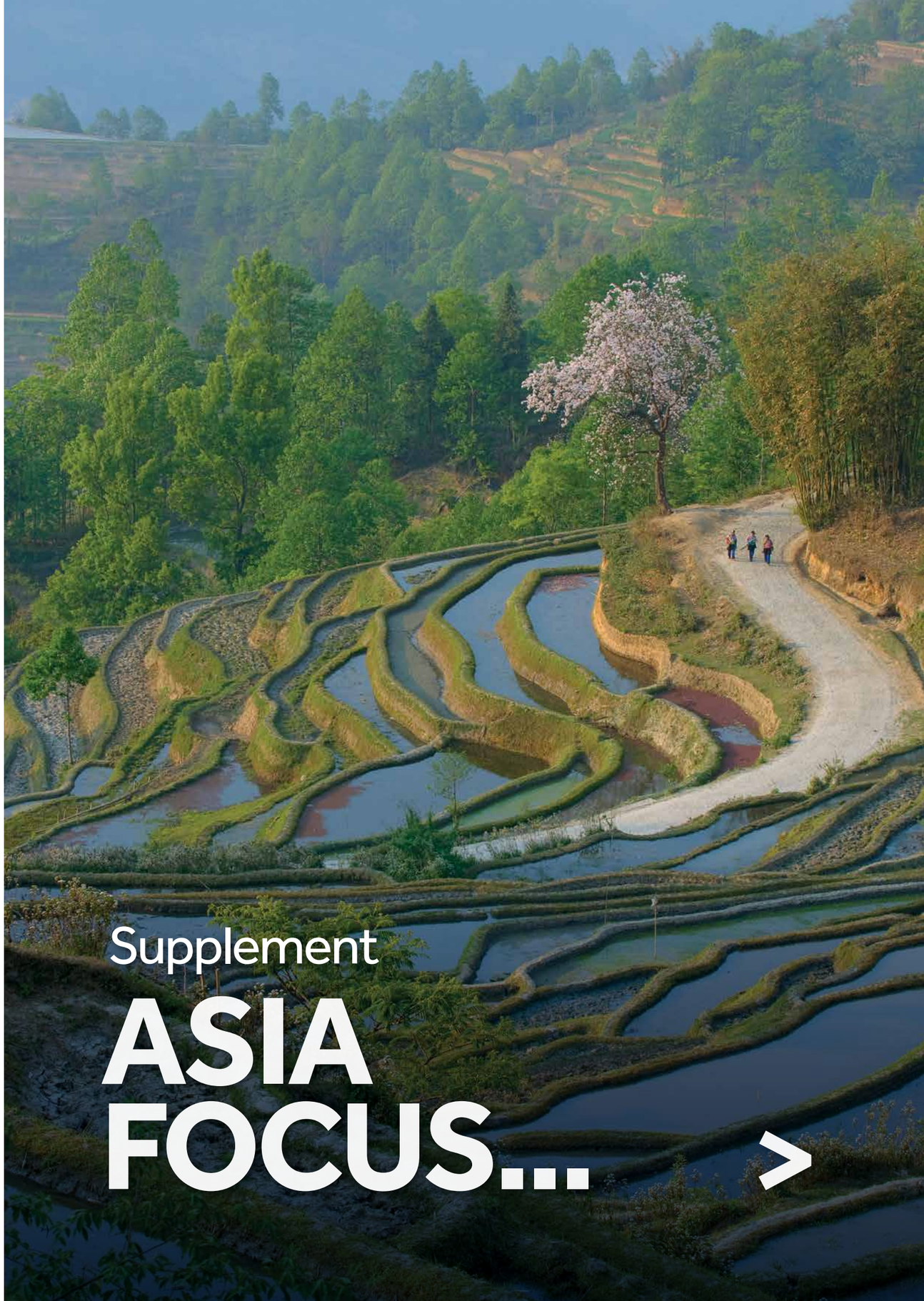


The Zero Growth Policy

and fertilizer innovations in China

by Yuelai Lu, **Senior Research Fellow, School of International Development, University of East Anglia**

David McBey, **Project Co-ordinator for N-Circle, Institute of Biological and Environmental Sciences, University of Aberdeen**

Roger Sylvester-Bradley, **Head of Crop Performance, RSK ADAS,**

Rachel Thorman, **Research Scientist, soils and nutrients, RSK ADAS**

After nearly four decades of booming agricultural production, China has become one of the most food-secure countries in the world and can now claim to successfully feed its population of 1.36 bn. However, the long term sustainability of Chinese agricultural production and food security face several challenges: limited arable land, scarce water resources, degraded soil, low efficiency of input use and therefore low competiveness, pollution from crop and livestock production and increased food demand driven by dietary change to a more protein (i.e. meat) based diet.

The Chinese government has started implementing a comprehensive strategy to modernise China's agriculture with a view to ensuring greater efficiency and lower environmental impact. The zero growth policy in fertilizer use by 2020 is one of the key components of the strategy and this is being supported by on-going programmes of extension, development, research and innovation.

> *In 2015, China's grain output reached a historic record of 621.4 million tonnes*

China's agricultural production

China has seen remarkable development in its agriculture and rural development over the past few decades. Using less than 9pc of the world's arable land, China now produces 25pc of the world's grain and can meet most of the food needs for 20pc of the world's current population.

In 2015, China's grain output reached a historic record of 621.4 mn tn following 12 years of relatively continuous growth even though there were serious regional or seasonal droughts in some years. All major crop and livestock products have experienced significant growth over the past three and half decades since the reforms that started in 1978 (see Figure 1).

Changes in agricultural production

Rapid economic growth, urbanization and market development are the key factors that have triggered change in the structure of Chinese agriculture through increasing demand for meat, fruit and other non-staple foods. One significant change is the massive growth in livestock and fishery production. From 1980 to 2013, total meat output increased from 12 .05 mn tn in 1980 to 86.25 mn tn in 2015; aquatics products increased from 4.5 mn tn in 1980 to 65 mn tn in 2014 (also see Figure 1). In terms of contribution to total value of agricultural outputs, the share of crops declined from 76pc in 1980 to 54pc in 2013. During the same period the share of livestock increased from 18pc to 28pc. The share of fishery increased most rapidly, from just 1.7pc in 1980 to 10pc in 2013.

> *Vegetable and fruit production has become one of the main drivers*

The manures generated from livestock production, although a precious source of nutrients and organic matter, are mostly not properly stored, processed and distributed and thus become a major source of pollution in agriculture.

Another significant change has occurred within the crop subsector. The sown area of grain crops has declined and the sown area of high value-added cash crops has increased. Rice and wheat areas have declined as a response to reduced demand, with concomitant increases in maize (mainly for feed), vegetable and fruit growing areas due to increased demand in non-staple foods. Increased vegetable and fruit production has become one of the main drivers of increased fertilizer use.

Future constraints for agricultural production

China's agricultural sustainability and food security face multiple challenges arising from the nature of its farming systems and the increasing scarcity of natural resources. Some of the initial driving forces of agricultural intensification are also bringing about constraints to the further development of agriculture production.

The 'household responsibility system' (HRS) was a major driver of agricultural production in the early stages of rural reform. However, the nature of much of Chinese agricultural production (i.e. small scale and fragmented household farming plots) has become a barrier to further improvement in resource use efficiency, mechanisation and market competitiveness. Intensive land and water resource use has led to a decline in natural resources and contributed to environmental degradation. Recognising the above constraints to increased productivity, the Chinese government has now made the major objectives of its national agricultural policies as: land consolidation, sustainability and protection of natural resources, improved resource and input use efficiency and reduced environmental damage.

Figure 1. Output of major agricultural products in China (1978-2015)

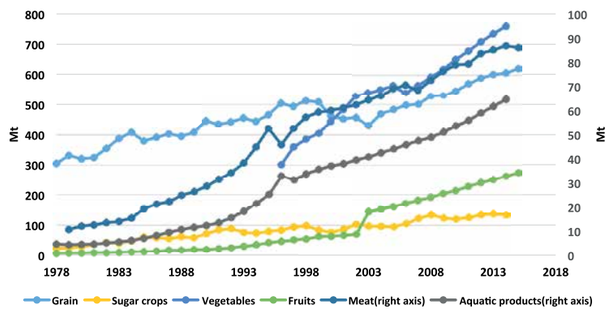
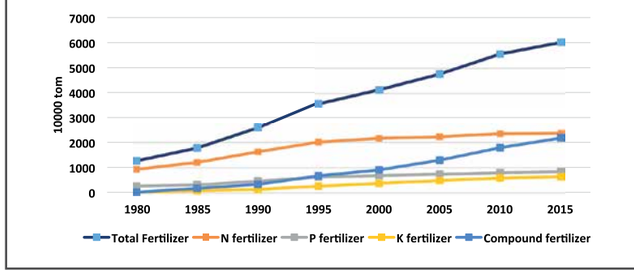


Figure 2. Fertilizer use in Chinese agriculture



Status of fertilizer use

Increased inputs, particularly synthesised nitrogen (N) fertilizers, made a substantial contribution to production growth. However, agricultural chemicals (fertilizer and pesticides) are now overused in much of Chinese farming.

As shown in Figure 2, from 1980 to 2015, the total volume of fertilizer use in China increased from 17.8 mn to 60.2 mn tn: pure nitrogen fertilizer increased from 9.3 mn to 23.6 mn tn; pure phosphorus fertilizer increased from 2.7 mn to 8.4 mn tn; pure potassium fertilizer increased from 3.5 to 6.4 mn tn; and compound fertilizer increased from 0.3 to 21.8 mn tn. While there was a general and steady increase in fertilizer use over the last three and half decades, some crops and regions receive and apply more fertilizer than others.

Grain crops remain the major recipients of fertilizers. However,

Table 1. Fertilizer consumption by crops during 1998–2008

Year	Grain		Economic crops		Vegetables		Tea and fruits		Total	
	Mt	pc	Mt	pc	Mt	pc	Mt	pc	Mt	pc
1998	26.76	71.0	4.22	11.2	3.64	9.7	3.05	8.1	37.66	100.0
2008	28.72	57.8	5.66	11.4	9.41	18.9	5.89	11.9	49.68	100.0

Source: Temporal and regional variations of China's fertilizer consumption by crops during 1998–2008, Journal of Geographical Sciences. (2012)

the share of fertilizer used on grains dropped from 71pc in 1998 to 58pc in 2008 while the share on horticultural crops (fruits and vegetables) gradually increased (see Table 1). The increase in fertilizer consumption in central and west China, which already accounted for 78pc of the national total, was higher than in other areas, the distribution being largely consistent with land use.

The economic and environmental consequences of the overuse of fertilizer are well documented. Overuse of fertilizer directly causes poor nutrient recovery and high production costs. High levels of N fertilization are the main reason for increased soil acidification in China. Over half of China's major lakes are now eutrophic and this situation is still deteriorating for most of them, with agriculture contributing 57pc of total nitrogen and 67pc of total phosphorus entering Chinese water systems. N fertilizer application is also the most significant contributor to agricultural carbon footprints in China, particularly for wheat (80pc) and maize (81pc). These increasing greenhouse gas emissions, along with ecosystem degradation, together constrain the long-term sustainability of Chinese agriculture.

The Zero Growth in fertilizer use – policies and actions

China is implementing a comprehensive overhaul of its agricultural sector, switching from its previously narrow focus on production to a more holistic approach, i.e. considering production, competitiveness and environmental concerns.

A comprehensive policy framework for agricultural transition has been developed which will be implemented in the 13th five-year plan (2016-2020), with zero growth in fertilizer an important component of the framework.

In February 2015, the Chinese Ministry of Agriculture (MoA) released: 'The action plan for zero growth in fertilizer use by 2020.' This document was a response to the government's No. 1 Central Document in 2015, which requested a change in agricultural production from a high productivity, high input and high pollution mode to a high productivity, high efficiency and environmentally friendly mode. The fertilizer zero growth action plan is thus part of China's agricultural modernization strategy.

Objectives

The overall objective is to establish by 2020 a management and technology system for scientific fertilizer application in order to achieve zero growth in fertilizer use. This includes:

- Further optimization of fertilizer products, with more optimal composition of NPK and micro-nutrients
- Improvements in fertilizer application techniques, including mechanical rather than manual fertilization of over 40pc of crop land; the area with fertigation is also to cover 150 mn mu (1 bn hectares).
- Better fertilizer use efficiency: for major crops this should be 40pc or more

Key activities over the next few years

Promoting soil testing and adoption of fertilizer recommendations by:
- Expanding the soil testing programme to cover vegetable, fruit, tea and other cash crops
- Encouraging and facilitating business sector participation in the soil testing and fertilization recommendation programme
- Supporting professional organizations providing comprehensive soil testing, fertilizer formulation, fertilizer supply and fertilizer application services

Transforming fertilizer application methods by:
- Promoting mechanized fertilizer application
- Promoting fertigation technologies
- Disseminating fertilization scheduling technologies

Promoting the application of new fertilizers and new technologies by:
- Enhancing research and development which focusses on high crop yields and new fertilizers and fertilization equipment which enhance nutrient recovery
- Speeding up the dissemination of new products, including slow releasing fertilizers, water soluble fertilizers, liquid fertilizers, foliar fertilizers, bio-fertilizers and soil conditioners
- Disseminating technology packages demonstrated as achieving high nutrient recovery

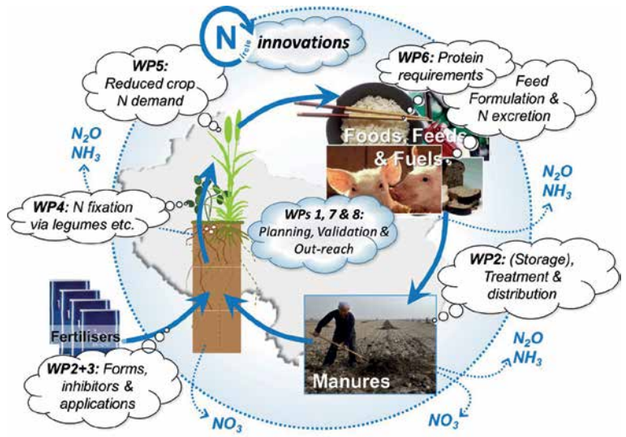
Promoting improved utilization of organic manures and by-products by:
- Greater recycling of agricultural by-products, particularly livestock manures
- Greater incorporation of straw and haulm into field soils
- Growing and soil-incorporation of green manure crops, when appropriate.

- Proposed means by which these objectives may be achieved include promotion of precision fertilization techniques (application methods and decisions), more optimal choice of fertilizer products and replacement of chemical with organic fertilizers

Other related initiatives

Together with the strategy above, the Chinese government has initiated further actions which will help to realise the goal of fertilizer zero growth. The 'Campaign on Agricultural Non-Point Pollution Control and Prevention' issued by the MoA includes measures to promote water-saving agriculture, advance pollution control on livestock and poultry farms and carry out heavy metal treatment of polluted farm-land. The 'Plan for Establishing a Green-oriented Agricultural Subsidies System' which has been jointly issued by the MoA and the Ministry of Finance is intended to shift the priority target in agricultural production from quantity growth to growth in quantity and quality. This will encourage the flow of subsidies towards resource-saving and environmentally friendly agriculture and stimulate appropriate research and development.

Figure 3. Conceptual diagram for the N-Circle Project. Work-Packages (WP) seek innovations at successive points in the grain-based N cycle. Further information on N-Circle is available at http://www.abdn.ac.uk/ncircle



> *"The Chinese government has initiated actions to realise the goal of fertilizer zero growth*

N-Circle – research into an integrated approach for improved nitrogen management

Funded by the UK research councils BBSRC and NERC, a consortium of British and Chinese scientists is working to support these policies by exploring a set of ideas that, when integrated, should help to improve China's use of nitrogen fertilizer. The central objective of the project, known as 'N-Circle: Virtual Joint Centre for Closed-Loop Cycling of Nitrogen in Chinese Agriculture', is to quantify the interdependence between di-nitrogen fixation for agriculture (both industrial and biological) and agricultural emissions of ammonia (NH_3), nitrate (NO_3) and the greenhouse gas, nitrous oxide (N_2O) i.e. how N inputs cause N emissions. Sustainable intensification of agriculture in China depends on reducing both whilst continuing to enhance production. N-Circle will set an agenda for 'closing' agricultural cycling of N in China by employing ensemble modelling to estimate N inputs, transformations, transfers and emissions for China's principal farming systems and by identifying points for technological intervention, so to set targets for innovation.

The specific objectives of N-Circle are to:

1. Define a range of options to deliver closed-loop N cycling in Chinese agro-ecosystems
2. Define practices to enhance recovery of applied N, both from fertilizer & manure
3. Provide options to reduce GHG emissions due to N applications
4. Devise rotations and cropping practices that maximise leguminous N fixation and uptake
5. Define mechanisms to reduce crop N demand, by predicting canopy N demand, maximising C & N fixation & harvest and minimising grain N demand (by grain protein manipulation)
6. Quantify the role of reducing end-user demand for N and N excretion by livestock
7. Demonstrate impacts of objectives 1-6 through case studies at farm, catchment and regional scales
8. Provide multi-level (farmer, extension service, regional / national policy-maker) out-reach and dissemination

The conceptual diagram for the N-Circle Centre (see Figure 3) shows how work packages are charged with addressing each specific objective above, hence with achieving impacts at key points. ■

Integrated soil health and fertility management:

an Indian perspective

by Dr. K.L. Sharma and Dr. Ch. Srinivasa Rao, **Central Research Institute for Dryland Agriculture, India**

India is primarily an agricultural country and occupies 2.4pc of the world's geographical area and 4pc of its water resources. However, the country needs to support about 17pc of the world's human population and 15pc of the livestock. About 58pc of the population still depends on agriculture as a principal source of income and the raw materials supply a large number of industries.

In spite of efforts to increase production the country produced 259.32 million tonnes of food grains in 2011/12, of which 131.27 million tonnes were during *kharif* (monsoon) and 128.05 million tonnes during the *rabi* (post monsoon) seasons.

The 'green revolution' was largely confined to irrigated farming areas and mainly to rice and wheat, therefore the overall productivity per unit area of Indian agriculture today is much lower than other major crop producing countries. As well as several other constraints, the agricultural productivity in India is held back by the decline in soil fertility and deterioration of overall soil health. The predominant causes of soil health/quality deterioration include:

- Erosion of topsoil and loss of organic matter
- Intensive deep tillage
- Low levels of fertilizer application and widening of nutrient removal-use gap
- Imbalanced nutrition
- Mining and removal of top soil for commercial activities,
- Mono cropping
- No or low use of organic manures
- No or low green manuring
- Water logging, salinity, alkalinity and acidic soils
- Excessive use of polluting chemicals.

This article highlights several issues related to poor soil fertility and soil health and the effective management of both.

Land availability and productivity of different crops

India is an asset with large agronomic potential and vast productive land resources. Land use in India includes 157 Mha of cropland, 10.3 Mha of grazing land and approximately 70.3 Mha of land equipped for irrigation. Based on estimates on per capita land availability and crop productivity of major crops in India for the period between 1961-2014 it was found that in 2015, the per capita land area in India was; 0.12 ha for crop land, 0.01 ha for grazing land, 0.06 ha for forest land and 0.03 ha for irrigated crop land.

Increase in grain yield (kg ha^{-1}) between 1961-2014 grew from 851 to 3033 for wheat, 1542 to 3622 for rice and 957 to 2752 for maize (see Figure 1). During the same period, the yield of pulses stagnated.

Degrading land and soil

Land degradation and soil quality deterioration are two of several reasons behind agrarian stagnation and perpetuation of hunger and malnutrition and are a major threat to India's food and environmental security. Out of the 329 Mha of total geographical area in the country, the total degraded area accounts for 120.7 Mha, of which 73.3 Mha area is affected by water erosion, 12.4 Mha by wind erosion, 6.73 Mha by salinity and alkalinity and 25 Mha by soil acidity. The severity of land degradation and soil quality deterioration adversely affects the factor productivity and thus the overall productivity of crops.

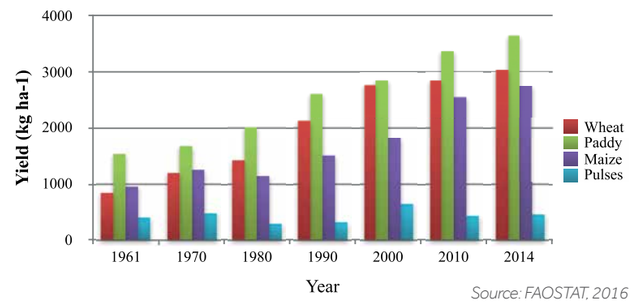
Indian soil fertility status

Being a tropical country, most Indian soils are low in organic matter and fertility. Soil test data is the best source available to assess soil fertility status. Based on the soil test values for different nutrients, soil samples are generally classified into three categories, low, medium and high (see Table 1). Using these fertility classes, a nutrient index is calculated. This approach is a general recommendation for a given area and does not consider the individual field.

Based on several soil test studies, it has been found that the Indian soils are deficient in major plant nutrients. The data on the NPK status of different soils across 500 districts during the period 1995-2008 showed that soils in 283 of the districts were low in N, 182 districts registered medium N and 33 districts were high in available N content. Around 51pc of districts were low in available P, 40pc medium and 9pc were high. In other words, in more than 90pc (combining low and medium category) of the districts availability of N and P was a critical constraint in maintaining soil productivity and soil health.

In addition, widespread deficiencies of S and Zn are also witnessed across the country.

Figure 1. National average yield of predominant crops in India from 1961-2014



Source: FAOSTAT, 2016

Table 1. Critical limits (classes) for soil fertility parameters

S.No	Soil Nutrients	Critical limits (classes)		
		Low	Medium	High
1	Organic carbon (%)	<0.5	0.5-0.75	0.75
2	Available N (kg ha^{-1})	<280	280-560	>560
3	Available P (kg ha^{-1})	<11	11-25.0	>25.0
4	Available K (kg ha^{-1})	<120	120-280	>280
5	Available Sulphur (kg ha^{-1})	<20	20-40	>40
6	Available Fe (mg kg^{-1} soil)	<4.5	--	--
7	Available Zn (mg kg^{-1} soil)	<0.6	0.6-1.2	>1.2
8	Available Cu (mg kg^{-1} soil)	<0.3	0.3-1.0	>1.0
9	Available Mn (mg kg^{-1} soil)	<3.0	--.	--
10	Available Boron (mg kg^{-1} soil)	<0.5	--.	--

Source: Takkar and Biswas

Present fertilizer use in India and future challenge

India is the second biggest consumer of fertilizer in the world next only to China. In India, the consumption of total nutrients ($N+ P_2O_5+ K_2O$) increased with galloping speed to 27 million tonnes in 2015-16 from 0.066 million tonnes in 1951-52. However, in 2015/16 there was 5.6pc increase in nutrient use over the previous year. With the anticipated increased food grain requirements, the corresponding demand for nutrients will also increase and the country has to gear up to meet this demand. There are estimates that India would need to produce 350 million tonnes of food grains to feed the population of 1.3 billion by 2025. This emphasizes the urgency for developing efficient nutrient management strategies for sustaining higher crop productivity and soil quality under intensive agriculture systems.

Declining fertilizer response is another hurdle in increasing the productivity. The constant decline in factor productivity in respect of fertilizer use is a conspicuous indicator of soil health deterioration and decline in soil resilience capacity. As an example, the fertilizer response (kg grain per kg nutrient) was reduced from 49.79 in 1970/71 to 8.69 in 2010/11.

Balanced and integrated nutrient management based on soil tests and conjunctive use of both inorganic and organic sources of plant nutrients is the ideal solution to prevent deterioration of soil health. In

Growing of Sorghum (*Sorghum bicolor*) - green gram (*Vigna radiata*) in strip cropping system along with INM practices helps in improving soil health and productivity in rainfed Alfisol soils

Growing of legumes like Cowpea (*Vigna unguiculata*) in rotation with Sorghum (Sorghum bicolor) with minimum tillage helps in protecting the land from erosion during the rainy season, increases organic matter, hydrolyzable nitrogen fractions and overall soil quality indices in semi arid tropical (SAT) Alfisol soils

addition, split application of nutrients synchronizing with crop uptake, placement of fertilizer in bands, use of slow releasing N-fertilizers and nitrification inhibitors, inclusion of leguminous crop in crop rotation, recycling of crop residues and adoption of resources conservation (water and soil) technologies (RCTs) are also advocated.

Integrated nutrient management for improving soil fertility and soil health

Integrated nutrient management (INM) is defined as the maintenance or adjustment of soil fertility and of plant nutrient supply to an optimum level for sustaining the desired crop productivity through optimisation of the benefits from all possible sources of plant nutrients in an integrated manner. Considerable research on INM has been carried out in India. The important components of integrated nutrient management and soil health improvement in India include:

- Diagnostic balanced fertilization using chemical fertilizers
- Capitalization of 'Legume effect' i.e. biological N fixation
  (a) Inter cropping with legumes
  (b) Crop rotation with legumes
- Use of organic manures (Farm yard manure, composts, vermi-compost, detoxified sewage and sludge etc).
- Green manuring, (in situ - green manuring using green manuring crops such as *Sesbania aculeata, Crotalaria juncea* and others, tree based green leaf manuring using leaves and biomass of N fixing shrubs and trees like *Gliricidia maculata* and *Leucaena leucocephala*)
- Crop residue recycling (recycling of residues of crops which are not palatable as fodder for animals)
- Use of bio-fertilizers (symbiotic and non-symbiotic N fixing bacteria, phosphorus and zinc solublisers, azolla, mycorrhizae etc...)
- Use of chemical soil amendments (gypsum, pyrites, lime etc...)
- Conservation agriculture practices (zero or minimum tillage, crop residue retention, legume based crop rotation)

> *Integrated nutrient management is defined as the maintenance or adjustment of soil fertility*

To improve soil fertility and soil health in Indian agriculture the following steps are absolutely necessary on long-term basis:

- Rejuvenation and reorientation of district soil testing labs in terms of infrastructure, capacity for sample handling, adequate and trained man power
- Periodical assessment of soil quality and issue of soil health cards to small and marginal farmers. More incentives and encouragement on agricultural management practices which enhance soil organic matter such as INM, application of organic manures, green manuring, tree-leaf based green manuring, crop residue recycling, sheep-goat penning, organic farming, conservation tillage and crop residue recycling, inclusion of legumes in crop rotation etc...
- Development and promotion of other bio-resources for enhancing microbial diversity
- Site specific nutrient management
- Increasing the fertilizer use and use efficiency through precision farming
- Amendment of problematic soils and improving their quality
- Land cover management
- Mass awareness programmes about the importance of land, water and soil resources and their protection and maintenance using electronic and print media and school curriculums. ■

About the authors:
Dr. K.L. Sharma, Principal Scientist and Former National Fellow, ICAR (Soil Science) and Dr. Ch. Srinivasa Rao, Director are placed at ICAR - Central Research Institute for Dryland Agriculture, Hyderabad, Telangana State, India. Both of the authors have extensive experience in the field of soil fertility and plant nutrition with special emphasis on conservation agriculture, residue recycling, INM and overall soil health management in rain-fed agriculture.

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Improved nitrogen use efficiency

in lowland rice fields for food security

by Yam Kanta Gaihre, Upendra Singh, Ishrat Jahan and Grahame Hunter,
International Fertilizer Development Center (IFDC)

The productivity of agricultural systems must improve substantially to support increasing populations without further conversion of wilderness into farmland. By 2050, it is estimated that 70pc more food must be produced to feed an estimated global population of over 9 bn with changing food consumption patterns and preferences.

Rice is the staple food of more than half of the world's population. More than 90pc of the world's rice is grown in Asia where one-half of the world's population and 80pc of the world's poor are concentrated. In Bangladesh, one of the most climate-vulnerable nations, farmers intensively cultivate rice on 80pc of the agricultural lands. With the increasing population growth rate, it is estimated that the demand for rice will be 56pc higher by 2050 than in 2001. Therefore, rice productivity should be increased to meet the food demand of a growing population, taking into account the dwindling amount of land area available for farming. This requires judicious use of agricultural inputs, including quality seeds and fertilizers and water management, among other good agricultural practices.

Rice field trials with different fertilizer treatments in Bangladesh

Nitrogen retention

Fertilizer use has played a crucial role in meeting the food demand of a growing world population. Among the fertilizers, nitrogen (N) fertilizer is the main driving force to produce large rice yields under irrigated and favorable rain-fed conditions. Farmers usually apply urea as a broadcast method. Much research conducted across countries reported that more than 50pc of applied nitrogen is not utilized by crops and lost to the environment as reactive forms (ammonia, nitrate, nitrogen oxides) through volatilization or surface water runoff, contributing to greenhouse gas emissions and other environmental problems such as eutrophication and groundwater pollution. This also results in higher costs for farmers given that N fertilizers generally represent over 10-15pc of crop production costs. Therefore, fertilizer management should consider the 4R concept – right methods, right time, right rates and right sources to increase use efficiency, crop yield, soil health and farm profits and to reduce negative environmental effects.

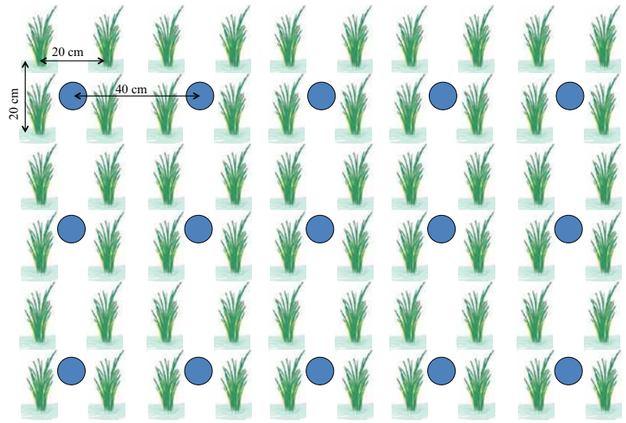
Figure 1. Fertilizer briquetting machine producing urea briquettes

Selecting a right placement method – urea deep placement

Over the past years, many research and development groups, including the International Fertilizer Development Center (IFDC), have worked on improving N use efficiency (NUE) through urea deep placement (UDP), urease inhibitors and slow and controlled N fertilizers such as polymer- and sulphur-coated fertilizers. Research conducted across different countries showed that UDP could be one the best management techniques to achieve the multiple benefits of increasing grain yields, farm profits and NUE while reducing negative environmental effects; in short, more yield with less fertilizer. In the UDP technique, urea is made into 'briquettes' (see Figure 1) of one to three grams based on required N rate and placed at a depth of 7-10 cm at a spacing of 40 cm or at the centre of four rice plants (see Figure 2) within seven days after transplanting.

Since IFDC introduced UDP to smallholder Bangladeshi rice farmers since 2008, more than 2 mn now apply the technology on 1 mn hectares of rice. The technology reduces urea use by more than 30pc while increasing yields by an average of 15-20pc. Farmers experience 24pc higher incomes, while the government of Bangladesh saves USD30 mn per year on fertilizer subsidies. If the technology is scaled up to 11 mn hectares of rice, the government's subsidy saving will be huge. There is large potential of UDP in the Asian rice growing countries where N fertilizer subsidies exist.

Figure 2. Geometry of urea deep placement



Limiting losses

In lowland rice fields, placement of N in the root zone reduces its losses and increases use efficiency and crop productivity. However, in broadcast urea, most of the N is lost within a week of application either as ammonia volatilization or surface runoff. Studies conducted by Bangladesh Rice Research Institute and Bangladesh Agricultural University show the negligible amount of N losses as ammonia volatilization, surface runoff and emissions of greenhouse gas nitrous oxide when urea was deep-placed in continuously flooded rice soils. Seasonal total nitrous oxide emissions in the dry (boro) season were 60-80pc lower in UDP compared to broadcast urea (see Figure 4).

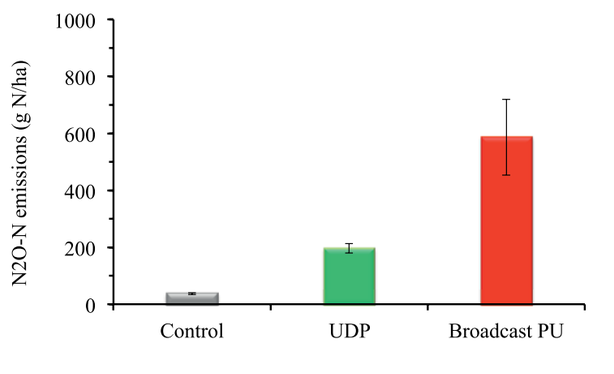
In deep placed urea, the majority of N remains in the form of ammonium, which is much less mobile than nitrates. As a consequence, more N is available to the crop throughout rice growth stages. Therefore, losses to the atmosphere, groundwater and waterways are drastically reduced. With the reduction of these losses and increased plant uptake, UDP increases N use efficiency up to 80pc compared to 30-45pc of broadcast application.

Figure 3. Farmers applying urea briquette in rice field

In addition to favourable irrigated and rain-fed environment, UDP is a potential technology for stress-prone environments such as drought, submergence and salinity. Farmers in those areas have poor control over water and in turn for fertilizer application. For conventional split application of nitrogen, farmers in drought-prone areas are unable to catch optimum timing due to an extended drought. UDP is a better alternative because it reduces the dependence of fertilizer application on weather compared with broadcast fertilization.

> *Most farmers in developing countries are not familiar with balanced fertilization*

Figure 4. Nitrous oxide (N2O) emissions from UDP, broadcast urea and control (without N) in dry season rice 2014 in Bangladesh



Balanced use of fertilizers

Fertilizers, particularly nitrogen, phosphorus and potassium – with balanced use of other secondary and micronutrients – is a major input required to produce high crop yields and improve soil fertility. However, most farmers in developing countries, such as Bangladesh, are not familiar with balanced fertilization practices. They often use excessive N and insufficient phosphorus and potassium fertilizers, with little or no secondary and micronutrient fertilizers. To address these issues, use of compound fertilizer (NPK) briquettes was recently introduced in Bangladesh, supplying all three major nutrients in a compound briquette.

The compound briquette is deep placed as with UDP. Since many farmers do not practice balanced fertilization, deep placement of compound fertilizer briquettes offers the potential for higher yields, improves fertilizer use efficiency and soil fertility because of balanced use of nutrients and reduced nutrient losses. It also saves labor with a one-time application of NPK briquette. Field trials conducted across different districts in Bangladesh showed that deep placement of NPK briquettes used approximately 30pc less fertilizer compared to broadcast prilled urea with conventional P and K application and produced grain yields and N use efficiency similar or higher than UDP.

It is a fundamental principle that crop productivity is often controlled by the most limiting nutrient. For example, if soil is deficient in any essential nutrients, addition of other nutrients will not have any yield benefits. Therefore, IFDC is currently focusing research on balanced fertilization, particularly inclusion of secondary and micronutrients. Our research being conducted in Myanmar shows that phosphorus, sulphur and potassium are as critical as N and the extent of the deficiency depends on soil type (see Figure 5). Soil analyses also show zinc as a limiting element in some soils. The availability of nutrients such as phosphorus, sulphur, iron and zinc are also influenced by changes in soil pH, as well as wetting and drying cycles, which may become more common as a management practice or due to climatic variability. IFDC is also conducting similar studies in African countries.

Reducing barriers of wider adoption

The majority of the farmers in Bangladesh are small land holders (<2 ha). Fertilizer deep placement technology is being disseminated by the Government of Bangladesh in partnership with IFDC by developing micro-enterprise briquette producers. Each local entrepreneur who owns a briquetting machine – many of whom are fertilizer dealers – produces fertilizer briquettes amounting to approximately one tonne per day.

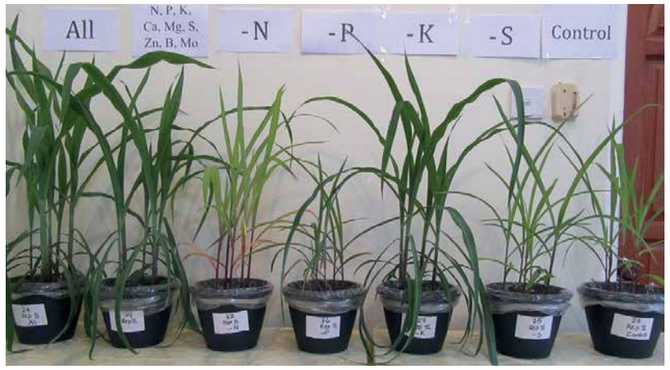


Figure 5. Maize plants grown in nutrient omission trial in Myanmar

> *Wider adoption of UDP requires government and private sector initiatives*

Farmers access fertilizer briquettes through retailers' networks. This approach is effective in small scale farming where household labour is sufficient for cultivation, but requires modifications to work in larger scale farming systems such as in Myanmar where labour availability is an issue. Due to the increasing trend of labour outmigration, availability of labour has become one of the major issues of UDP adoption.

Wider adoption of UDP requires government and private sector initiatives to make fertilizer briquettes more widely available through industrial-level briquette production while developing suitable tools for smallholder production systems to reduce the labor intensity of manually placing UDP briquettes. In Myanmar, IFDC is working with agri-machinery companies to design and develop a combine seeder and UDP applicator that can be driven using either a power tiller or four wheel tractor for rice and for maize. This will have immediate impacts, particularly for large producers and consumers of N fertilizer such as China and India. China alone consumes 29pc of the world's total fertilizer followed by South Asia (20pc). Given that China and India have recently committed to increasing fertilizer use efficiency – with China's laudable goal of zero growth in N fertilizer by 2020 being a prime example – UDP could be a key technology to contribute to these goals. ■

IFDC's current work in Asia addresses nutrient use efficiency, climate-smart agriculture, balanced soil fertility management, enhanced smallholder productivity and profitability and improved agricultural input and service markets. IFDC is promoting UDP as a climate smart agriculture because it has proven record of increasing productivity in a sustainable manner, improves adaptation of rice to stress environments by reducing risks associated with climatic variability and it reduces GHG emissions directly with lower nitrous oxide emission and indirectly with reduced ammonia volatilization and runoff losses.

Nutritional imbalance

in smallholder oil palm plantations in Indonesia

by Lotte Woittiez, **Plant Production Systems group, Wageningen University, Netherlands**

Oil palm (Elaeis guineensis Jacq.) is an exceptionally efficient producer of vegetable oil. Its potential production is estimated to be well over 10 tons of oil per hectare per year, at least three times more than the second most efficient vegetable oil producer, canola. The cultivation of oil palm provides a steady source of income for both plantation companies and smallholders. In Indonesia, the world's largest oil palm producing country, around 45% of the area under oil palm is owned by smallholders. The majority of the smallholders manage their plantations individually, applying inputs and implementing management practices as they see fit. Yields in smallholder plantations are estimated to be 3-4 tons of oil per hectare, which is lower than company-owned plantations and far less than the production potential. Poor fertilizer application practices come up in many studies as a key problem in smallholder systems. Farmers tend to over-apply cheap nutrients (especially N) and under-apply the more expensive ones (especially K), leading to nutritional imbalance. There are several obvious solutions to improve plant nutrition, but the implementation of these solutions in the complicated socio-economic context of the smallholders is challenging.

Depending on the definition, smallholder oil palm farmers own anything between a garden with a few palms and a plantation of up to 50 hectares. Unlike plantation companies, smallholders usually do not operate their own mill, so the nearby presence of a mill for the rapid processing of the harvested fresh fruit bunches is crucial.

In some cases, smallholders have a contract with one mill, often coupled with a loan for the (re)planting of the plantation. In this case, the smallholders are termed "scheme", "plasma" or "tied" smallholders. Farmers without a contract are the so-called "independent" smallholders. They are free to sell their fruit bunches to any mill, but often they are dependent on traders or middlemen, who will pay a lesser price for the bunches.

Fertilizers account for 50-70% of the variable production costs in smallholder oil palm plantations. The Indonesian government provides subsidized fertilizers aimed at smallholder farmers (less than two hectares) through a closed system of producers, retailers, and farmer groups placing requests. The subsidized products are urea, sulphate of ammonium, super phosphate (SP-36), NPK (usually Ponska: 15-15-15 + 10S) and certain organic fertilizers. Registered oil palm farmer groups can request the subsidized fertilizers, but they are also regularly (and illegally) traded on the market, for inflated prices. The subsidy policies are reflected in farmer practices; surveys among >500 oil palm farmers in Sumatra and Kalimantan showed that the majority relied on NPK Ponska, often supplemented with urea or SA and SP-36, for the mineral nutrition of their plantations. This combination of fertilizers is not sufficient to meet the nutrient demand of oil palm on most tropical soils, as large amounts of K are also removed from the plantation in the harvested bunches, and need to be replenished. While MOP is usually applied at rates of 300-550 kilogrammes per hectare in company plantations, most Indonesian oil palm farmers don't apply any because they consider it too expensive. This under-application of K is illustrated in the graph, which shows the nutrient applications in smallholder plantations as calculated from several case studies. While N and P are often applied in excess compared with the estimated offtake rates, K is applied in insufficient amounts, both compared with N and with the offtake rates. A pilot sample collection among 48 smallholders in Sumatra and Kalimantan confirmed widespread K deficiency in the palm tissue, alongside with N and P deficiencies in some plantations.

Nutrient deficiency symptoms in a mature smallholder plantation in West-Kalimantan

Investment limitations

The current low crude palm oil (CPO) prices, combined with insecure relationships with mills, poor bunch quality, poor planting material, and increased climatic risks due to climate change, cause Indonesian smallholders to be less willing to invest in fertilizers. Under such conditions, aiming for maximum yields is risky, and it is not always the most profitable approach. However, there are numerous options to improve palm nutrition without requiring large additional investments in fertilizers.

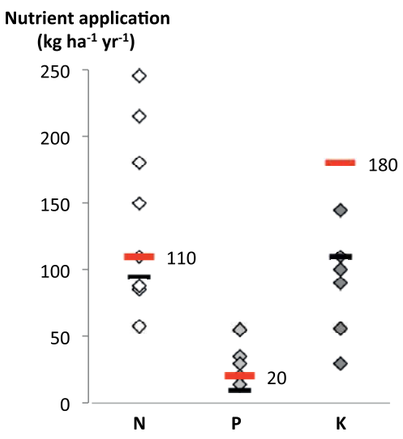
Firstly, the use of mill waste streams, especially empty fruit bunches, as organic fertilizer is necessary for improving the nutrient balance in smallholder plantations. Empty bunches can be applied in several ways: directly as a mulch; incinerated to produce bunch ash; or mixed with palm oil mill effluent (POME) and composted for two to four months. Empty bunches are very rich in K, and an application of 25-40 ton ha-1 as mulch can meet the K demand of a high-yielding plantation for one year. The positive effects of empty fruit bunch applications on soil quality are well documented, and include strong increases in organic matter content, water holding capacity and water infiltration, and nutrient content. In peat soils, bunch ash can provide large quantities of K and alleviate soil acidity. But empty fruit bunches are not much used by smallholders, for several reasons, such as lack of awareness among about the benefits, lack of access due to competition with company plantations, high transport and labour costs, and lack of a proper distribution system at mill level. When companies are allowed to buy up empty bunches at the expense of smallholders, this leads to a de facto stream of nutrients (especially K) from resource-constrained smallholder plantations to resource-rich company plantations. The commitment of leading trading and plantation companies (especially RSPO members) to ensure that their mills implement fair and proper distribution of empty bunches to smallholders would be a great step forward.

Management and applications

Secondly, plantation management needs to be optimized in order to achieve maximum nutrient capture. Problems in plantation management include the clear-weeding of fields (leading to soil erosion and fertilizer run-off) and the inefficient spreading of the available organic material (pruned fronds). Clear-weeding practices are often a consequence of lack of knowledge, but a certain

Figure 1. Nutrient applications in Indonesian smallholder oil palm plantations from case studies among >500 farmers in Sumatra and Kalimantan.

Each case study is represented with a dot. The red line shows the nutrient removal at a production of 24 ton fruit bunches ha^{-1} $year^{-1}$, and the black line shows the average fertilizer applications in oil palm plantations in Indonesia. Data from publications by Michael Euler, Janice Lee, Lifianthi, Irina Comte, Hereward Corley, and Patrick Heffer.



> *When farmers are not supported by companies, they usually cannot access adequate fertilizer*

preference for the aesthetics of a 'clean' plantation and the use of imprecise or poorly calibrated spraying equipment also play a role. Although path and circle weeding is more rapid and requires less herbicide use once the circles and paths have been established, clear-weeding is still perceived by farmers as necessary and useful to keep weeds under control. Frond stacking is normally done in piles or rows, but stacking in boxes is recommended to maximize the covered soil area, speed up decomposition, and reduce surface runoff. Harvesters cut most of the fronds, but they are paid per ton of harvested bunches and therefore have no incentive to implement proper frond stacking. This leads to limited implementation of box stacking, although it does not take more time or effort than stacking in a pile or row.

Thirdly, poor fertilizer application practices reduce nutrient capture. Farmers tend to apply all fertilizers in a narrow band around the palms (leading to increased leaching and run-off). They apply fertilizers only once per year, rather than in multiple splits, and mix them manually. While the available studies do not show any effect of fertilizer placement on oil palm yield, the even spreading of fertilizers on the largest possible soil area is recommended in mature plantations, based on agronomic principles.

Roots of mature palms are well able to colonize the area between palms, and the application of fertilizers on top of decomposing fronds, rather than on the dry and bare soil in the palm circle close to the trunk is recommended to improve fertilizer infiltration and reduce leaching and run-off. The application of N, K and Mg fertilizers in at least two splits reduces leaching and ensures nutrient availability throughout the year. The use of multiple rounds is especially important on light soils and in high-rainfall areas. The manual mixing of straight fertilizers is obviously not recommended. Farmers use this as a labour-saving option, and are not aware of the poor fertilizer distribution that will result.

Empty fruit bunches

Nutrient requirement knowledge

The application of sufficient quantities of good-quality fertilizers remains an important challenge for the smallholders. If the over application of N is reduced and the resources are re-invested in K fertilizer, then the overall palm nutrition could be improved without requiring additional investments. But when farmers are not supported by companies, they usually cannot access adequate fertilizer recommendations. It is considered good practice in oil palm cultivation to rely on leaf sampling in order to provide recommendations, but for many farmers this is prohibitively expensive, due to their smaller scale. In addition, training and experience are required to identify the correct leaf for sampling, and to collect and process the samples. Many farmers have limited knowledge about the nutrient requirements of their crop, which limits their ability for critical selection of proper fertilizers. They rarely have access to well-trained extension workers who can provide best-estimate recommendations. Fake fertilizers are a common problem throughout Indonesia, with the expensive fertilizers being replaced with cheaper materials, such as ground bricks in case of MOP. When farmers work together as a group, they can afford to test the fertilizers they purchase, but for individual farmers this is not feasible. The purchase of expensive fertilizers therefore becomes risky, and many farmers are not aware of simple tests such as dissolving fertilizers in water. In addition to fake fertilizers, there are many 'snake oil' fertilizers on the market, such as bacterial and hormonal solutions. These are sold to the farmers through smart sales campaigns and because the farmers lack background knowledge about plant physiology and nutrition, they are not well able to detect nonsense products. It is very worrying to see farmers invest in overpriced bacterial solutions, which also require large labour-investments for their application, but fail to invest in proper mineral fertilizers such as MOP because they are considered too expensive.

A smallholder farmer in Jambi applies dolomite in the palm circle

Access to fertilizers

There is currently much attention from industry, government and NGOs to include smallholder oil palm producers in the supply chain and promote the use of good agricultural practices. In order to achieve lasting improvements in plant nutrition, partnerships with farmers, mills, fertilizer dealers, banks, and extension services are required. An early and affordable win is to encourage mills to ensure the availability of empty fruit bunches and to promote their use among smallholders. Also, farmers need to be encouraged to work together as a group to access subsidized fertilizers. Although the benefits of subsidized fertilizers may be debated, it is clear that the lower costs can stimulate farmers to buy fertilizers, especially when returns on investments are expected to be small due to constraints such as poor planting material and low prices for fruit bunches. Subsidized fertilizers alone are not sufficient to provide the correct nutrient balance and therefore it is essential that farmers are connected with a reliable fertilizer dealer, or are provided with good-quality fertilizers by the mill they deliver to. In order to purchase the fertilizers, some farmers will need access to credit through banks, cooperatives, or traders. The use of mobile devices and apps can help farmers to implement proper yield recording, which is necessary to support decision-making with regards to fertilizer applications. Finally, good trainings and extension materials (such as posters and movies) dealing with the basics of soil science, plant physiology, and plant nutrition should be made available for those farmers who interested in becoming more knowledgeable.

The smallholder oil palm sector in Indonesia is an important driver of rural development and continues to expand its market share. Addressing the numerous issues related to plant nutrition can provide large benefits to smallholders and improve the profitability and sustainability of the Indonesian oil palm sector as a whole. ■

Lotte Woittiez is a PhD student with the Plant Production Systems group of Wageningen University in the Netherlands. Her work focuses on yield gaps in smallholder oil palm plantations in Indonesia. The project is co-funded by K+S Kali, Johnson & Johnson, SNV, and IDH. The commercial partners played no role in the collection, analysis and interpretation of the data, nor in the writing and the decision to publish.

The unholy cross

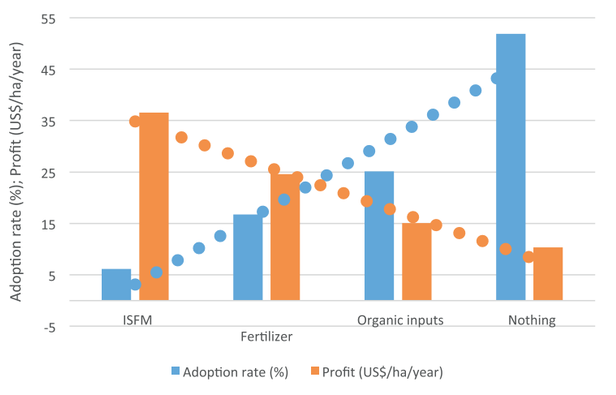
Profitability and adoption of soil fertility management practices in sub-Saharan Africa

by Ephraim Nkonya, **Senior Research Fellow, International Food Policy Research Institute (IFPRI), USA**

Intensity of fertilizer use (the amount of nutrients used) in sub-Saharan Africa (SSA) has only increased from one kg/ha of nitrogen, phosphorus and potassium (NPK) in 1961 to 13kg NPK/ha in 2014.

The slow growth rate of inorganic fertilizer use has translated into poor crop production – plunging the region into a net food importer status since 1980. Different methods have been used by SSA countries to increase fertilizer consumption and consequently food production. The most common method has been fertilizer subsidies. This has led to greater use of fertilizers but such programmes have led to crowding out private sector development in input marketing. The subsidies have also been facing budgetary challenges – making them unsustainable. It is important to examine the farmer fertilizer adoption pattern in order to better understand policies and strategies that could be used to enhance fertilizer use. This article examines profitability and adoption rates of different management practices in SSA.

Figure 1. The unholy cross: Inverse relationship between profitability and adoption rate of soil fertility management practices



Note: Average adoption and profitability of soil fertility management practices in Kenya, Malawi, Mali, Niger, Nigeria, Senegal and Uganda

Source: Calculated from household survey raw data from each country

The unholy cross

IFPRI conducted a study to determine the profitability of fertilizers and other soil fertility management practices and the results reveal a puzzling pattern. According to economic theory: The higher the profit of a soil fertility management, the higher the adoption rate. However, the results from IFPRI are contrary to this principle.

An analysis of data on household surveys from seven SSA countries showed an inverse relationship between profitability and the adoption rate of soil fertility management practices (see Figure 1). The integrated soil fertility management (ISFM) – which is a combination of improved varieties, organic inputs and judicious amount of inorganic fertilizer – has the highest profit. The IFPRI study also indicated that in addition to being the most profitable practice, ISFM reduces climate-related production risks and is more sustainable than use of inorganic fertilizers or organic input alone. Surprisingly, the adoption rate of ISFM is low and the majority of farmers (52%) do not apply inorganic fertilizer or organic inputs.

There are a number of reasons why farmers do not follow the ISFM method.

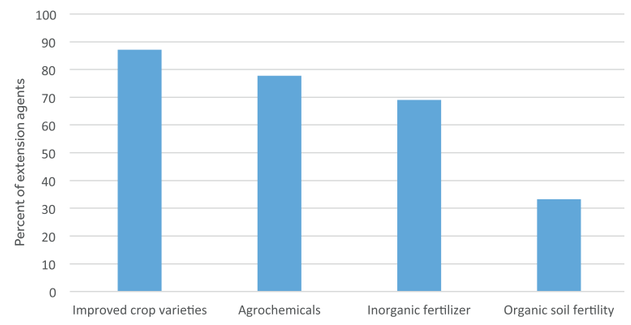
Firstly, the promotion of ISFM by extension agents is weak. IFPRI conducted a study of extension agents in Nigeria and Uganda and asked them to report the type of extension messages that they give to the farmers.

Only a third of extension agents provided messages on organic soil fertility management practices – compared with about 70% who provided advisory services on inorganic fertilizers (see Figure 2). Not one extension agent in either country promoted the use of ISFM.

This suggests that the capacity of extension agents to provide advisory services on ISFM is weak.

Extension information on improved varieties and agrochemicals were the most common (provided by about 90% of extension agents). These are traditional information provided to farmers since the early 1960s to increase crop yield. The new paradigm of ISFM started in the late 1980s and it is possible that the extension service providers did not receive adequate training on ISFM methods. The majority of the extension agents interviewed were middle-aged with an average age of 44 in both countries. IFPRI conducted this study in 2012, which would mean they graduated college in the early 1990s when ISFM was not yet widely known.

Figure 2. Type of information given to farmers by extension agents in Nigeria and Uganda



Source: Survey of extension service providers in Nigeria and Uganda

> *The study demonstrated that labour accounted for 50% of the total cost of production*

ISFM involving biomass transfer is labour intensive

The majority of farmers who used organic inputs applied manure. The study demonstrated that labour accounted for 50% of the total cost of production for ISFM adopters who used manure or other forms of organic inputs involving biomass transfer – i.e. the transportation of organic inputs from a source (e.g. cattle kraal) to crop plots.

The best strategy to address the high labour intensity of ISFM is to use agroforestry – i.e. the incorporation of trees on agricultural land. Studies have shown that planting leguminous trees on cropland could provide a large quantity of atmospheric nitrogen and carbon, both of which enhance soil fertility. For example, Sesbania sesban could provide to 84kgN/ha, a level that delivers the entire amount of recommended amount of nitrogen for maize – the leading consumer of fertilizer in SSA. Agroforestry labour is only high during planting and the labour required to maintain agroforestry trees is quite modest.

High fertilizer cost

Fertilizer prices in SSA are much higher than in other countries - a kilogramme of urea costs around one US dollar. In the US, urea pricing is 35% lower at USD0.65 per kg. High fertilizer pricing in SSA is a result of high transportation costs, which translates into lower profits for the farmer. The majority of farmers also use unimproved varieties which have a low yield response to fertilizers. All these factors translate to low fertilizer demand.

What could be done to undo the unholy cross?

A number of factors need to be taken into account to address the challenges.

Part of the solution would be to send the extension agents back to school. As mentioned, the capacity of extension agents to provide advisory services on ISFM, organic soil fertility and other new paradigms on sustainable soil fertility management practices needs to be improved.

Short-term training and workshops would help to address this. Researchers, NGOs and other scientists, with sufficient knowledge of current sustainable soil fertility

Girl selling agricultural products in Kilosa Tanzania, February 2016 .....*Image credit: Milo Mitchell, International Food Policy Research Institute*

> ***Smallholder fertilizer users need to be treated as commercially oriented farmers***

management practices, could provide this training.

In addition, ISFM and other soil organic fertility management practices need to be incorporated into the agricultural college syllabus to ensure that graduates are equipped with the up-to-date knowledge.

Another issue is that the government and even donor policies and strategies have treated smallholder farmers as subsistence farmers and this is out-dated.

As a consequence, the policies and strategies directed towards the farmers have largely focused on provision of production rural services.

The public extension agents affiliated with the ministries of agriculture provide the majority of production-related advisory services. In most countries, agricultural marketing advisory services are relegated to the ministry of industries and trade – where they typically do not receive sufficient attention. Collection of market intelligence and dissemination of marketing information such as crop prices, demand and supply are also limited. The lack of agricultural market information and advisory services leaves smallholder farmers with limited capacity to participate in markets. Instead, they conduct business with agricultural traders who have better negotiation skills and access to market information. Limited market participation weakens the smallholder farmer's ability to buy fertilizer, improved seeds and other key inputs. Additionally, profitability would be improved if fertilizers were applied to improved crop varieties that respond better to fertilizers.

Smallholder fertilizer users need to be treated as commercially oriented farmers and appropriate advisory and other rural services should be provided. This includes provision of marketing advisory services, which also need to be incorporated in the strategies for increasing capacity of extension services and included in the syllabus of agricultural colleges. ■

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Shipping news

MAR/APR 2017

NCOC to start Kashagan sulphur export in 2017

NCOC which operates the offshore field Kashagan in Atyrau region plans to start export of the sulphur produced as a result of treatment of the Kashagan's acid oil.

"During execution of the project it is supposed to sell the entire sulphur produced at Bolashak facility as a result of treatment of Kashagan oil. During the project in average there will be produced about 1.1 tons of elementary suphur per year which is 3,800 tns per day. Export of sales sulphur is planned for mid 2017", said NCOC Managing Director Bruno Jardin.

Eagle Bulk Shipping Announces Agreement to Acquire 9 Ultramax Vessels

Eagle Bulk Shipping Inc. has announced that it has reached a definitive agreement to purchase a minimum of six and up to nine Crown-63 Ultramax dry bulk sister vessels for an aggregate price of USD153M, assuming all nine ships are transacted. The vessels, which range in age from 2-5 years, will be acquired from Greenship Bulk Trust, a company registered on the Norwegian OTC list. The agreement includes the outright acquisition of six vessels, with an additional three vessels contingent upon final approval from Greenship's unit holders.

Deliveries are anticipated to commence in April of this year.

Gary Vogel, Eagle Bulk's CEO, commented, "Eagle Bulk continues to execute on our fleet renewal and growth strategy, and today's announced acquisition affirms our ability to transact in a meaningful way. We are especially pleased that we were able to reach an agreement to purchase six, and potentially nine, sister ships en bloc in a market where quality tonnage is difficult to find. We view this as a milestone transaction, as it can increase our number of vessels by over 20pc while meaningfully advancing the build-out of our owner-operator business model."

Assuming the successful delivery of all nine vessels, the Eagle Bulk fleet will consist of 50 owned vessels.

Fixtures - Examples in January/February 2017

ROUTE	SIZE	LOAD/DISCHARGE RATES TPD	$ RATE
Loading Arabian Gulf			
Bulk Sulphur			
Delivery Jubail – redelivery China	58,000 dwt	On time charter	9,250 pd
Ruwais – Santos	37,000	8,000 SHinc / 12,000 SHinc	15
Bulk Urea			
Ruwais – Fairless Hills	36,000	5,000 SHex / 6,000 SHinc	c 20
Assaluyeh – Yantai	60,000	8,000 SHex / 8,000 SHinc	9/10
Ruwais – Fairless Hills and Mississippi River	44,000	5,000 SHex / 6,000 SHinc - 10,000 SHinc	c 20 (basis 1/2)
Mesaieed - Brazil	40,000	10,000 SHex / 5,000 SHinc	14.5
Assaluyeh - Topolobampo and Manzanillo	30,000	8,000 SHex / 5,000 SHex	c 30
Jubail – Vitoria	44,000	6,000 SHex / 5,000 SHinc	c 14
Assaluyeh – 1 to 3 ports Turkey	30,000	8,000 SHex / 5,000 SHex	c 17 (basis 1/1)
Loading Baltic/Continent (including Barents Sea)			
Bulk Fertilizers			
Delivery Baltic – redelivery Far East	57,000 dwt	On time charter	16,000 pd
Sluiskil and Heroya – 3 ports Brazil	25,000	6,000 SHex / 4,000 SHinc	24
Glomfjord and Heroya – 2 ports West Coast Mexico	21,000	6,000 SHex / 4,000 SHinc	42.5 (basis 2/2)
Bulk AN			
Riga - Salaverry and Callao and Matarani	30,000	10,000 SHinc / 4,000 SHinc	28/29
Bulk Urea			
Riga – Great Lakes	25,000	8,000 SHinc / 3,000 SHinc	c 25
3 ports Baltic – Topolobampo and Manzanillo	34,000	8,000 SHinc / 5,000 SHinc	c 35 (basis 3/2)
Kotka – Abidjan and Douala	27,500	7,000 SHInc / 2,000 SHInc	34 (basis 1/2)
Bulk MOP			
St Petersburg – Phu My and Quinon	36,000	8,000 SHinc / 2,500 SHex	34 (basis 1/2)
Klaipeda – China	62,000	12-15,000 SHinc / 5,000 SHinc	29
Bulk Sulphur			
Ust Luga – Tampa	35,000	7,000 SHex / 8,000 SHinc	c 25
Ust Luga – San Lorenzo and Buenos Aires	30,000	7,000 SHex / 4,000 SHex	28/29
Loading Mediterranean/West Africa			
Bulk Fertilizer			
Delivery Morocco – redelivery Singapore	52,000 dwt	On time charter	12,000 pd
Bulk Urea			
Arzew – Mississippi River	29,000	5,00 SHex / 10,000 SHinc	14.5
Onne - Mississippi River	33,000	8,000 SHinc / 10,000 SHinc	15.5
Loading Asia			
Bulk Urea			
Karachi – Mombasa	27,000	3,000 SHex / 2,000 SHex	c 19
China – 3 ports West Coast Central America	33,000	4,000 SHInc / 5,000 SHinc	c 25 (basis 1/3)
Bulk Sulphur			
Delivery Kandla – Redelivery China	34,000 dwt	On time charter	5,200 pd

Krishnapatnam Port Container Terminal (KPCT) – Connectivity boost to Far East and South-East Asia with the commencement of HMM's weekly ACS Service

A direct weekly service of Hyundai Merchant Marine's (HMM) ACS Service was flagged off from Krishnapatnam Port Container Terminal in February. Inauguration of the maiden vessel, 'M.V. HYUNDAI PRESTIGE', heralded a new chapter in the EXIM trade from East Coast of India.

The KPCT team conducted a formal inaugural ceremony commemorating the maiden call with Mr. Y.D Park (MD, Hyundai Merchant Marine India) and Mr. Anil Yendluri (CEO, Krishnapatnam Port) launching the service from KPCT. Mr. Jithendra Nimmagadda (COO, KPCT) welcomed the vessel by presenting a memento to the vessel Captain Musteata Loan. Sales, Operations and Customer service teams of HMM and their agents Choice Group along with KPCT team were part of this memorable inaugural event.

The port rotation of this Service is: Krishnapatnam – Port Klang – Singapore – Pusan – Ulsan – Shanghai – Hongkong – Yantian

This weekly service will provide the fastest and most competitive service to exporters/importers of Andhra Pradesh, Telangana, Karnataka and Northern Tamil Nadu fastest connectivity to the ports of Port Klang, Singapore, China, Busan, US West Coast and European markets.

HMM team announced that this service was possible due the immense support received from the EXIM trade particularly from exporters of Tobacco, Shrimps, Cotton, Granite, Buffalo meat, Chillies, etc. and Importers of Solar panels, Furniture, Pharmaceuticals, Timber, etc. and due to the World-class facilities of KPCT.

Rhine freight rates fall but barge restrictions persist

Freight rates for Rhine barges kept falling this week for locations south of Frankfurt, as water levels on the river have recovered significantly over the past month.

Freight rates for gasoil barges travelling south from the Amsterdam-Rotterdam-Antwerp hub declined this week by 7pc for Frankfurt, 6pc for Karlsruhe and 9pc for Basle. Rates for all three locations have gone down by around 70pc in total since late January, when they were at their highest since November 2015.

But levels at measuring point Kaub near Frankfurt are still below the 200cm required for barges to pass the bottleneck without restrictions on loading capacity, with barges currently loading around 60-70pc. Barges will be able to pass Kaub fully loaded again starting this Friday, according to current estimates by measuring service Elwis.

Water levels at Kaub were at 152cm on average in February, already a significant improvement in conditions after levels had lingered around 77cm on average throughout December and January. The level at Kaub was at 163cm on Wednesday and is forecast to reach 226cm on March 4 before slightly declining again, according to Elwis.

Melnichenko (Eurochem) puts a value on Murmansk port

Fertilizers producer Eurochem sold a 25pc stake in the Murmansk Commercial Sea Port to SUEK, the coal company in late 2016. The deal is worth RUB8.74 bn (USD143 mn).

Sources at Eurochem say that the Murmansk deal reflects the port's market price.

That would indicate that the current total value of the whole Murmansk port is about USD572 million.

Both Eurochem and SUEK are owned by Andrey Melnichenko, the business tycoon ranked as Russia's 11th richest man. In 2016, he had personal wealth of USD13.4 billion, figures from Forbes indicate.

In late 2012, Eurochem bought 47,67pc of the Murmansk Sea Port. That same year, SUEK, the coal company, acquired another major stake.

While Eurochem uses the Murmansk port for out-shipments of fertilizers and ore from Kovdor, SUEK exports major volumes of coal from site. In 2016, the coal company exported 14 million tons of coal from Murmansk, which was more than 90pc of total port turnover.

Andrey Melnichenko controls more than 90pc of both Eurochem and SUEK.

Port of Catoosa reports shipping tonnage for January

Shipping tonnage volumes were strong during the month of January 2017, with the Tulsa Port of Catoosa shipping 258,243 waterborne tns. One of the commodities routinely shipped on the waterway is liquid asphalt, shipped by Nustar Energy. Liquid asphalt is used in road construction.

Representative Ammonia Fixtures - January & February 2017

VESSEL	VOYAGE LOAD/DISCHARGE	CARGO (METRIC TONNES)	LOADING DATE	FREIGHT (US$ PT)	CHARTERER
Al Jabirah	Saudi Arabia / Morocco	23,400	Jan 01-05	t/c	SABIC
Cambridge	Estonia / Morocco	23,000	Jan 01-05	t/c	OCP
Touraine	Mississippi River / Belgium	25,000	Jan 05-10	rnr	CF Industries
Gas Grouper	Algeria / Belgium	23,300	Jan 05-10	rnr	Trammo
Clipper Mars	Saudi Arabia / Tunisia	30,000	Jan 10-15	t/c	Ameropa
Hellas Apollo	Trinidad - Venezuela / US Gulf	40,000	Jan 15-20	t/c	Koch
Gas Ray	Brazil / Morocco	23,400	Jan 15-20	t/c	Trammo
Marycam Swan	Oman - Bahrain	15,350	Jan 20-25	t/c	Trammo
Eupen	Saudi Arabia / South Korea	25,000	Jan 25-30	t/c	Ma'aden
Yara Kara	Estonia / Norway	14,000	Jan 25-30	t/c	Yara
Clipper Neptun	Mississippi River / Far East	40,000	Feb 01-05	t/c	Koch
Al Jabirah	Algeria / Belgium	23,400	Feb 01-05	t/c	OCI
AlMarona	Qatar / Jordan	15,300	Feb 01-05	t/c	Muntajat
GasChem Stade	Kuwait / West Coast India	13,000 pc	Feb 01-05	t/c	Trammo
Cambridge	Mississippi River / Morocco	23,000	Feb 05-10	t/c	OCP
Navigator Nova	Qatar / 3 x India	23,000	Feb 05-10	t/c	Muntajat
Rose Gas	Saudi Arabia / 2 x East Coast India	18,000	Feb 05-10	rnr	Ma'aden
Gas Ray	Algeria / Senegal - Morocco	23,000	Feb 10-15	t/c	Trammo
Coral Ivory	Latvia / Sweden	4,000	Feb 10-15	t/c	Yara
Clipper Mars	Ukraine / East Coast India	40,000	Feb 15-20	t/c	Ameropa
GasChem Stade	Oman / Turkey	23,000	Feb 20-25	t/c	Trammo

Key: pc = Part cargo | rnr = Rate not released | t/c = Timecharter basis

Source: ABS, Oslo

ABS are shipbrokers specialised in gas and tanker chartering for the fertilizer and chemical industry. Tel: +47 2311 8200 Fax: +47 8502 9000 Email: mail@abs.no

Note: The information provided above is given in good faith and is believed to be correct but cannot be guaranteed. No responsibility or liability can be taken by ABS or the publishers for the use of this information.

Over 90pc of roads in the U.S. are made of asphalt, according to the American Oil and Gas Historical Society. In 2016, Nustar Energy shipped over 31,000 barrels of asphalt through the port, by barge. But Nustar, like many of the Port of Catoosa's shipping partners, brings more than just commodities through the Tulsa area; they also give back to the local community.

Nustar Energy purposely invests in the Tulsa area giving back to local, nonprofit organizations.

Nustar Energy, which has been at the Port of Catoosa since 2004, demonstrates the importance it places on being invested in the communities where it is located. In fact, Nustar matches 50pc of all donations that it's employees make to the Tulsa Area United Way. That means that the company donated more than USD15,000 last year alone.

Additionally, all Nustar employees donate time throughout the year to the Salvation Army, 4H, Special Olympics and numerous other charities.

Nustar Energy, a terminal and pipeline company based in San Antonio, Texas, operates 88 terminals nationwide and miles and miles of pipeline. Nustar stores and ships all types of products from crude oil, gasoline, fertilizer and asphalt.

The Port of Catoosa location receives, stores and ships liquid asphalt and Nustar works to keep as much product locally controlled and operated as possible.

Nustar Energy is diversified in its operations, delivering product by rail, truck and barge. Local trucking companies are used, which also helps the community by keeping those transportation jobs close to home. The City of Tulsa-Rogers County Port Authority is proud to be able to partner with companies like Nustar and the other 70+ companies located at the Port.

The Tulsa Port of Catoosa is a singular combination of a multi-modal shipping complex and 2,500-acre industrial park resulting in an annual economic impact of USD300 million to Oklahoma.

The complex hosts roughly 72 companies and employs nearly 3,200 Oklahomans.

Located at the head of navigation for the McClellan-Kerr Arkansas River Navigation System in Northeast Oklahoma, it is one of the largest, most inland river-ports in the US.

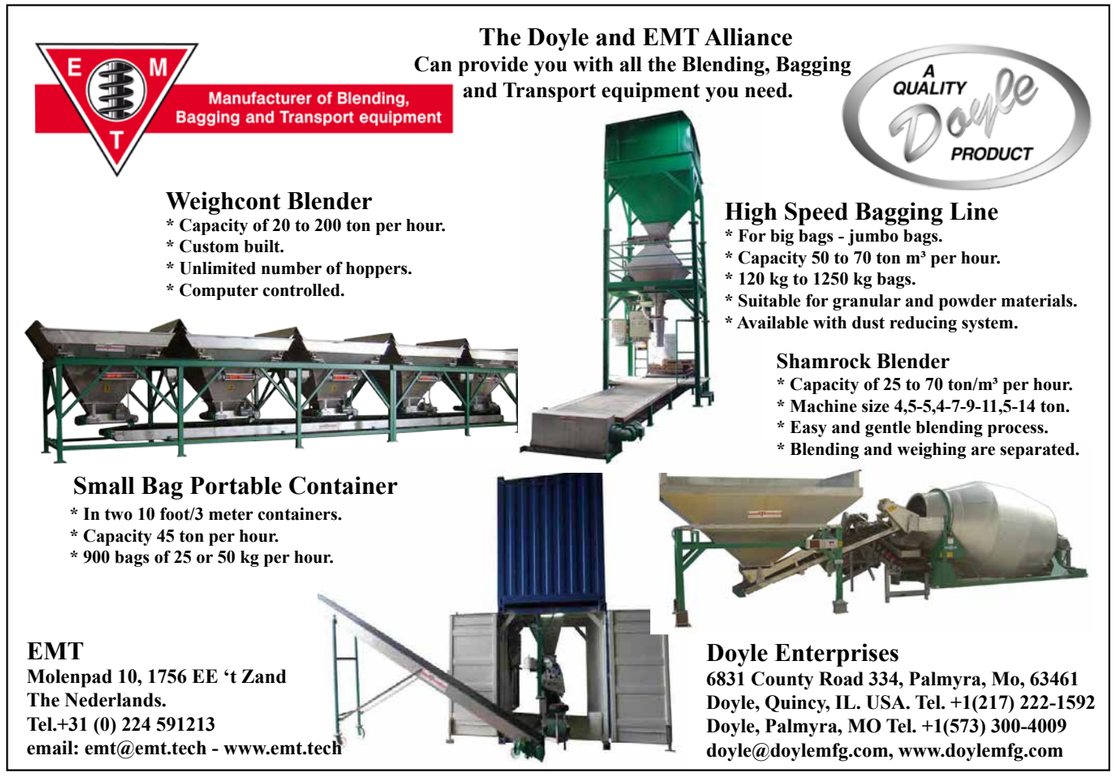
The Tulsa Port of Catoosa's unique position allows companies to move millions of tons of bulk freight by barge each year and at a fraction of the cost and environmental impact of rail or truck. Just a few of the bulk freight industries utilizing the Tulsa Port of Catoosa includes portions of fertilizer distributors, industrial gas suppliers, wheat growers and manufacturers of consumer goods.

The Port of Catoosa is managed and operated by the City of Tulsa-Rogers County Port Authority and provides development services through Tulsa's Port of Catoosa Facilities Authority.

Port of Bellingham hires new marine terminals Business Development Manager

The Port of Bellingham, US, is pleased to announce the hiring of Chris Clark as its Marine Terminals Business Development Manager. Mr. Clark will be responsible for sales, marketing and business development at the Bellingham Shipping Terminal and Bellingham Cruise Terminal.

Mr. Clark has over 30 years of experience establishing new shipping routes for bulk and break bulk cargoes throughout the world including a period exporting goods from Whatcom County. In the 1990s, Mr. Clark helped launch a break bulk line shipping frozen poultry and meat from Bellingham Cold Storage to the Russian Far East. ■



The visual impact of colour on fertilizer formulations

by Adam Newberry, **New Business Development – performance colourants and ingredients, Milliken & Company**

Within the agricultural sector, colour is utilized in many applications such as fertilizer, seed treatment, and crop protection. The two main reasons for its use are: indication and identification.

'Indication' is a trigger to represent the presence of a particular material or item. It is hard to indicate that white salt is present in a glass of water because it forms a clear and colourless solution, but you would quickly realize it upon tasting. However, adding food colouring to the salt first will make it very apparent when it is also in an aqueous salt solution.

'Identification' highlights a specific item or trait amongst many options. Vegetable farming provides a great example. A farmer may need different fertilizer blends depending on which crop is being addressed. However, when they all look alike it can be difficult to ensure the appropriate fertilizer is matched with the relevant crop. A solution would be to colour a tomato-specific fertilizer red and one designed for leafy vegetables green. Colour can be utilized for more than just a visually pleasing afterthought, it can be a valued contributor to a formulation.

Colour contamination

Using colour has traditionally come with its challenges. Powered colours are dusty and messy to work with, having the tendency to spread and colour everything with which they come into contact. Pigments and dyes are inherently a dry powder or particle. This means they come in the form of very light and airy powders that create high dusting in manufacturing or they have been compacted into hard particles that are difficult to handle and disperse. These materials are designed to stain the surface of fertilizers, however, the employees, equipment and the facility are also stained. This staining can lead to long changeover times between batches or contamination of product, both of which lead to losses in time and money. Alternatively, liquid dispersions or solutions are available for some colourants but these have many inherent issues including low colour concentration, poor shelf-life, high water content, poor carrier compatibility, poor coverage. They also still present significant challenges in regard to staining.

(Left) Through enhanced brand identity, application indication and increased functionality, soluble colourants allow for easy blending for a broad colour space with low inventory requirements. This reduces waste and downtime, which ultimately saves money.

(Above) 'Liquitint Agro' colourants provide a broad range of colour options that increase the value of your fertilizer offerings

> *Colour plays a significant role in fertilizer formulations*

Pigments and dyes for fertilizers

Water soluble fertilizers are commonly sold as powders and their users require complete solubility when added to the irrigation system. Since pigments are defined as insoluble particles or agglomerates, this immediately presents a major problem. No manufacturer wants to add a colour to a formulation only to have it clog the customer's spray nozzles or settle to the bottom of the mix tank.

Additionally, water soluble fertilizers are highly hydroscopic. This creates a number of issues for dyes. Dyes are small molecule materials that can be easily absorbed by the fertilizer particle (or skin) requiring high loadings to provide the desired visual effect. Also, if the dye is added via an aqueous liquid solution, the low solubility of dyes in water forces high levels of water to be added to the fertilizer leading to compaction and caking of the fertilizer. This is unwanted by most product manufacturers who would prefer to sell a free-flowing powder fertilizer rather than a brick to their customers.

Innovation in non-staining liquid colourants

In a major breakthrough to support the use of colour within agricultural formulations, Milliken & Company has developed a unique liquid colourant technology that overcomes existing challenges. 'Liquitint Agro' colourants employ a unique technology and are neither traditional pigments nor dyes. Its unique nature makes it inherently liquid. It also exhibits non-staining characteristics. As such it allows many interesting and beneficial properties for the fertilizer manufacturer and their customers.

For the manufacturer, traditional dusting issues are resolved when handling a liquid product. In addition, the non-staining behavior of these colourants means that changeover times and waste are also significantly reduced. Other benefits of this technology include; deep and bright colours to highlight high quality fertilizers, broad blendability, high chemical stability and easy handling.

Furthermore, 'Liquitint Agro' also creates greater inventory flexibility. It is possible to blend thousands of colours from across the spectrum on demand from only three to four liquid colours held in inventory. This advantage supplements the aforementioned benefits of quick colour changes between batches, no dusting and staining of the plant, as well as no detrimental issues for the fertilizer product.

A bright future

Colour can play a significant and highly beneficial role in fertilizer formulations. The new opportunities created for manufacturers to easily utilize bright and deep colours and highlight quality and breadth of product offering will advance greater acceptance for colouration in this industry segment. ■

People & events

EuroChem announces new Head of Russian subsidiary

EuroChem Group AG has announced that the Board of Directors has approved the appointment of Dmitry Sokov as Head of its Russian subsidiary, JSC MCC EuroChem.

Based in Moscow, Mr Sokov will manage day-to-day operations and further develop EuroChem's business in Russia. He will report to the Group's CEO, Dmitry Strezhnev. With EuroChem's significant global expansion, this appointment will enable Mr Strezhnev to focus on the implementation of the Group's global strategy and further international growth.

Prior to EuroChem, Mr Sokov held a number of senior management positions during his long career with JSC Cordiant, including most recently serving as its CEO from 2012. He holds an MBA in Strategic Management from one of Russia's leading universities, the National Research University Higher School of Economics, and graduated from Russia's leading technical university, the Moscow State Technological University "STANKIN", with a degree in Financial Management.

Dmitry Strezhnev, EuroChem CEO, commented: "We are pleased to welcome Dmitry Sokov as head of EuroChem's well-established business in Russia. With his wealth of management experience in the Russian chemical industry, we are confident that Dmitry will significantly contribute to the implementation of the Group's strategy in one of its key markets and will actively grow EuroChem's fertilizer business there."

Dmitry Sokov said: "I am honoured to step into the role of Head of EuroChem's business in Russia. EuroChem is widely known as one of the leading global fertilizer companies and a trusted industry brand not only in Russia but worldwide. I would also like to thank EuroChem's Board for putting their confidence in me. I'm impressed by what the Russian team has already accomplished and looking forward to working together on taking EuroChem's Russian business to the next phase of growth."

Sirius Minerals announces Executive Director appointment

Sirius Minerals PLC announces the appointment of Thomas Staley to the Board as Finance Director.

Thomas Jay Staley has been with the Sirius since October 2014, initially as Corporate Development Director and since 10 December 2014 as Chief Financial Officer.

Thomas is responsible for leading the Company's finance team, including in relation to the Stage 1 financing. Thomas has over ten years of experience developing and financing energy, resource and infrastructure projects across a range of international markets.

During his career before to joining the company, Thomas has worked for Origin Energy and Babcock & Brown in Australia and Mubadala Development Company in Abu Dhabi. In addition to his broad financing experience, he was previously responsible for the financial and governance oversight of Origin Energy's portfolio of International Development projects.

Russell Scrimshaw, Chairman of Sirius, said: "On behalf of the directors we would like to welcome Thomas to the board. Thomas has demonstrated his strong capabilities as CFO over the last two years but especially in the delivery of the company's Stage 1 financing. His financing and governance experience with projects over his career brings valuable experience and we are delighted to add him to our board."

He currently holds no other directorships and has a beneficial interest in 572 400 ordinary shares in the Company representing 0.01pc of the issued share capital of the company.

Itafos announces senior leadership changes

Itafos has announced the appointment of Mr. Brian Zatarain as Chief Executive Officer, effective February 2017. The move replaces Mr. Cristiano Melcher, who has resigned to pursue other opportunities.

Mr. Zatarain was most recently selected by the Board in October 2016 to lead the successful restructuring and recapitalisation as the Company's Chief Financial Officer. Mr. Rafael Rangel will step in as the Company's Chief Financial Officer with a focus on Accounting, Tax and Treasury functions, a role he previously held on an interim basis from April 2016 to October 2016.

Mr. Brent de Jong, Chairman of the Board of Directors, commented: "Itafos is uniquely positioned with high quality phosphate assets in Brazil, West Africa, United States and Peru, a compelling opportunity set and a skilled and dedicated workforce. We are excited about this next chapter and can count on Mr. Zatarain's leadership, with the support of the Board and the management team, to maintain focus and momentum on the implementation of the Company's business plan and to advance the value creation initiatives underway, including the completion of the recommissioning of its primary asset, the Itafos-Arraias fully integrated SSP operations located in Brazil."

Focus Ventures appoints Gordon Tainton as President and announces private placement

Focus Ventures is pleased to announce that Gordon Tainton has been appointed President and a Director of the company effective immediately. Mr. Tainton brings many years of experience in the international fertilizer and financial markets and will succeed David Cass who is stepping down as President. David will remain as a Director and continue to provide services as a consultant to the Company.

Mr. Tainton has over 25 years of experience at senior management levels in various sectors of the fertilizer industry, including inspection and testing services across all nutrients, distribution, port/terminal development, trading, shipping, off-take agreements, and project finance. Within management teams, he has financed and developed port/terminal projects for bulk liquid and solid products in the Americas, Asia and Oceania. He spent eight years with Sumitomo Corp. of Tokyo sourcing, purchasing and delivering key intermediate bulk and bagged products to the phosphate production industry. In 1992, Gordon participated in a management led acquisition of Inspectorate plc, one of the world's largest independent control services groups, which was subsequently sold to British Standards Institute in 1998. During his tenure at Inspectorate plc, volumes of ferrous minerals, fertilizers and commodity chemicals inspected and tested increased by more than 25pc. Since 2010 Gordon has held various executive and non-executive Board positions in both public and private companies. Gordon is currently a Director of NEOS Resources plc and Executive Director of Grange Mining plc.

OMNIA HOLDINGS LIMITED – Change to the Board of Directors, retirement and appointment of Directors

Neville Crosse

Omnia Holdings has announced that Neville Crosse (64) will retire as non-executive director and Chairman of the Board on 31 May 2017.

Neville holds a BSc. Chem. Eng. degree and an MBL and has served 40 years with the Group. He joined Omnia in 1977 as a project engineer and has since served the Group in many capacities including Managing Director Omnia Fertilizer (1985), Group Managing Director (1991) and recently as non-executive Chairman of the Board (2000). During his tenure as Group Managing Director, he steered the Group through many milestones including the acquisition of its mining division, now called BME, the construction of the state-of-the-art nitrogen complex at Sasolburg and the establishment of Omnia Fertilizer's first operations in Zimbabwe and Zambia. As Chairman of the Board, he championed the creation and implementation of the Group's two BBBEE employee share ownership transactions in Sakhile I and II and the Group's various other employee share schemes. He also previously served as Chairman of the Chemical and Allied Industries Association (CAIA).

Rod Humphris

Omnia also announces that Rod Humphris (59) will retire as Group Managing Director of the Company effective 31 May 2017. The Board has approved his appointment as non-executive director and Chairman of the Board with effect from 1 June 2017.

Rod holds a BSc. Chem. Eng. and a B Com degree, and he joined the Group in 1982 as a project engineer. Having occupied various positions within the Group, he became Managing Director of Omnia Fertilizer in 1995 and Group Managing Director of the Company in 1999. During his tenure, and under his leadership, the Group expanded its geographical footprint in Africa and into regions such as Australasia, South America and South East Asia, acquired its Chemicals division in the form of Protea Chemicals and constructed its second nitric acid plant, thereby becoming one of the largest producers of compound chemical fertilizers in Africa. He has also served as President of the Fertilizer Society of South Africa and was recently appointed as Chairman of CAIA.

Adriaan de Lange

The Omnia board has approved the appointment of Adriaan de Lange (41) as Group Managing Director of the Company and as executive director of the Board with effect from 1 June 2017. Adriaan holds a B. Compt. Honours degree and is a Chartered Accountant. He joined the Group in 2003 as financial controller for BME and was promoted to Financial Manager, where he played an important part in developing and implementing the mining division's business strategy.

Incitec Pivot has announced that James Fazzino will be stepping down as Managing Director and CEO

Incitec Pivot has paid tribute to Mr Fazzino, saying he was responsible for transforming the company from a fertilizer business to a global diversified industrial chemicals company. Mr Fazzino will remain at Incitec Pivot for a period of up to 12 months, until the company appoints a successor. The board has commenced a global search for a replacement for Mr Fazzino.

Incitec Pivot reported a net profit of USD129.4 million on 30 September 2016.

AFA forum round-up

The 23rd Arab Fertilizer Association (AFA) forum was held in Cairo, Egypt on 31 January-2 February 2017. Here we highlight some of the ideas discussed at the event.

Saad Abo El-Maati

AFA Chairman and Chairman of the board and CEO, Abu Qir Fertilizers company

Saad Abo El-Maati

This year's forum was convened under the title 'Arab Fertilizer Producers Continue to Shine'. The Arab fertilizer industry is characterized by abundant natural resources of natural gas, phosphate and potash. Arab countries are continuously striving to develop the fertilizer sector, which represents one of the main national economy sources for the region, within the framework of pursuing sustainable development.

The AFA has sought to develop mechanisms and programs in accordance with the latest updates and challenges facing such a vital industry and this was translated into the AFA's annual plans. These plans are considered the foundation for identifying the fertilizer industry's needs and coping with the international developments. They also aspire to raise efficiencies, improve performance and promote the industry on scientific basis, with regard to energy, environment protection, water usage rationalization, maintenance and the development of production methods.

It is noteworthy that the fertilizer industry is considered to be a main point of entrance to the agriculture sector and is indispensable in achieving sustainable agricultural development, eliminating the food gap and providing food security. Remarkable efforts have been exerted over many years in improving land productivity, providing farmers with adequate fertilizers and encouraging them to adopt modern technologies so as to increase fertilizer usage effectiveness. However, there is a definite need for new ideas to guide the industry towards a better future. This will not be fulfilled without involving all stakeholders, including farmers, international organizations, technology companies as well as scientific research institutions. Currently, efforts are focused on the different methods that would lead to crop production increase. The numerous factors with regard to achieving this goal include balanced fertilization of different crops without overlooking the key or secondary nutrients.

Dr. Abdulrahman Jawahery

IFA President and GPIC Chairman


Dr.Abdulrahman Jawahery

It is widely known that the fertilizer (and related products) industry is one of the world's most significant. It is recognized that the food industry, which depends on fertilizer, is in dire need of the application of a sustainability policy, particularly due to the heated competition accompanying the increase in supply rates and the lack of clear vision with regard to all types of fertilizer demand rates in the medium term. Thus, such a matter has necessitated taking rationalization measures to improve profitability and increase competitiveness in order to surmount the aforementioned challenges.

It is worth noting that during 2016 the world has witnessed a huge additional production capacity, particularly in areas close to strategic markets, reaching a total of 251 mn tn. It is also expected to record more than 270 mn tn by 2020 - a growth rate of 2-3pc annually.

On the other hand, fertilizer demand amounted to 235 mn tn during 2016 and is expected to exceed 257 mn tn by 2020 - an annual growth rate of 2.0-2.5pc.

In the light of the referred to developments, attention should be paid to raise stakeholders awareness of using available resources. In this regard, decision-makers are called upon to cooperate with specialized organizations so as to support and assist the industry, facilitate the application of sustainability principles and address the issue of fertilizer industry.

With this in mind, all concerned parties should collaborate to correlate economic activities with social responsibility programs.

Minister Ashraf Al-Sharkawy

Minister of Public Enterprise Sector, Egypt


Minister Ashraf Al-Sharkawy

Dr. Ashraf Al-Sharkawy, delivered a welcome speech at the forum, in which he stated that there are a number of remarkable projects that have recently come into existence and others are on their way. The government is strenuously working on supporting both public and private sector projects equally. He also expressed his pleasure for the effective participation and entrenched concern of Arab countries to be part of such an annual event.

In addition, he called upon Arab companies to contribute to the establishment of a unified Arab company, encompassing pioneering experiences and supported by modern technologies. He confirmed that the feasibility study of such a promising project would be sent directly to AFA, once finalized. AFA is accordingly recommended to invite AFA members, from different Arab countries, to participate in laying the foundations of such a remarkable project, which will undoubtedly lead to a significant economic return and strengthened social responsibility.

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Fertilizer Focus
Argus
175 St John Street, London, EC1V 4LW
Tel: +44 (0)20 7780 4340
Email: fertilizer@argusmedia.com
www.argusmedia.com/fertilizer

Publisher:
David Monaghan
david.monaghan@argusmedia.com

Editor:
Stefan Worsley
stefan.worsley@argusmedia.com

Contributors:
Julia Campbell, Natalie Kakish, Claira Lloyd, Stephen Mitchell, Mike Nash, Ewan Thomson, Christian Rees-Cooke

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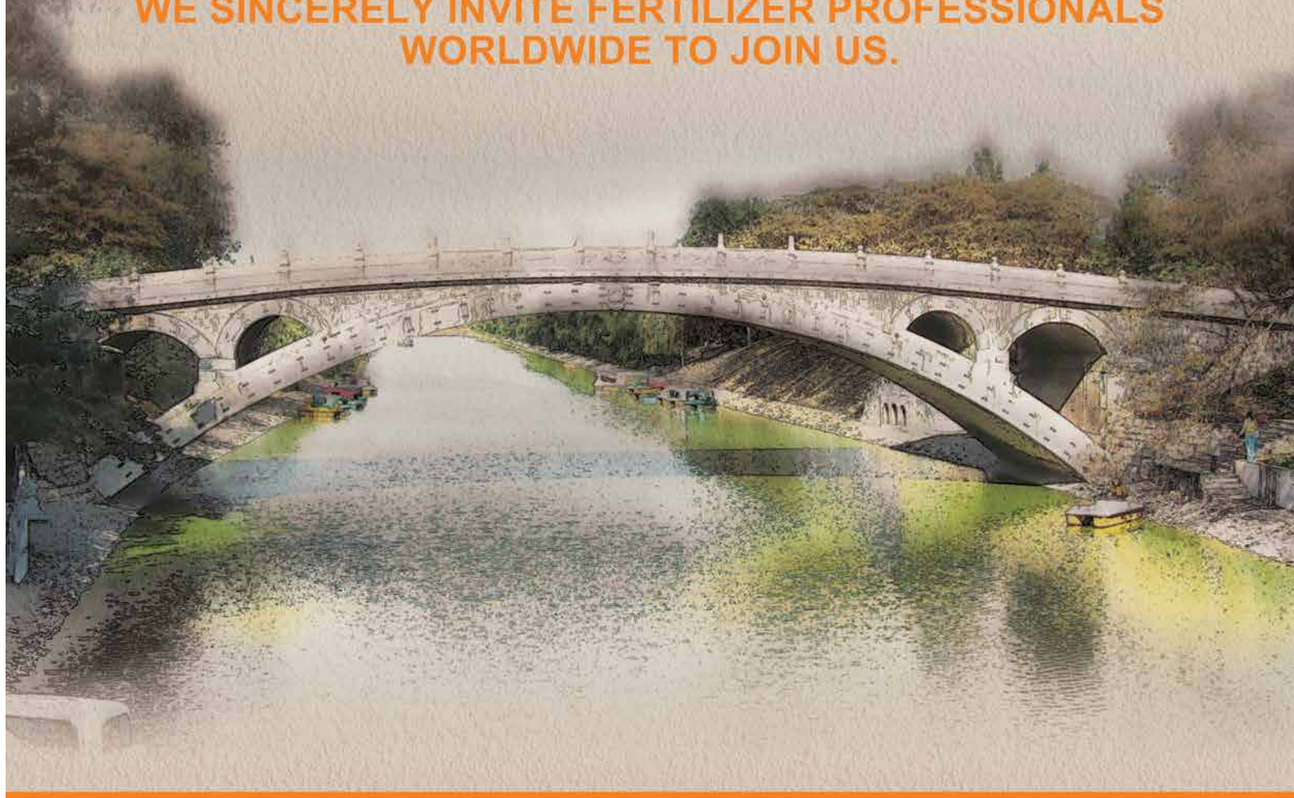

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Director Peter Li Likeqiang@jitainy.com
India, Latin America, South & North America David Zhang Davidzhang@jitainy.com
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