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incorporating PK Phosphorus & Potassium

Vietnam's hunger for fertilizers

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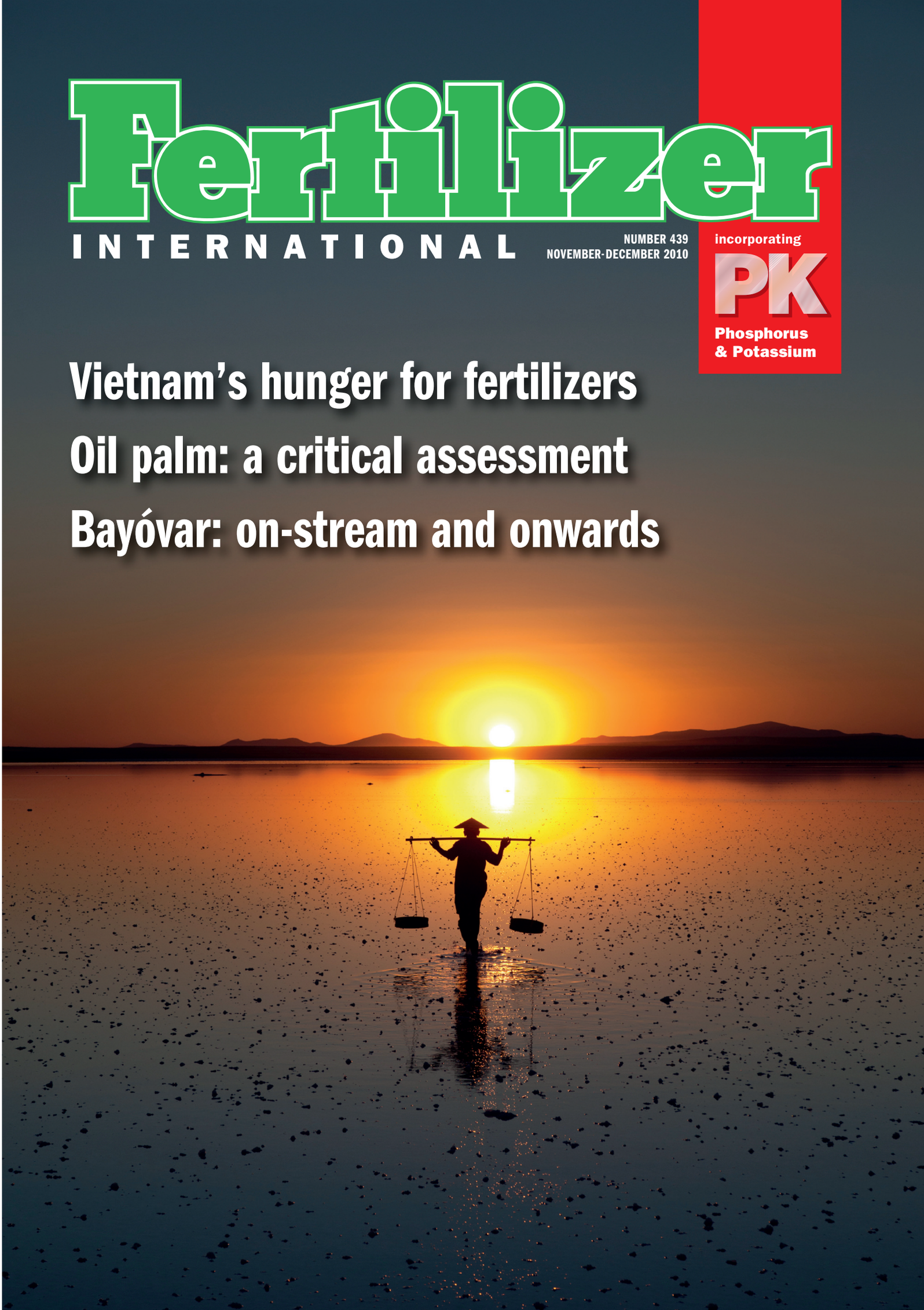

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PHOTO BY COURTESY OF TSI

The Sulphur Institute has helped spread the message about tackling S deficiencies on Indian soils, promoting seminars and local meetings among farmers.

Shell Thiogro's Indian breakthrough

Several years of R&D have borne fruit for Shell Sulphur Solutions as it announced the first licensing agreement for its Shell Thiogro fertilizer technology in Asia.

On 13 September, it was announced that Shell Research Limited has agreed licence terms with Coromandel International Limited, India, enabling Coromandel to produce sulphur-enhanced ammonium phosphate fertilizers at its Visakhapatnam plant for sale in the Indian domestic market. Coromandel may later extend production to its Kakinda complex.

The agreement is a significant breakthrough, enabling Indian farmers to secure sulphur-containing fertilizers. It also represents Shell's first licensing agreement in Asia for its pioneering Shell *Thiogro* fertilizer technology.

India is the second largest consumer and producer of fertilizers in the world. While the country's agriculture has made impressive gains during the past 2-3 decades in achieving self-sufficiency in its food production, the momentum of growth in crop yields has tailed off in recent years. In particular, many agricultural scientists have identified a chronic deficiency of sulphur in Indian soils as an increasingly limiting factor. According to The Sulphur Institute (TSI), the sulphur status of Indian soils is going down with each passing year. Soil analysis and crop response data generated by the TSI-FAI-IFA project between 1997 and 2006 found that 46% of the 49,000 soil samples analysed were deficient in S and another 30% were medium in available S and potentially S-deficient. Soil S deficiencies were encountered in all parts of India, indicating that S deficiencies were a critical problem in 40-45% of districts – equivalent to between 57-64 million ha of the net sown area.

Several factors have contributed to the growing incidence of S deficiency in India. These are related to a high level of cropping intensity in irrigated areas, a wide gap between the addition and removal of S, a large acreage under pulses and oilseeds which require more S per unit crop produced but are not as intensively fertilised as irrigated cereals. Although India has a long-established single superphosphate (SSP) fertilizer capacity, fertilizer use patterns today have become dominated by products such as urea, DAP and potassium chloride, all of which unlike SSP lack S.

One of India's most progressive fertilizer companies, Coromandel International is headquartered in Hyderabad and is a member of the Murugappa Group. It is one of the country's leading producers of phosphate fertilizers, with production facilities at eight locations in Andhra Pradesh, Tamil Nadu, Maharashtra, Gujarat and Jammu and Kashmir. Coromandel manufactures and markets around 2.9 million t/a of phosphate fertilizers, making it the second largest phosphate fertilizer supplier in India. As part of its strategy to provide a complete range of plant nutrition options, Coromandel last year set up a Specialty Nutrients Division (SND). This division manufactures and markets speciality nutrients, including zinc, boron, sulphur, water soluble fertilizers and organic composts.

The company has also established strategic partnerships with leading companies around the world and in August 2009, it raised its equity stake in Foskor Ltd. of South Africa from 2.5% to 15%. Coromandel has a technical services agreement with Foskor and is actively managing the process plants.

Coromandel's agreement with Shell Solutions brings two innovative groups together. Although known around the world for its involvement in the oil and energy sectors, Shell has also had many years of experience in handling the sulphur that is a by-product of its oil and gas operations in Qatar and Alberta, Canada, and it continues to explore new ways of exploiting the natural properties of sulphur.

Maximising the value of sulphur

One of Shell's goals is to create a virtuous circle of sulphur management: this embraces the removal of sulphur where it adds little value (as in fuels) and then using the recovered sulphur to add value somewhere else (for example, as a component of new end-products with significant benefits over traditional products of a similar nature). By applying its leading-edge technological expertise, Shell has developed technology that successfully brings the benefits of sulphur to a range of applications, such as in concrete (*Shell Thiocrete*), roads (*Shell Thiopave*) and fertilizers (*Shell Thiogro*). (*Innovative Solutions for Sulphur in Qatar*, Marwa Al-Ansary, Qatar Shell Research & Technology Centre. Paper presented at The Sulphur Institute Sulphur World Symposium, Doha [April 2010].)

Loh Seng Yee, General Manager, Shell Thiogro Technologies, explained further: "We need to get smarter with energy resources. Sulphur provides us with a great opportunity, but we must also get smarter around sulphur and recognise its value. The increasing stringency of fuel specifications around the world is one of the factors in the growing shortage of available sulphur in soils. This is becoming a universal phenomenon as there is less sulphur in the air from emissions. Farmers have thus been increasingly deprived of what was previously a virtually a free nutrient. With the *Shell Thiogro* technology, fertilizer producers now have an efficient and effective way to add S to their fertilizer formulas."

The patented process introduces both forms of sulphur – elemental and sulphate – into phosphate-based fertilizers. The technology enables producers to manufacture fertilizers with customised formulations of both slow-release elemental S and fast-release sulphate. The technology is compatible with a range of other modifications, including the incorporation of micronutrients. The unique facets of this innovative technology include:

- A wet micronisation technology eliminates the risk of dust explosion from the milling process for applications with low phosphate reactor temperatures.
- The use of a patented molten sulphur addition process, including the use of Shell-developed process additives for applications with higher phosphate reactor temperatures.
- Evenly-distributed sulphur particles throughout the granule, providing a greater surface area for bacterial conversion of elemental S to sulphur.

The Shell *Thiogro* technology processes sulphur in any suitable liquid stream found in the manufacturing process. This is typically phosphoric acid, ammonium phosphate slurry or process water. The complete additive/elemental sulphur/ammonium or calcium phosphate slurry is then fed to a granulator for conversion into finished granular phosphate fertilizer products, such as DAP, MAP, TSP or compound NPKs.

The Shell *Thiogro* production process can be used in conjunction with almost any phosphate fertilizer production process, involves a relatively low initial capital cost for installation and avoids any substantive change in operating conditions. The technology is easy to control and operate: the sulphur particle size and particle distribution is changed by adjustment of operational parameters. The micronised sulphur can be added to a range of raw materials: in addition to concentrated phosphoric acid, it can be incorporated in diluted scrubber liquid.

Formulations for phosphate-based fertilizers and compound NPKs incorporating Shell *Thiogro* micronised sulphur include 11-40-0 + 12S (66.7% elemental S and 33.3% sulphur-SO_4), 12-42-0+10S (60% elemental S and 40% SO_4) and 12-24-12+12S (66.7% elemental S and 33.3% sulphur SO_4). Typical formulations from agronomic recommendations and soil requirements target a P_2O_5:S ratio of two to four. These formulations will include sulphate sulphur which is beneficial for early crop development before the oxidation of elemental S to sulphate takes place. The remainder of the elemental S becomes a slow-release form of sulphur, which is available during the crop's full growth cycle.

Among the markets which Shell has identified for fertilizers made with Shell *Thiogro* technology are:

- Regions which are not economically served by other sulphate-based fertilizers, such as SSP or ammonium sulphate
- Sulphur-deficient regions which are exposed to high levels of leaching
- Crops such as corn, canola/oilseed rape, sugarcane and cereals, which require S throughout the growth cycle.

Shell is a well-resourced company and has tested the *Thiogro* technology thoroughly over a period of years. Crop and pasture field trails have been undertaken in various parts of the world known for their sulphur-deficient soils, including Australia, Brazil, China, India and Argentina. Shell has worked in conjunction with universities, government agencies, larger farming operations and fertilizer producers to carry out trials, as well as undertaking co-sponsored trials with The Sulphur Institute.

In China, field tests on 21 S-responsive sites resulted in an average increase in rice yields of 13%. In Brazil, soybean yields increased by an average of 18% with Shell *Thiogro*-produced fertilizers in eight field trials, while a 98% increase in clover production was recorded in Australia.

Shell has been working in collaboration with Australian fertilizer producer Incitec Pivot Limited for a number of years. However, the licensing agreement with Coromandel International is Shell's first licensing agreement with a producer in Asia. Carlos Maurer, General Manager Product Development and Ventures, Shell Sulphur Solutions, said: "We are honoured and delighted to have the opportunity to work with one of the most respected fertilizer companies in India. It is very exciting to think that our Shell *Thiogro* technologies can be part of the contribution to improving agricultural yields in a country where farming dates back many years and is still a very important contributor to the Indian economy."

With new technologies such as Shell *Thiogro*, fertilizer producers have more options to ensure that their customers have the right products to meet the increasing challenge of sulphur deficiency in soils.