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international news, comments, features and conference reports

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LEAD ARTICLES

MONSANTO WINS TRIAL

Monsanto has won a patent infringement trial in the US District Court against DuPont Pioneer. The trial centred on DuPont's unauthorised use of Monsanto's patented *Roundup Ready* technology. In giving its verdict, the Federal jury found that DuPont and DuPont Pioneer had willfully infringed Monsanto's technology when it tried to deal with the problems it had with its own *Optimum GAT* (OGAT) technology that had failed in earlier development. The jury awarded damages of $1 billion to Monsanto. The finding of willful infringement could yet lead to an increased award of damages in the case.

“This verdict highlights that all companies that make early and substantial investments in developing cutting edge technology will have their intellectual property rights upheld and fairly valued,” said David Snively, Monsanto’s executive vice president and general counsel. “DuPont’s unauthorised use of the *Roundup Ready* technology was both deliberate and aimed at rescuing its own failed technology. Material obtained from DuPont files during this case highlight that the company’s senior leaders were actively working to hide the fact their *OGAT* technology had failed and were using elaborate schemes to cover that up with the unlicensed use of our technology. They knew that *OGAT* technology had not worked for years, but opted to tell a much different story to their customers. It is deeply disappointing that repeated requests to DuPont's leadership and board to investigate their own internal actions were not addressed and corrected, which ultimately required the matter go to trial.”

Monsanto's *Roundup Ready* technology was first commercially introduced to US soybean farmers in 1996. Today, the company broadly licenses *Roundup Ready* technology to alfalfa, corn, cotton, soybean, spring canola, sugar beet and winter canola farmers. It originally filed a suit against DuPont and DuPont Pioneer in May 2009. The lawsuit sought to prevent the unlicensed combination of Monsanto's proprietary *Roundup Ready* herbicide tolerant technologies in soybeans and corn with DuPont's problem OGAT. DuPont had been offered a license prior to and throughout the duration of the trial, but the company refused to accept the offer. Monsanto says that the recent verdict represents the third time that court proceedings have determined that DuPont or DuPont Pioneer has violated Monsanto’s trait licensing agreement.

DuPont strongly disagrees with the verdict and says there were several fundamental errors in the case which deprived the jury of important facts and arguments. The company intends to appeal at the earliest possible opportunity and expects to overturn the verdict. It says it believes that the evidence presented during the trial demonstrated clearly that Monsanto’s *Roundup Ready* soybean patent is invalid and unenforceable and that Monsanto intentionally deceived the US Patent and Trademark Office on several occasions as it sought patent protection. DuPont also believes that the awarded damages of $1 billion are unjustified, particularly as Pioneer has never sold a single *Optimum GAT* seed and has no plans to do so in the future. “DuPont’s license to sell *Roundup Ready* soybeans remains in place and is not impacted by this verdict,” said DuPont senior vice president and general counsel Thomas L Sager. Several aspects of Monsanto’s misconduct involving this patent, which were not tried in this case, will be presented to a different jury as part of DuPont’s antitrust and patent misuse case against Monsanto in September 2013. “We continue to stand by our position that we did not infringe the *Roundup Ready* soybean patent and that the Monsanto patent is invalid. We will continue to fight hard to ensure American farmers have choices and that no one company decides what is best for them,” concluded Mr Sager.

COURTS UPHOLD BAYER’S CLAIMS AGAINST DOW

The US District Court for the Eastern District of Virginia (EDVA) has upheld Bayer's right to pursue its claims against Dow AgroSciences (DAS) based upon the unauthorised use of Bayer patents related to glufosinate-tolerance technology (*Liberty Link*). The Federal court denied Dow's motion to dismiss the pending lawsuit and ordered the company to enter into arbitration with Bayer on the matter within 30 days and to provide the court a ‘joint status report’ every 120 days until the arbitration is concluded. The license agreement between the parties includes a broad arbitration clause.

The court issued a stay of the pending EDVA lawsuit until the arbitration is concluded or the case is otherwise removed from the court docket. The lawsuit asserts infringement of four Bayer patents and follows two previous claims involving seven Bayer glyphosate-tolerance technology patents and Bayer's 2,4-D herbicide tolerance patent. Bayer's actions in defence of its glufosinate-tolerance, 2,4-D

herbicide tolerance and glyphosate-tolerance technology patents and stacking of such technologies followed announcements made by Dow AgroSciences regarding its *Enlist Weed Control System.*

BAYER ENFORCES ITS NATIVO TRADEMARK IN VIETNAM

In another action Bayer has successfully enforced its *Nativo* (trifloxystrobin + tebuconazole) trademark against the Vietnamese company Viet Duc Ltd. Viet Duc sold crop protection products which looked very similar to Bayer CropScience´s *Nativo* rice fungicide under its own trademark *Natido*. These products will now be withdrawn from the market and destroyed. The company was also fined. "*Nativo* is a very strong brand in Vietnam, and our customers associate it with high quality and efficacy," said Torsten Velden, Bayer CropScience country head for Vietnam. "Trademark protection is key to protecting the environment for continued innovation. We are, therefore, on the constant alert for any activities that infringe our intellectual property rights."

In February 2012, Bayer requested the Vietnam Intellectual Property Institute (VIPRI) to examine whether the marketing of *Natido* infringed its trademark *Nativo*. After a positive VIPRI conclusion, Bayer filed a petition with Vietnam's Ministry of Science and Technology (MOST) to enforce and settle VIPRI´s decision. An on-site inspection of Viet Duc´s premises in Kien Giang province together with external counsel and representatives of the MOST and the Science and Technology Department in Kien Giang province confirmed the allegations.

EUROPEAN NEWS AND MARKETS

UPL ACQUIRES AGRICHEM

United Phosphorus Ltd (UPL) has acquired the Dutch pesticide manufacturer Agrichem. In a communique to the Bombay Stock Exchange UPL said that its overseas subsidiary had entered into an agreement with SD Agchem Europe, a subsidiary of Punjab Chemicals, to acquire 100% of Agrichem along with all tangible and intangible assets, IPR, product registrations, brands, distribution network and manufacturing facilities. The company said: "Agrichem will give a new and enhanced market access in European countries. It has an exciting registration portfolio with products that will be complimentary to UPL's existing product range in Europe." Agrichem produces and markets herbicides, insecticides and fungicides and holds registrations in several European countries such as the Netherlands, Belgium, the UK, France, Germany, Ireland, Denmark, Italy, Slovakia, Czech Republic, Belarus and Switzerland.

SUMITOMO CHEMICAL TO DISTRIBUTE NUFARM PRODUCTS IN ITALY

Nufarm and Sumitomo Chemical Company Limited have signed a non-exclusive distribution contract in Italy. This new collaboration will enable Sumitomo Chemical Italia to access Nufarm's entire crop protection portfolio, except for seed treatment. Nufarm's general manager for South West Europe, Yvonnick Jambon, said: "Italy is the third largest market in the EU. We expect this new arrangement to increase our product sales." Managing executive officer of Sumitomo Chemical, Ray Nishimoto, added: "Since our capital tie-up in April 2010, the two companies have expanded successful distribution collaborations in 19 countries throughout the world.

UK DEFRA OUTLINES FUTURE OF PESTICIDES WITH DRAFT PLAN

The UK's Department for Environment Food and Rural Affairs (Defra) has issued a draft plan outlining the future of pesticide use in the UK. The National Action Plan for the Sustainable Use of Pesticides (NAP) (**www.defra.gov.uk/consult/2012/07/30/uknap-pesticides**) is designed to ensure that the UK adheres to EU rules and has been met with approval by farming unions including the National Farmers Union (NFU). The draft plan, which recently opened for consultation, focuses on the continuing use of voluntary approaches to meet pesticide targets. Initiatives such as those promoted through the Voluntary Initiative (**www.voluntaryinitiative.org.uk**) are highlighted as ways to improve best practice without the need to regulate. NFU deputy president Meurig Raymond said: "The NAP consultation document appears to take a scientific risk reduction approach to pesticide usage, and bases its recommendations accordingly. We feel that this is a positive move, as a holistic, science-led approach to the management of pesticides is the right course of action. In addition, the recognition of the high standards of pesticide stewardship by the farming sector is welcome and justified, as the UK agricultural industry already operates to world leading levels of stewardship."

SYNGENTA APPEALS AGAINST THIAMETHOXAM BAN IN FRANCE

A French ban on the use of Syngenta's seed treatment insecticide *Cruiser* (thiamethoxam) was reported to be imminent last month (*June CPM*). This has since been imposed by the French government in response to data which suggests that the neonicotinoid insecticide is a contributing factor in the decline in bee populations. The ban applies to oilseed rape seed treatment only. It will be in operation in time for the oilseed rape planting season in the autumn. The announcement was made by agriculture minister Stephane Le Foll and followed a two week response period. The decision to impose the ban was based on the advice from the French food and environment safety agency, ANSES. The agency has also recommended that the EU introduces stricter assessments for agricultural chemicals. A number of studies from around the world have been reported which indicate that neonicotinoid insecticides may be responsible for bee population decline (*March CPM*). However, it is claimed by crop protection companies that other factors including diseases of bees are more important contributors. Syngenta, France, has announced that it intends to launch a fast track appeal against the French government's ban. Laurent Peron, a Syngenta spokesman, is reported as saying: "We are going to file very quickly an urgent appeal to seek a suspension injunction from the administrative court."

GMOS POSE NO ADDITIONAL RISK SAYS EU'S CHIEF SCIENTIFIC ADVISOR

"Politicians sometimes shy away from science, but they should be clear about why they reject scientific evidence in future," Professor Anne Glover, the European Commission's first chief scientific advisor, told the EU information website EurActiv (**www.euractiv.com**) in a recent interview. "GMOs are a good example of where policy has trumped science." She continued: "There is no substantiated case of any adverse impact on human health, animal health or environmental health, so that is pretty robust

evidence. I would be confident in saying that there is no more risk in eating GMO food than eating conventionally farmed food." Professor Glover was appointed to her position by the EU president José Manuel Barroso in December 2011 having previously served as chief scientific advisor for Scotland since 2006. She commented that she was not promoting GMOs and made the point that eating all food presents risks and that most plants are toxic in some way, adding : "It's only because we cook them, or the quantity that we eat them in, that makes them suitable."

With reference to policymaking on GM food Professor Glover called for a stronger role in the use of scientific evidence. In reference to policies adopted by countries that have banned GMOs she added: "I think we could really get somewhere in Europe if when evidence is used partially, there was an obligation on people to say why they have rejected evidence." Professor Glover also said that the discomfort around the subject of GM crops in the 1980s and 1990s was "a generation ago; we have moved on and the challenges are completely different". She also raised doubts about the blanket adoption of the precautionary principle within EU policy, commenting that it was appropriate when applied properly, but adding: "We should not tie our hands behind our back in such a way that we will be so precautionary that we will wait for everyone else to use our knowledge before we use it. Knowledge is an international currency, and we are amongst the slowest in taking advantage of the knowledge we create, and that cannot be right."

Finally she commented on the pressure on land use within Europe: "If we are using land to produce biofuels, we are not producing food, and that means we have to intensify food production." Professor Glover also said that she was examining the possibility of creating a network of individual chief scientific advisors within EU member states to provide more clearly focused lines of communication on scientific evidence within EU policymaking.

UK SURVEY RECORDS SHIFT IN FAVOUR OF GM CROP DEVELOPMENT

Public opinion appears to be shifting in favour of the development of GM crops, according to a survey of consumer attitudes commissioned by the Independent newspaper. In the survey, carried out by the market research agency ComRes, respondents were asked whether the government should encourage experiments on GM crops so that farmers can reduce the amount of pesticides they use. 64% of the public agreed, 27% disagreed, and 9% replied "don't know."

Analysis of the survey data showed that there were few differences by age, social class or geography. However, there were differences recorded between the views of men and women with 70% of men believing that experiments on GM crops should be encouraged, while only 58% of women agreed. The survey did not show up any differences in the attitudes of political party supporters. It has been reported that Liberal Democrat ministers would expect many of their party members to be hostile to a big push on GM foods. But the survey shows that Liberal Democrat supporters' views are in line with those of Conservative and Labour voters. The overall findings from the survey gives encouragement to scientists who hope a more measured approach to the development of GM crops in Britain will gradually win over a sceptical public.

IRELAND GIVES GO AHEAD TO TEST GM BLIGHT RESISTANT POTATOES

The Irish Environmental Protection Agency (EPA) has given approval for a genetically modified blight resistant potato crop to be tested by Teagasc, the agriculture and food development authority, at Oak Park in County Carlow (*February CPM*). Two hectares of the crops will be planted over the next four years. The blight study will assess the impact of GM potato cultivation on bacterial, fungal and worm diversity in the soil. It will also identify integrated pest management strategies and components which could be positively or negatively affected by the adoption of a GM late blight resistant potato.

The EPA stated that the trials will be subject to strict conditions with regular monitoring and reporting direct to the EPA. The trial sites will also be checked for compliance with the licence conditions on a regular basis by the EPA. The Food Safety Authority of Ireland, the Department of Agriculture and the National Advisory Committee on Genetically Modified Organisms and 83 representations from interested parties were consulted before the consent was granted. The EPA hopes to use the results of the study to engage and discuss the issues that most concern farmers, the public, grocers and scientists about the cultivation of GM crops in Ireland. Opponents of GM will have a three month window to lodge a judicial review of the licence.

GM blight resistant potato crops have been tested in three locations in the Netherlands with no unforeseen effects on biodiversity compared to conventional crops. Tests are also being carried out in Belgium and the UK.

AMERICAN NEWS AND MARKETS

DOW OPENS NEW RESEARCH FACILITIES IN CANADA

Dow AgroSciences has recently opened new research facilities in Canada. The company says the Nairn Research Facility will conduct cereal research and breeding programmes to serve the needs of the growers, millers, food companies and ultimately consumers. The majority of the finished wheat and other cereal varieties developed by the Nairn research station are to be marketed by Hyland Seeds.

The new facility combines state-of-the-art breeding techniques such as di-haploids, disease nurseries and shuttle breeding, where germplasm is shuttled between a winter nursery in Chile, Nairn and two other Dow AgroSciences research facilities in Washington State and Australia. "The techniques used at the research centre provide customers with new, high-yielding, high-quality varieties in an accelerated time frame specifically adapted to target environments," says Henry Olechowski, the site leader at the Nairn research centre.

The main breeding goal is to develop Dow AgroSciences wheat varieties that are superior in yield, standability and have natural genetic tolerance to disease, specifically Fusarium head blight, the most economically important cereal disease. The research and development team will also leverage germplasm and technology (gene markers to assist in identifying the best plants in fewer generations etc) from Dow AgroSciences global wheat research efforts.

INCOTEC TO TREAT BRASSICA SEED WITH BASF FUNGICIDE

Incotec (Integrated Coatings and Seed Technology) has announced an agreement that will allow the company to treat brassica seeds with a BASF fungicide seed treatment *Coronet* (boscalid + pyraclostrobin). Incotec will also offer the product to seed companies for on-site application within the US. *Coronet,* registered by the US Environmental Protection Agency (EPA) in 2008, provides effective control against a broad spectrum of seed-borne fungal pathogens. "*Coronet* helps control key seed and seedling diseases from the start, while improving plant stress tolerance," said Robert Yaklich, market manager for BASF Seed Solutions in North America.

CALIFORNIAN REGULATORS APPROVE CERTIS USA FUNGICIDE

The California Department of Pesticide Regulation (CA-DPR) has issued a certificate of registration for the Certis USA Fungicide *Double Nickel 55*. The product is a bacterial biofungicide based on *Bacillus amyloliquefaciens* strain D747 (Ba D747). Another formulation, *Double Nickel LC*, is expected to be approved for use in the near future. The fungicide is used to control powdery mildew, Botrytis and bacterial diseases of fruiting and leafy vegetables, grapes, strawberries and tree fruit. It protects plant surfaces both above the ground, as well as below and is highly potent, compared to other bacterial-based biofungicides. It is also National Organic Programme (NOP) approved and Organic Materials Review Institute (OMRI) Listed and available for conventional use as well as organic production.

BASF OPENS SEED TECHNOLOGY CENTRE IN BRAZIL

BASF Crop Protection has opened its new technology centre for seed treatment in Santo Antônio de Posse near São Paulo, Brazil. The facility further expands the company's research activities in South America and will provide technological support as BASF continues to improve and promote its local seed treatment business. The investment by BASF amounts to $5 million.

BASF says the new centre will deliver innovation and services for the seed treatment business. These include product and service development as well as improved training for the sales force through workshops and field days. Leandro Martins, BASF Crop Protection, director of R&D for Latin America said: "We are focusing on the crops that are important to our region - soybeans, corn, cotton, beans, wheat, barley, sunflower, canola, sorghum and peanuts."

ROUNDUP READY SUGAR BEET APPROVED IN US

The United States Department of Agriculture Animal and Plant Health Inspection Service (APHIS) has entered a final record of the decision that transgenic sugar beets resistant to glyphosate herbicides are "no longer subject to our regulations." This follows years of disputes, lawsuits and counter suits. Lawsuits filed in 2009 aimed to prevent the release of the variety, leading to a court decision calling for a thorough environmental impact statement (EIS) and plant pest risk assessment (PPRA).

During the review process, three public meetings were held and thousands of comments were gathered for analysis and consideration. A statement released by the USDA said: "Since a district

court decision in 2009, APHIS has worked hard to complete this final EIS to ensure it is sound and comprehensive. APHIS' determination of non-regulated status of *Roundup Ready* sugar beets reflects this hard work and will become effective upon publication of the Agency's notice of availability of the determination and record of decision in the Federal Register on 20 July 2012.

Some reports suggest that the Centre for Food Safety, one of the activist groups which filed the original lawsuits against the USDA, may still challenge the validity of APHIS' new unconditional deregulation determination. Since early 2011 a partial deregulation has been in operation under which farmers who planted transgenic sugar beet had to apply several restrictions. Growers were subject to geographic limitations on where the crop could be cultivated, as well as training, field monitoring, record keeping and transportation requirements. In principle these restrictions have expired with the full deregulation. However if the full deregulation is challenged in court and overturned by a judge, then the USDA could resurrect the partial deregulation measures.

NEW EXPORT OPPORTUNITIES FOR BRAZIL'S GM SOYBEANS

In 2011 the European Commission agreed to allow traces of GM material in animal feed to be imported even where the GM crop is not approved within the EU. Material has to be derived from crops approved in a non EU country and an authorisation request has to have been lodged for at least three months with the European Food Safety Authority (EFSA). According to statements made by the Brazilian Association of Seeds and Seedlings (ABRASEM), this relaxation of the EU authorisation is seen as an opportunity for Brazilian GM soybean production particularly as Europe is the second most important export for Brazilian soya products, after China.

The ABRASEM president, Narciso Barison Neto, said that the Brazilian regulatory framework is one of the most highly evolved in the world. However, he expressed regret that the situation is not the same in the principal markets for Brazilian exports. "Nowadays, companies are investing more and more in new technologies for the Brazilian market. It is therefore necessary for the markets that are importing our agricultural production to keep pace with this movement."

A new GM soybean trait that offers a combination of herbicide tolerance and insect resistance, Monsanto's *Intacta RR2 Pro*, was approved for growing and commercialisation in Brazil by the Brazilian National Technical Commission for Biosafety in 2010. It is the first variety developed from the combined genes especially for Brazil. According to ABRASEM, it is planned to expand production to other countries, particularly the other members of the Mercosul economic grouping (Argentina, Paraguay, Uruguay and Venezuela). *Intacta RR2 Pro* offers environmental benefits, since it will considerably reduce the use of herbicides and insecticides by growers. While it is to be planted in Brazil it must be approved by the countries Brazil wishes to export to. Approval has just been granted in South Korea and is currently being processed in China.

OTHER NEWS AND MARKETS

BAYER AND CSIRO TO DEVELOP HIGHER YIELDING WHEAT

Bayer CropScience, the Commonwealth Scientific and Industrial Research Organisation (CSIRO) and the Australian Grains Research and Development Corporation (GRDC) have formed a partnership to increase yield in wheat. CSIRO has, through genetic modification, developed wheat that produces significantly more grain. The partnership intends to build on the discovery by CSIRO of a gene technology that produces up to a 30% increase in wheat yield in glasshouse trials. The GRDC and CSIRO provided initial research funding and Bayer CropScience will now join them to support the next stage of development.

"We are committed to pursuing innovation in wheat varieties that will lead to increased productivity and meet the need for sustainable solutions for wheat production on a global scale, for example by increasing yields, increasing nutrient use efficiency and making plants more tolerant to stressful growing conditions such as drought or heat," said Mathias Kremer, head of the BioScience business unit at Bayer CropScience. "With this technology, we see more vigorous wheat with increased vegetative growth, larger seed heads, and larger seed," said Dr Bruce Lee, director of CSIRO's Food Futures Flagship. "If we can achieve significant yield increases in the field, this will have a major impact on food production on a global scale." John Harvey, GRDC managing director, said that improving crop yield will benefit grain growers. "Increasing wheat yields under the water limited environments that Australian growers face is a significant driver for GRDC investments. This yield technology is an exciting discovery that could lead to a significant impact on wheat productivity."

BAYER TO ACCESS NEW WHEAT TECHNOLOGY

Bayer CropScience has signed an exclusive license agreement which gives the company worldwide research and development rights to Plant Sensory Systems' (PSS) proprietary Nitrogen Use Efficiency and Stress Tolerance (NUEST) technology in wheat (**www.plantsensorysystems.com**). "PSS has demonstrated the ability of the NUEST technology to produce more seed with less nitrogen," said Kathleen Turano, president of PSS. "Crops with the technology also have the ability to withstand extended periods of drought. Both traits will be very beneficial to wheat farmers and consumers."

PPS is a privately held agricultural biotechnology company in Baltimore, US that develops technologies to improve crop performance for production of food, feed, fibre, biofuel and bio-based products. The company has developed traits that increase yields, improve nitrogen and water use efficiency, promote tolerance to drought and high temperature, increase seed oil content, and enhance nutritional value**.**

BASF SALES INCREASE

Due to the strong season in the northern hemisphere, BASF's Agricultural Solutions segment posted successful sales results in the second quarter of 2012. Sales were €1,467 million, up by 21.7% compared with the same period of last year. EBIT in the second quarter increased by 25.1% to €414 million and EBITDA rose 20.4% to €449 million. Volumes, prices and currencies rose by 14%, 2% and 6% respectively, they both contributed to sales growth. BASF says business development was very positive for fungicides in particular.

Sales in Europe increased significantly as the growing season developed positively. This was mostly due to high demand for the *Clearfield* herbicide tolerance system and the successful introduction of the fungicide *Xemium* (fluxapyroxad). Sales rose in North America, driven by the company's business with products for plant health as well as by the imidazolinone and *Kixor* (saflufenacil) brand herbicides. Positive currency effects also boosted sales growth. Higher demand for herbicides in India aided sales growth in Asia. Sales in South America also recorded exciting growth despite continuing drought in the southern regions. Sales volumes for insecticides based on the active ingredient fipronil continued to increase. Business with the fungicide *F 500* (pyraclostrobin) also developed well.

Sales in the first half year reached €2,794 million, up by 14.7% and EBITDA was up 19.9% to €908 million. Fungicides was the largest category in the first-half, accounting for 45% of crop protection's total sales, followed by herbicides (38%) and insecticides (17%). Europe accounted for the largest share (47%) of the company's total sales in all regions. North America was in the second place with 29% and Asia Pacific 11%, South America, Africa, Middle East 13%.

DOW AGROSCIENCES POSTS RECORD SALES

Dow AgroSciences' Agricultural Sciences segment posted record sales of $1,676 million for the second quarter of 2012, up 11.7% compared to the same period in 2011. EBITDA for the segment was $307 million, up by 7%. Volume increased 10% and price rose 2%. North America, Latin America, and Asia Pacific all posted double-digit sales growth driven by customer adoption of new products and healthy agricultural markets.

Sales of crop protection products rose 8% versus the prior year, driven by strong sales growth in North America, Latin America, and Asia Pacific. Sales of new crop protection products grew 17%, led by gains in aminopyralid and pyroxsulam herbicides and the insecticide spinetoram. Seeds, Traits and Oils (ST&O) reported sales gains of more than 30% versus the same period in 2011. Increased corn sales in North America and Latin America were a key driver of growth, with increased penetration of *SmartStax* hybrids and *Refuge Advanced* in North America, and further adoption of *Herculex* technology in Latin America. For the first half year, sales of Agricultural Sciences segment increased by 13.1% to $3,514 million, and EBITDA rose by 9.4% to $758 million.

FMC REPORTS GOOD GROWTH

FMC's Agricultural Products segment increased 19.4% to $393.6 million in the second quarter of 2012 with substantial sales gains in Latin America and North America. Segment earnings of $111.2 million increased 17.9% compared to the same quarter in 2011 driven by strong volume growth, partially offset by higher spending on targeted growth initiatives. First-half year sales were up 25.9% to $847.8 million, and earnings rose by 23.7% to $241 million.

In Latin America, sales increased significantly, driven by the company's continued strength in sugar cane, growth in soybeans, and sales from a new market access joint venture in Argentina. In North America, sales also increased significantly due to strong demand for proprietary herbicides, higher insecticide sales, and increased non-crop sales. Asia and Europe/Middle East/Africa sales were marginally down versus the prior-year period.

FMC expects its Agricultural Products segment to achieve its ninth consecutive year of record earnings, delivering a year-on-year percentage increase in earnings in the high-teens, reflecting increased volumes, particularly in Latin America, North America and Asia, due to strong market conditions and growth from new and acquired products, but partially offset by higher spending on targeted growth initiatives.

SYNGENTA REPORTS 10% GROWTH FOR SALES IN FIRST HALF 2012

Syngenta reported that during the first half of 2012 its sales increased by 10% at constant exchange rates to $8.3 billion. Sales volume increased by 6% and prices were 4% higher. At constant exchange rates EBITDA increased by 15% and the EBITDA margin was 29.1% compared to 27.9% in 2011. The company says that the increase in underlying profitability reflects the operational leverage from volume growth, price increases and higher trait royalty recognition, accompanied by cost savings of $85 million, largely from the integrated business model. This more than offset the impact of higher raw material costs and a net $80 million charge for the settlement of US litigation relating to the herbicide atrazine.

Mike Mack, CEO, said: "After a strong first half volume performance in the northern hemisphere and the achievement of targeted price increases, the focus of our business is now Latin America where the outlook is positive given record soybean prices, our leadership position and advances in our integrated portfolio. Currency headwinds are likely to diminish in the second half and we will realise further cost savings. For the full year, we expect an increase in EBITDA margin at constant exchange rates and substantial free cash flow generation."

Syngenta said that all 19 of its territories are now commercially integrated, enabling the sales force to offer a combined portfolio to the customer. The centralisation of support services, he said, is already reaping cost efficiencies. The global crop teams are fully established and are working alongside the regional and R&D teams to develop new crop-based offers. Mr Mack said: "The need for technology in agriculture was never greater than it is today, and we believe that our integrated strategy can enhance the value of that technology for customers and shareholders alike." The company's aim is to gain an average 0.5% market share annually across the combined business over the next five years.

SCIENTISTS DISCOVER POTENTIAL BIOPESTICIDE

A team of scientists from the University of Greenwich's Natural Resources Institute (NRI), working with colleagues in the UK and Tanzania, has made a discovery that could provide a new means to control insect crop pests around the globe. The research team has discovered that some African armyworms carry a small bacterium called Wolbachia which makes them more vulnerable to a natural virus which can be used as a biopesticide. The African armyworm is a devastating caterpillar pest which feeds on cereal crops, including maize, wheat, millet and rice. Up to 500,000 caterpillars can sometimes attack a single hectare and totally destroy a crop. They are a major threat to food security in Africa, where chemical pesticides are too expensive for most farmers.

David Grzywacz, entomologist and virologist at the University of Greenwich, said: "The mass release of insects infected with Wolbachia could turn out to be an important new tool in the fight to control some insect crop pests. It may prove particularly useful for those that are difficult to control with chemical pesticides." Researchers at the University of Greenwich, Lancaster University and a Tanzanian company called EcoAgriConsult have been investigating safe, affordable control measures to tackle the caterpillars. They have been carrying out research into *SpexNPV,* a virus that naturally infects and kills the African armyworm, and which shows great promise for use as a biopesticide in Africa. Not only can it be produced cheaply and locally, but it infects only armyworm caterpillars, leaving beneficial insects, livestock and humans completely unharmed. Armyworm carrying the bacterium Wolbachia were found to be between six and 14 times more susceptible to *SpexNPV*.

MAKHTESHIM AGAN APPOINTS NEW CHIEF COMMERCIAL OFFICER

Makhteshim Agan has appointed Ignacio Dominguez, current CEO of MAI Europe, as its chief commercial officer (CCO) and head of the Global Products and Marketing Division. In his new role Mr Dominguez will be responsible for MAI's global commercial strategy, including global crop and product portfolio management, global products development and global registration, as well as the company's global marketing and branding strategies. Mr Dominguez has served in a variety of managerial positions with MAI since 2001. Prior to joining MAI, he held positions with ICI, American Cynamid and Syngenta. He will continue to serve as head of MAI's European Region until a successor is appointed. Erez Vigodman, MAI's president and CEO, said: "The appointment of a CCO to MAI is another step to support our strategy of reinforcing MAI's differentiation and market leadership. In a complex and competitive market place this appointment will allow us to improve our global market orientation and worldwide customer service capabilities."

GATES FOUNDATION DONATES £6.4 MILLION TO JOHN INNES CENTRE

The Bill and Melinda Gates Foundation will be donating a grant of £6.4 million to scientists at the John Innes Centre (JIC), Norwich, UK. The donation is for research over the next five years into the possibility of developing genetically engineered cereals to associate with nitrogen-fixing bacteria. The long term aim is to benefit farmers in the developing world by lessening the need for the application of expensive artificial nitrogen fertiliser.

Professor Giles Oldroyd from JIC in welcoming the award said: "During the Green Revolution, nitrogen fertilisers helped to triple cereal yields in some areas…But these chemicals are unaffordable for small-scale farmers in the developing world." As a result, yields are 15 to 20% of their potential. Nitrogen fertilisers also come with an environmental cost. Making and applying them contributes half the carbon footprint of agriculture and causes environmental pollution. If it is found to work, farmers would be able to share the technology by sharing seed. The research also opens the door to the use of grasses as rotational crops to enhance soil nitrogen.

Katherine Kahn, senior programme officer of agricultural development at the Bill & Melinda Gates Foundation said: "We are excited about the long-term potential of this research to transform the lives of small farmers who depend on agriculture for their food and livelihoods …We need innovation for farmers to increase their productivity in a sustainable way so that they can lift themselves and their families out of poverty. Improving access to nitrogen could dramatically boost the crop yields of farmers in Africa."

The focus of the investigation will be maize, the most important staple crop for small-scale farmers in sub-Saharan Africa. It is hoped that parallel studies on the wild grass, *Setaria viridi*, which has a smaller genome and shorter life cycle than maize, will speed up the rate of discovery. Ultimately it is hoped that the development will be applicable to all cereal crops including wheat, barley and rice. The research will start by attempting to engineer in maize the ability to sense nitrogen-fixing soil bacteria

and it is believed that this could be enough to activate a symbiosis that provides some fixed nitrogen. Even slight increases could improve yields for farmers who do not have access to fertilisers.

The project will help to highlight where further research is needed. It will run in parallel to on-going research funded by the UK government's Biotechnology and Biological Science Research Council, BBSRC, into how nitrogen fixation works in legumes and alongside an existing Gates-funded project, N2Africa, designed to improve nitrogen management in African farming systems more immediately.

CROPS FOR THE FUTURE

NIAB Innovation Farm (www.innovationfarm.co.uk) held a conference Breakthrough technology: crops for the future *at its headquarters in Cambridge on 28 June 2012. The day comprised updates from three high profile areas of crop improvement, a number of short 'elevator pitches' from small young businesses, and a field tour. Dr Alan Baylis reports for* Crop Protection Monthly*.*

NIAB Innovation Farm is a partnership between science and industry to highlight advances in plant genetics and to facilitate their transfer into commercial development. The aim is to demonstrate how crop genetic improvements can address food security, climate change, sustainable resources, and health and nutrition. It is based at the Cambridge headquarters of NIAB, formerly known as the UK National Institute of Agricultural Botany. Once famous for evaluating the field performance of new crop varieties, NIAB, has in recent years, developed its research capabilities in both the laboratory and on-farm. It now has an emphasis on 'pre-breeding' or the use of genomics to discover novel traits and in 2009 joined forces with TAG, an arable agronomy organisation, to be able to offer a complete pathway for the development and field testing of new crop genetics.

Improving photosynthesis

Professor Howard Griffiths (Cambridge University) discussed the various options and progress being made towards improving the efficiency of photosynthesis as a means of achieving higher yields of wheat. This is one of a number of crop improvement strategies that emerged from a recent Gates Foundation forum. Others included manipulating leaf canopy architecture to let more light into the crop, improving the use of solar radiation by reducing damage from sudden increases in intensity, and reducing inter-plant competition within the crop.

The fundamental problem with photosynthesis is that the key enzyme involved in capturing carbon dioxide and converting it to plant carbohydrates is flawed. The enzyme, Rubisco (ribulose-1,5-bisphosphate carboxylase oxygenase), is the most abundant protein on earth. Unfortunately, it has an affinity for oxygen as well as carbon dioxide, resulting in the loss of carbon dioxide in 'C3' plants such as wheat through photorespiration. Some plants have evolved a way of capturing and recycling this lost carbon dioxide by utilising additional enzymes and compartmentalising different stages of the process. Maize is a 'C4' plant in which carbon dioxide is fixed as organic acids with four carbon molecules and concentrated in 'bundle sheath cells' before ultimately being exposed to Rubisco from which stage carbohydrates are made in the same way as in C3 plants, but with an overall greater efficiency, meaning higher yields.

The key extra enzyme in C4 plants is PEP carboxylase (phosphoenolpyruvate carboxylase), described as a 'turbocharger', which delivers carbon dioxide to Rubisco. This mechanism is certainly robust, as it is known to have evolved independently 66 times in plants. Indeed, it helps to increase the competitiveness of plants, for example a major weed of rice, *Echinochloa crus-galli* (barnyardgrass), is C4 while the crop is C3.

An alternative carbon concentrating mechanism to C4 that is being investigated is found in algae. For algae, the problem is the poor solubility of carbon dioxide in water and a biophysical rather than biochemical solution has evolved. This involves utilising bicarbonate and carbonic anhydrase, but must take place within pyrenoids, situated inside chloroplasts, so that the back diffusion of carbon is prevented.

Engineering C4 photosynthesis or other carbon concentrating mechanisms into C3 plants is challenging because not only are the genes for additional enzymes required, but they must be expressed in certain specialist tissues or within membrane-bound structures such as pyrenoids which also need to be constructed.

Hybrid wheat

Colin Patrick (Saaten-Union) presented a review of progress with hybrid wheat. France grows the greatest area of hybrid wheat at 170,000 ha, 7% of the country's total wheat area. To create a hybrid and reap the benefits of hybrid vigour, the selected male and female parents must be efficiently crossed and any self-pollination prevented. This is achieved by various forms of male sterility: physically in plants like maize where male flowers (tassels) are separate and can be relatively easily removed; genetically (cytoplasmic male sterility); or chemically by the use of a chemical hybridising

agent (CHA). Using a CHA has the great advantage that sterility is confined to the generation of the cross, compared to a genetic approach where fertility must be restored so the progeny produce seed. Several years of back-crossing are then required, during which time the hybrid yield advantage is off-set by advances in conventional breeding.

Saaten-Union has exclusively developed a CHA, sintofen, which is registered in the EU and used in the production of hybrid wheat in France as *Croisor.* The time of sintofen application is critical, with a narrow window when floral development of tillers within the crop means that embryonic ears are all at a susceptible stage. To be certified as hybrid, seed must be 90% hybrid. This is checked by monitoring seed production in pollen-proof cages set within the female parent strips.

Male and female parent varieties are selected and grown in individual strips not more than 9 m wide, as wheat pollen does not travel far. Male parents are selected on traits that make for a good pollinator - taller than the female and producing copious pollen which is easily shed. An important female trait is receptivity to pollen from a different variety (normally wheat is inbreeding). However, most important is the compatibility of parents in terms of the time of flowering. The female must be ready to receive pollen when shed by the male.

Currently, wheat hybrid seed is about twice the cost of conventional seed, but because of more tillering and better tiller survival, it should be drilled at no more than 75% of usual seed rates. Hybrid vigour can achieve a yield advantage of about 15% compared to the mean of the parents, and more when crops are under drought stress. The greater yield is expressed largely as heavier grains. Protein content can also be higher. Hybrids have been found to have greater overall biomass, particularly in the roots (60% more) compared to shoots (40-50% more).

Low cost DNA sequencing

Dr Cristobal Uauy (John Innes Centre/NIAB) is a wheat geneticist. He described how there has been an exponential decrease in the cost of DNA sequencing over the past decade. Soon an individual human genome will cost less than £1000 to sequence, having cost £100,000 in 2002. Recently, he has been involved in the discovery of a gene conferring partial resistance to yellow rust, a more durable form of resistance. His research programme now includes studying traits such as leaf wax composition in relation to adaptation to changing environments and identifying genes controlling pre-harvest sprouting.

Synthetic wheat hybrids

In the field, NIAB wheat breeder, Phil Howell, demonstrated the synthetic hexaploid wheat (SHW) lines that are being used as a source of new genetic diversity for transfer into elite breeding lines. SHWs are the result of crosses between tetraploid durum wheat varieties with *Aegilops tauschii* (wild goat grass). This recreates the rare hybridisation events between the three original diploid grass species in the 'Fertile Crescent' of the Middle East 10,000 years ago that resulted in bread wheat. Also, lines from a programme to identify and characterise the photoperiod response genes controlling flowering time were on show. Selecting for earlier flowering under drier conditions can result in very significant yield increase (30% in Southern Europe). Grain from early flowering wheat varieties fills for longer under conditions of higher soil moisture.

Also in the programme were a number of short 'elevator pitches' by start-up and small and medium sized companies involved in the Cambridge Partnership for Plant Sciences (CPPS). These included novel approaches to controlling nematodes, breeding more nitrogen efficient oilseed rape varieties, using triticale for bioethanol feedstock, and a weed control system using hot foam based on plant extracts.

AGRICULTURAL OUTLOOK 2012-2021

Agricultural Outlook Report *produced collaboratively by the Organisation for Economic Co-operation and Development (OECD) and the Food and Agriculture Organisation (FAO) of the United Nations. It brings together the commodity, policy and country expertise of both organisations and input from collaborating member countries to provide an annual assessment of medium-run projections of national, regional and global agricultural commodity markets. The projections constitute a plausible scenario of what may happen under a certain set of assumptions, such as normal weather conditions, a specific macroeconomic environment over the coming ten years, population trends, as well as current agricultural and trade policy settings of countries around the world.*

The recent 18th edition of the *Agricultural Outlook Report* provides world market trends for biofuels, cereals, oilseeds, sugar, meats, fish and dairy products over the 2012-2021 period and contains an evaluation of recent developments, and key issues and uncertainties in those commodity markets (**www.oecd.org/site/oecd-faoagriculturaloutlook**).

Nominal prices of the commodities covered in the current *Outlook* report are expected to trend upwards over the next 10 years and are projected to average 10%-30% above those of the previous decade. Prices in real terms (adjusted for inflation) will remain flat or decline from current levels. However, despite strong prices, slower production growth is anticipated. Growth in global agricultural production has been above 2% per annum over the past several decades, but is projected to slow to 1.7% per annum over the next decade. Growing resource constraints, environmental pressures, and higher costs for some inputs are anticipated to inhibit supply response in virtually all regions. In this context, the current *Outlook* suggests that more attention be paid to increasing sustainable agricultural productivity growth.

The growing role of the developing countries

Based on their greater potential to increase land devoted to agriculture and to improve productivity, developing countries will provide the main source of global production growth to 2021. Annual production growth in developing countries is projected to average 1.9% per annum compared to 1.2% per annum in developed countries. An additional 680 million people are expected to inhabit the planet by 2021 with the fastest population growth rates in Africa and India. Rising incomes and urbanisation will lead to changes in diets that shift consumption to more processed foods, fats and animal protein. This will favour higher value meats and dairy products, and drive the indirect demand for coarse grains and oilseeds for livestock feed.

Biofuels

Global production of bio-ethanol and bio-diesel is projected to almost double by 2021, heavily concentrated in Brazil, the US and the EU. Biofuels based on agricultural feedstocks are expected to consume a growing share of the global production of sugarcane (34%), vegetable oil (16%), and coarse grains (14%) by 2021. In response to government mandates, biofuel trade between the US and Brazil is expected to increase. The report anticipates that the US will import sugarcane-based ethanol mainly from Brazil to help meet domestic demand created by its mandate for advanced biofuels, while Brazil will import lower priced maize-based ethanol principally from the US to satisfy the demand from its large fleet of flex-fuel vehicles. US low-blend ethanol demand is expected to be constrained by the 'blend-wall', the point at which the domestic ethanol market becomes saturated or almost saturated, from 2016 onwards.

Global trade

Emerging economies will capture an increasing share of the expanding world trade in agriculture. Most prominent are countries such as Brazil, China, Indonesia, Thailand, the Russian Federation and Ukraine all of whom have made significant investments to boost agricultural production capacity. By 2021, developing countries will account for the majority of exports of rice, oilseeds, vegetable and palm oil, protein meals, sugar, beef, poultry meat, fish and fish products.

Cereal stock-to-use ratios will remain below historical averages, posing the risk of future price volatility. The Russian Federation, Ukraine and Kazakhstan are expected to become much more important sources of wheat exports by 2021, but high production variability in this region may have implications for global trade and world price volatility.

Larger exports of rice are projected from least developed countries in Asia, while rice imports are to increase in Africa. Oilseeds production and exports continue to be dominated by the traditional players, but emerging exporters like Ukraine and Paraguay are expected to increasingly contribute to global export growth. China, the dominant importer, will account for more than half of total world imports. Brazil's oilseed production growth is expected to slow from 4.9% to less than 2% per annum over the next decade.

Food and ethanol demand for sugar crops will be sustained over the medium term, maintaining high sugar prices. Production cycles will continue to characterise sugar markets in Asia, leading to occasional large trade fluctuations and price volatility. Because of Brazil's dominant position in the sugar market, the allocation of its sugarcane crop between ethanol and sugar production remains a key market driver.

Increased demand for meats will mostly stem from large economies in Asia, crude oil exporting countries and Latin America, where income gains are expected to be significant. Poultry meat will lead this anticipated growth as the cheapest and most accessible source of meat protein, overtaking pig meat as the largest meat sector by the end of the outlook period. Fish production is one of the fastest growing sources of animal protein. World fisheries and aquaculture production are expected to grow by 15% over the projection period. However, with a 33% growth in aquaculture production, it will surpass capture fisheries as the primary source of fish for human consumption by 2018.

A modest increase in consumption of dairy products is expected in developed countries with the exception of cheese and fresh dairy products, while in developing regions consumption of all products is expected to increase about 30% by 2021. Developing countries are projected to overtake developed countries in milk production by 2013, with large increases in China and India.

Longer term perspectives

The report concludes that agricultural production needs to increase by 60% over the next 40 years to meet the rising demand for food. This translates into an additional 1 billion tonnes of cereals and 200 million tonnes of meat a year by 2050 compared with 2005/07 levels. Additional production will also be necessary to provide feedstock for expanding biofuel production.

Globally, the scope for area expansion is limited. Total arable land is projected to increase by only 69 million hectares (less than 5%) by 2050. Additional production will need to come from increased productivity in the same way as it has for the past 50 years. Increasing productivity will be central to containing food prices in a context of rising resource constraints and will be a key factor in reducing global food insecurity. Productivity gains in the medium-term may come primarily from reducing the productivity gap in developing countries. A significant share of the increased output of crops, used as feedstocks, can be expected to go into biofuel production.

At the same time, there is a growing need to improve the sustainable use of available land, water, marine ecosystems, fish stocks, forests, and biodiversity. Some 25% of all agricultural land is highly degraded. Critical water scarcity in agriculture is a fact for many countries. Many fish stocks are overexploited, or in risk of being over-exploited. There is a growing consensus that climate change and extreme weather events will increase.

Encouraging better agronomic practices, creating the right commercial, technical and regulatory environment, and strengthening agricultural innovation systems (eg research, education, extension, infrastructure), including measures addressing the specific needs of smallholders, are essential policy challenges identified in the report. Measures to reduce food loss and waste are also key to meeting rising demand and improving productivity in the supply chain.

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