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The year witnessed a lot of changes in the area of genetically modified crops. New EU rules under EU Directive 2015/412 came into force in March allowing member states to opt out of cultivating EU-approved GM crops on grounds such as policy objectives, co-existence problems, and socio-economic impacts. Member states wishing to opt out had to notify the European Commission by October 2nd. All such requests received from 17 member states and four devolved administrations were cleared by the Commission. The requests covered six maize lines that had either been approved or have authorisations under consideration.

But a similar move to push through plans to allow member states to ban the use of EU-approved GM food and feed failed. The European Parliament’s Agriculture Committee rejected the proposal in September with the Parliament’s Environment Committee rejecting it the following month. The Committees decided to reject the proposal on the basis that it was unworkable and would lead to the reintroduction of border controls between pro- and anti-GMO countries.

Apart from the evident conflict with free-trade laws, questions were asked over the far-reaching consequences of the proposals, particularly on European livestock production, which is dependent on imported GM feed. European feed industry groups had warned that feed costs would rise by €2,800 million ($3,000 million) if all EU countries took part. The main impact would be the need to replace imported GM soybeans with premium-priced non-GM soybeans.

The Parliament called on the Commission to come up with alternative legislative proposals. However, the Commission indicated that it had no plans to do this.

But delays continued to beset the approval of GM crop lines for import, processing and use in food and feed. In April, the Commission finally signed off such approvals for 17 GM crop lines, along with two GM carnations for import as cut flowers. Some of the crop lines had been stalled in the EU registration system since the end of 2013.

In December, two more GM maize lines were cleared following the failure of EU member states to reach a majority vote for or against the approvals in the appeal committee. That came days after the Environment Committee members urged the Commission to suspend any further approvals for the import or use of products derived from GMOs until the adoption of new legislation covering the authorisation process for GM food and feed. The resolution needs the backing of the full Parliament, which is scheduled to vote on it this month.

The industry continued complaining about the time taken to complete an EU assessment of a GM crop, which it said is over five years, compared with less than two years in 2006. Data for other countries in 2011 showed average times for a complete GM product approval of 25 months in the US, 27 months in Brazil and 30 months in Canada.

A steady increase between 2006 and 2014 in the average time taken by the European Food Safety Authority (EFSA) to deliver a scientific opinion on applications was blamed. That was compounded by the publication of numerous additional EFSA guidance documents, which frequently changed what data were required from applicants, the association EuropaBio said. Sixteen new guidance documents had been published since 2006 and 11 additional ones are due between 2015 and 2016. New requirements are often applied retroactively to all applications under EFSA review, making it impossible for applicants to know what will actually be required when they are preparing their dossiers.

As of July 6th 2015, over 40 GMO applications were awaiting an EFSA risk assessment. The oldest product in the EU approval system, Monsanto’s twin-trait cotton, combining glyphosate-tolerant Roundup Ready Flex (MON88913) with insect-resistant Genuity Bollgard II (MON15985), has been awaiting the EFSA’s scientific opinion for more than eight years.

A report from the UK Parliament’s Science and Technology Committee criticised EU regulations calling them not fit for purpose. It called for the process-based EU approval system to be replaced by a trait-based system for regulating new crop breeding technologies. The Committee further demanded devolution of the approval process so that decisions about access to and use of safe products be made by national governments rather than by the EU. A separate report called

By Sanjiv Rana
for the launch of field trials of GM insects so that the country could make the most of its status as world leader in this area of research.

Endocrine disruptors
Delays were the underlying theme in many projects of the Commission during the year.

The Commission was supposed to have compiled by March, a list of active ingredients that would fall under each of its proposed options for regulating endocrine disruptors (EDs). But it finally issued in December, the list of ais chosen for screening in the project to develop criteria for identifying EDs. The screening is part of an impact assessment on the development of ED criteria. Final results are expected by the end of the second quarter of 2016.

The list comprised 324 agrochemical and 95 biocidal ais chosen from all ais approved in the EU by May 11th 2015. It excluded micro-organisms, substances approved as "basic" or "low-risk", natural extracts, mixtures or repellents, attractants (pheromones) or plant hormones and inert substances. The Commission also does not expect guidelines on various aspects of ED risk assessments to be ready until the end of 2016.

In December, the European Court of Justice’s General Court ruled that the Commission breached EU law by failing to establish criteria for identifying EDs in biocides. Sweden brought the lawsuit in 2014 after the Commission missed the ED criteria deadline of December 13th 2013. The case concerned the EU biocidal products Regulation (528/2012), but the outcome has implications for ED criteria for agrochemicals, where the Commission has missed the same deadline.

The Commission has long defended the ongoing delays in setting ED criteria, citing the complexity and differing scientific views on the issue. But the Court ruled that the Commission could not rely on its argument that initial proposed criteria in 2013 were subject to scientific criticism. The existence of criticism was irrelevant to the fact that the Commission had an obligation to act by a certain date, the Court said.

But following the Court ruling, a Commission spokesperson stressed that ongoing work on an impact assessment was “on track” and repeated that the existing schedule to complete the assessment by the end of 2016 would be maintained. But he desisted from specifying a date for deciding on final ED criteria.

Neonicotinoids
Delays were also the order of the day in the re-evaluation of the risks to bees posed by three neonicotinoid insecticides, clothianidin, thiamethoxam and imidacloprid, by the European Food Safety Authority (EFSA). Those will not be completed until January 2017. The work was linked to the Commission’s suspension of many uses of the three ais in 2013, due to concerns over bee health. At that time, the Commission said that it would review the measures within two years. In its request late last year for the EFSA re-evaluations, the Commission gave a completion date of October 31st 2016.

However, the EFSA responded with a new deadline of January 2017. The existing neonicotinoid suspension continues until the Commission completes its review of the measures.

The EFSA issued a call in May for data on the risks to bees from the use of the three insecticides with responses coming in by the end of September. In the same month, the Agency issued a call for data on the risks to bees from the insecticide, fipronil, as a first step in the Commission’s review of its two-year suspension of certain fipronil uses in 2013. The deadline was January 15th 2016.

Meanwhile, in August, the EFSA concluded that neonicotinoid insecticides applied as foliar sprays pose a risk to bees. For all authorised foliar uses, high risks were identified or could not be excluded, or the risk assessment could not be finalised due to lack of data. The EFSA suggested that some cases could be helped by risk mitigation measures.

EU farmer’s groups kept warning about the fall in oilseed rape by as much as 7% during the year owing to the neonicotinoid ban. They warned that farmers were reducing their oilseed rape plantings because of fears over losses to pests.

Some member states granted emergency approvals in the face of the EU ban. In the UK, approval was granted for 120 days for seed treatment on some 30,000 ha in four counties worst affected by cabbage stem flea beetles (Psylliodes chrysocephala). Other member states included Denmark, Finland, Estonia, Romania and Bulgaria.

On the subject of bees, the EFSA launched in June a major project to investigate the combined effect of various stressors, including pesticides, and develop a way to predict how they affect a colony. The ultimate goal of the work is to establish a framework for the risk assessment of multiple stressors in honey bee colonies. The multi-annual project will consider stressors such as parasites, infectious agents, agrochemicals and environmental changes. It will involve scientists and experts across the EU and be co-ordinated by the EFSA’s Multiple Stressors in Bees (MUST-B) working group.
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Candidates for substitution

At the beginning of the year, the EU Standing Committee on Plants, Animals, Food and Feed agreed a proposed list of 77 pesticides that are to be classified as candidates for substitution. The Commission had missed the original deadline of December 31st 2013 due to disagreements over identification methods. From August 1st 2015, new applications for authorisation, renewal or extension of use for products that contain candidates for substitution are would have to go through the comparative assessment procedure to identify possible alternatives.

Glyphosate

In its much-anticipated review of the herbicide, glyphosate, which came out in November, the EFSA declared that the ai was unlikely to pose a carcinogenic hazard to humans. The Authority was tasked by the Commission to consider the UN WHO’s International Agency for Research on Cancer (IARC) finding that the herbicide was probably carcinogenic. In response, the EFSA noted that the EU evaluation considered a large body of evidence, including a number of studies not assessed by the IARC, which was one of the reasons for reaching different conclusions. Furthermore, the IARC looked at all glyphosate-based formulations regardless of their composition, whereas the EFSA looked solely at the ai. It is likely that the genotoxic effects noted by the IARC for some formulations were related to co-formulants, the Authority said.

The conclusion is in the Authority’s peer review of the herbicide, which is being reassessed as part of the application for renewed EU approval. The EFSA does not propose classification as carcinogenic, but it has proposed a new safety measure to tighten the control of glyphosate residues in food. It set an acute reference dose (ARfD) for glyphosate of 0.5 mg per kg of body weight, the first time such an exposure threshold has been applied to the active ingredient. The EU approval of glyphosate expires on June 30th 2016.

The EFSA came under fire for its conclusion from members of the European Parliament’s Environment Committee. MEPs questioned the EFSA’s methods and independence, because its conclusion contrasted with the IARC finding that glyphosate was probably carcinogenic. But EU Health and Food Safety Commissioner Vytenis Andriukaitis rejected a call by a group of scientists to disregard the EFSA’s conclusion.

In September, the new EU minor uses co-ordination facility started work as part of plans to improve the availability of agrochemicals for use on minor crops. The facility was proposed by the Commission in 2014. It will co-ordinate data sharing and work among member states, and create a database of minor uses.

France

The year started with France declaring that its plan launched in 2008 for halving usage of pesticides in the country had failed. Six years after its launch, the plan, dubbed Ecophyto 2018, and launched under the government’s environmental initiative, Grenelle de l’Environnement, had not delivered the expected results. Usage had, in fact, increased, having gone up by 5% on average between 2009 and 2013. The Ministry of Agriculture came up with a new version of the Ecophyto plan, saying that the previous plan was too ambitious without the means to change the production model. The new plan would place emphasis on encouraging biopesticides and organic farming. At the same time, the Ministry wants to shift the focus from the view of organic farming being good and conventional farming being not so.

But agrochemical distributors in France “strongly objected” to being made scapegoats in the new plan. One aspect of the plan involves a requirement in the form of plant protection product savings certificates, called Cepp, for distributors to reduce by 20% over five years the number of agrochemicals sold. A penalty would be imposed on any distributor not reaching the target of 20% in five years. The distributors pointed out that it was farmers who decided on the actions implemented on their farms. They cautioned that the consequences of the decisions would be a growing number of farmers buying their crop protection products beyond French borders, where constraints and taxes were lower. Farmer co-operatives complained that the restrictions and penalties being formulated would distort competition between France and other EU countries.
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Bees, lawsuits and hints of a precautionary shift

By J R Pegg and Andy Beer

Concern about the impacts of legal pesticide uses on commercial honey bees, wild pollinators and endangered species drove much of US pesticide policy in 2015 and left registrants worried about possible new use restrictions as well as a possible shift by the US EPA towards a more precautionary approach to pesticide regulation.

Pollinator protection took centre stage in May when a White House task force, led by the USDA and the EPA, released a mammoth and ambitious federal strategy aimed at reversing declines of honey bees, monarch butterflies and other native pollinators. Much of the effort was clearly driven by concern about the plight of commercial honey bees. US commercial beekeepers lost 42% of their colonies from April 2014 to April 2015 and have been accruing annual losses of some 30% for much of the past decade. Such losses are considered economically unsustainable for beekeepers and are worrisome for growers who depend upon commercial pollination services.

Major US beekeeping groups and environmentalists say that widespread agricultural use of pesticides, particularly neonicotinoid insecticides, is a key factor and have ramped up pressure on the EPA to intervene. But the Agency has thus far resisted calls to follow the EU’s lead and impose a moratorium on neonicotinoid uses. The EPA has, however, not stood still on the issue and in 2015 showed a clear willingness to pursue additional restrictions to protect pollinators.

In April, the Agency told the pesticide industry that new neonicotinoid uses were unlikely to be approved until additional data on bees had been submitted and pollinator risk assessments completed. The EPA said that it was also considering new pesticide data requirements intended to better assess the potential risk to bees and other pollinators, but did not issue a proposal in 2015.

In the wake of the White House report, the Agency proposed restrictions in May on an array of pesticides under specific conditions to protect commercial honey bees. The proposed rule would prohibit foliar applications of 76 pesticides the Agency considers “highly toxic” to bees. Such applications would be banned when crops were in bloom and commercial bees have been brought in for pollination services.

But the EPA’s proposal was met with broad criticism from all stakeholders and appears to have stalled. US farm groups and the pesticide industry called on the Agency to abandon the proposal while environmentalists and beekeepers contended that it did not go far enough. Of perhaps greater concern to the EPA was opposition voiced by the USDA, which questioned the need for the new rule and suggested that the Agency lacked the authority to implement the regulation.

The courts also handed the Agency a blow related to its efforts to protect bees from pesticide uses. In September, the US Court of Appeals for the Ninth Circuit overturned the EPA’s approval of the insecticide, sulfoxaflor, concluding that the Agency relied on “flawed and limited” data when it issued an unconditional registration for the Dow AgroSciences’ product. The EPA subsequently issued a cancellation order for sulfoxaflor products, but allowed growers to use existing stocks. The ruling could have serious ramifications for how the EPA assesses the risks to bees and other pollinators from legal pesticide uses. It is the first court decision regarding a pesticide registration that relied upon the EPA’s new framework for assessing risks to pollinators and suggests that the Agency will be held to a high bar if it has to defend its decisions in court.

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the scope of the changes, but have yet to pursue legal action to block implementation of the WPS.

The EPA also proposed new rules in 2015 for applicators of restricted-use pesticides, calling for stricter standards for certification, training and supervision as well as suggesting a minimum age requirement of 18 years. The Agency said that the revamped regulations would reduce the likelihood of harm from the misapplication of pesticides and ensure consistent enforcement across all 50 states. That effort has also faced scepticism from stakeholders. State pesticide and agricultural officials, who will bear much of the burden for implementing the rules, have questioned the revisions and suggested that they lack the resources to impose the proposed changes.

The EPA spent considerable time in 2015 defending other decisions in federal court, including its review of the insecticide, chlorpyrifos, its approval of Dow's Enlist Duo (2,4-D choline + glyphosate) herbicide and its legal responsibilities under the Endangered Species Act (ESA).

The ESA has been a long-running headache for the EPA and pesticide registrants and 2015 saw little change on that front. The EPA continued its work in 2015 with the federal wildlife agencies on a new approach for addressing flaws about the ESA consultation process, but the work has not deterred environmental groups from challenging pesticide registrations because of concerns about endangered species.

The EPA in June settled one ESA case with the Center for Biological Diversity (CBD), agreeing to conduct nationwide effects determinations for four herbicides on 11 endangered species in the San Francisco Bay Area. The pesticides in question are atrazine, simazine, propazine and glyphosate. The CBD has also threatened to sue the Agency for approving Syngenta's new maize bicyclopyrone-based herbicide, Acuron. The environmental group alleges that the EPA failed to consult with the wildlife agencies before it approved the herbicide. A similar suit, also filed by the CBD in 2015, is challenging the EPA's approval of DuPont's cyantraniliprole (trade-marked as Cyazypyr).

The legal battle over chlorpyrifos ramped up dramatically in 2015 and may ultimately result in the EPA effectively banning the insecticide. The US Court of Appeals for the Fifth Circuit sided with environmentalists in the summer of 2015 and ordered the EPA to respond to a petition calling for a ban on the widely used insecticide. The EPA responded by issuing a proposal to revoke tolerances for chlorpyrifos, suggesting that aggregate exposures from food and drinking water in “certain watersheds” may exceed safety levels set by federal law. Users of the insecticide and the pesticide industry said that the concerns were overblown and wanted the Agency to reverse course. Critics also worried that the EPA was using tolerance revocation, rather than standard administrative procedures, to potentially impose a ban. The Agency came under another court order to make a final decision by the end of 2016.

The EPA was also engaged in a high-profile legal battle over its approval of Dow's Enlist Duo herbicide, intended for use on the company's Enlist genetically modified crops. Environmentalists challenged the registration, alleging violations of the ESA and federal pesticide law. In August, the Ninth Circuit Court rejected their bid to temporarily block commercialisation of the product

The EPA was also engaged in a high-profile legal battle over its approval of Dow's Enlist Duo herbicide, intended for use on the company's Enlist genetically modified crops while the challenge was pending, but the tables turned in November when the EPA asked the Court to vacate and remand the registration. The Agency cited concerns about claims Dow made within a patent application about the product’s “synergistic weed control” properties. The EPA contends that it did not know about the claims. The Agency said that it was no longer certain its registration complied with federal pesticide law until it had reviewed new data on the possible synergistic effects of Enlist Duo. Of specific concern to the EPA was whether a 30-ft (9.1-m) downwind in-field buffer was adequate for protecting endangered plant species and other non-target organisms. Dow said that it had no problem with the EPA's request that the court remand the registration back to the Agency, but argued that “there is no basis in law or logic” to vacate it. The company contended that the EPA was trying to “short circuit” the regulatory process for vacating a registration.

Debate about GM crops and labelling in 2015 were largely confined to the courthouse. The Ninth Circuit Court is still considering the legality of GM crop bans and restrictions approved separately by three counties in the state of Hawaii. A settlement announced in December upheld a ban in Oregon's Jackson County, but gave GM alfalfa farmers some eight years to come into compliance. On the labelling front, the tiny state of Vermont continued to hold centre stage. Vermont's GMO labelling law is set to enter into effect in July 2106, but has been challenged by food groups who contend that mandatory labelling is unnecessary and violates federal law. A federal appeals court heard arguments in September 2015 on whether to impose a temporary hold on the law while the litigation was pending. The Court did not issue a ruling, but the debate pushed federal lawmakers to re-engage on the issue.

The US House of Representatives approved legislation in July to block states from enacting mandatory GMO labelling laws, but
the bill stalled in the Senate and its future in 2016 is at best uncertain.

**CANADA**

In Canada, politicians urged the country’s Pest Management and Regulatory Agency to conclude its re-evaluation of neonicotinoid insecticides “without delay”. The review should be based on evidence and sound scientific principles with an objective of protecting the health of bees. That was one of nine recommendations made in a report by the Standing Senate Committee on Agriculture and Forestry on “The importance of bee health to sustainable food production in Canada”.

Meanwhile, the province of Ontario finalised regulations aimed at reducing by 80% the area planted with maize and soybean seed treated with neonicotinoid insecticides by 2017. The rules took effect on July 1st. Draft regulations had been put forward in March following a discussion document in November 2014 aimed at addressing factors affecting pollinator health. The regulations established a new class of pesticides under the Pesticides Act comprising maize and soybean seed treated with the neonicotinoid insecticides, imidacloprid, thiamethoxam or clothianidin. There is also a new system for regulating such seed including: farmer training on IPM methods to protect pollinators; establishing methods that assess if pest problems require the use of neonicotinoid-treated seed; setting out requirements for the sale and use of neonicotinoid-treated seed; and tracking the sale of such seed.

Towards the end of the year, the province of Quebec decided to impose additional restrictions on the use of the “highest-risk pesticides” including neonicotinoid insecticides. The provincial government’s Quebec Pesticide Strategy 2015-2018 called for the agricultural application of such pesticides to be “justified by an agronomist in advance of 100% of cases”. It also advocated a tripling of the number of pesticides that to be banned in urban environments for use on lawns and green spaces. Legislation is due to be introduced this year.
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A near perfect storm hit the Brazilian agrochemical market sending sales plunging in 2015. The market dropped a reported 23% sending sales down to way below US$10 billion. That compares with a record of over $12 billion in 2014.

A crash in the value of the national currency as the country went through an economic crisis proved the sector’s major hurdle to surmount. The industry trades on many imported products, and struggled to pass on the higher costs to growers in the form of prices. The market was further weakened by low pest pressure and farmers’ reduced access to credit. Impacts were felt across the region.

For exporter countries, the fall in crop prices had a major impact on what farmers could earn, and the exchange rates saw severe falls. In Colombia, the value of the national currency fell by a third against the dollar. Argentina and Mexico saw major falls.

But a significant impact came from the weather. The effects of El Niño brought dry weather to Mexico and the Central American region, including the Caribbean. Farmers were unable to grow crops. Severe weather impacted Brazil and to some extent Argentina. All these issues compounded the other causes of falling demand.

Infestation levels of certain major pests were also down, causing less need for insecticide applications in Brazil.

Market data were released revealing that Latin America became the largest continental market at over $16 billion the previous year. That proved to be the end of recent boom.

Pro industry Ag Minister

A lack of product approvals, especially of new active ingredients in the past few years, drew a strident policy priority for the new Brazilian Agriculture Minister, Katia Abreu called for an expedited and reformed pesticide approval system. Ms Abreu also sought to create a new approvals body to replace the three that existed, each of which has a veto over registrations. In each of the previous five years, just 1-3 ais had been authorised. Approvals were running at more than 20 per year a decade ago.

A public consultation was launched in which growers and industry among others offered potential solutions to increasing the rate of pesticide approvals.

Ms Abreu also opposed the government’s platform position of switching from chemical to biological controls.

A federal judge in Brazil ordered the national health surveillance agency, the Anvisa, to complete its reassessments of the remaining ais in its 14 pesticides review by the end of the year. The agency launched a reassessment programme on 14 ais in 2008 It has since placed restrictions on several and implemented bans on the other pesticides.

There were six remaining pesticide ais to be assessed in the review. The programme started in 2008 with 120 days set for its completion. The six included: the herbicides, glyphosate, lactofen and paraquat; the fungicide, thiram; the insecticide, carbofuran; and the acaricide/insecticide, abamectin.

The agency restarted the remaining assessments in September It subsequently recommended a ban on paraquat use.

The Anvisa suffered from internal disputes due to problems with pesticide regulatory concerns. The Anvisa’s manager of toxicology was exonerated of mismanagement, but subsequently retired from her post. Another scandal involved the publications of secret compositions of 11 pesticides. Brazil legislated the previous year for more transparency with information from government. Documents were uploaded onto an online Ministry of Agriculture resource, Agrofit. But trainees employed to do the job uploaded the wrong documents and the secret information on 11 pesticides was issued. The system was ended, and the data are no longer publicly accessible.

The agency subsequently reformed its processes, including taking on more technical staff. A large backlog of applications led to the agency issuing a plan to prioritise certain products and ais. Furthermore, it published a database of revealing the queue pesticide applications for
The reforms, new management, and stated ambitions of the agency late last year convinced the Minister to shelve her policy of streamlining the approvals process in the hope that the changes would make such reform unnecessary. She had promised a system that would cut approval times by over two-thirds from a typical 24 month process to one taking 4-8 months.

The Ministry further prioritised eight pests, weeds and diseases as key targets for pesticides in the approval process. Those included Asian soybean rust, earworms (*Helicoverpa armigera*), nematodes and the resistant weeds, horseweed (*Conyza bonariensis*) and sourgrass (*Digitaria insularis*). It set out various ai/pest combinations that would get priority assessments.

The Argentine government committed itself to seeking ways to accelerate the approval processes for the imports of agricultural inputs.

Peru approved regulations covering the life cycle of pesticides that should significantly reduce pesticide approval times. Among the claimed benefits of the new rules in the regulation, DS No 00102015 Minagri, will be the consolidation into one regulation of all the activities of the life cycle of a pesticide, such as import, manufacture, formulation, marketing, distribution, packaging, phytosanitary emergencies, monitoring and control of registered products.

The industry in Brazil requested an extension to the 30-day limit for analyses and registration on 2,4-D impurities. The request was made on behalf of the industry's 2,4-D working group. It wants the requirement to be extended to 60 days as there is no available laboratory in Brazil to test for impurities and the required logistics in sending samples.

Brazil extended restrictions on four insecticides on cotton or winter crops within 300 m of cotton fields in the flowering stage early this year. They allow for aerial applications on cotton, which had been suspended, and last for one year. The imposed restrictions cover the neonicotinoids, imidacloprid, thiamethoxam and clothianidin, and the phenylpyrazole, fipronil, until the conclusion of the Ibama's reassessment of the ais.

In Colombia, the well-trailed UN assessment on glyphosate led to a ban of aerial application of the herbicide on areas where illicit crops, such as coca plants destined for the narcotics business. The ban did not cover any other registered uses. Later in the year, the government went back on its decision and re-allowed that use of the herbicide, claiming that it was ineffective.

The Paraguayan authorities introduced legislation to control pesticide usage, creating the control and monitoring system on pesticides and raw materials, and implementing the use of coded labels. The legislation was revoked later in the year as unworkable. That followed a change in leadership at the regulatory body, the Senave. The new system was intended to allow the service to guarantee the veracity of data presented at product registration application and at import, with the obligatory use of safety stickers with alphanumeric codes that identify products via an IT systems database at the Senave.

**Pests and diseases**

The previously devastating earworms (*Helicoverpa* spp) infestation levels were much reduced. Weather conditions aided growers, while more products became available to control them. The time when earworms were initially detected coincided with the withdrawal of several products. There were no pesticides to deal with *Helicoverpa*, but last year there were several.

The Brazilian government extended the implementation of emergency controls against infestations of earworms by another year towards the end of 2015. The Ministry of Agriculture issued a decree in 2013 granting it special autonomous powers to permit the use of pesticides that “do not cause grave damage to the environment” due to a state of emergency being issued to combat the pest. That included the import and use of emamectin benzoate insecticides. Furthermore, the extension could be added until a final registration decision on the ai had been taken.

Paraguay replicated Brazil’s IPM and the use of GAP for the control of the spread of earworms.

Three new agricultural pests in Brazil were detected and became the focus of calls for expedited approvals of pesticides to control them. Those were leaf miner flies (*Melanagromyza* spp), Australian bollworms (*Helicoverpa punctigera*) and Palmer amaranth (*Amaranthus palmeri*). The Brazilian government extended the implementation of emergency controls against infestations of earworms by another year towards the end of 2015. The Ministry of Agriculture issued a decree in 2013 granting it special autonomous powers to permit the use of pesticides that “do not cause grave damage to the environment” due to a state of emergency being issued to combat the pest. That included the import and use of emamectin benzoate insecticides. Furthermore, the extension could be added until a final registration decision on the ai had been taken.

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In Central America, coffee rust (*Hemileia vastatrix*) outbreaks were less severe than in previous years. Better understanding of rust management among growers and the dry weather limited its severity. Industry leaders claimed confidence in eliminating the losses fruit growers face from fruit fly infestations by the end of the year.

Overall, pressures from diseases and pests were reduced across the continent.

**GMOS**

International research was publishing showing that Brazil accounted for almost a quarter of the world’s genetically modified crop area in 2014.

During 2015, BASF and the Brazilian agricultural research corporation, the Embrapa, launched the first GM soybean line completely developed in Brazil. The imidazolinone herbicide-tolerant Cultivance (CV127) soybeans were co-developed by the companies. Biosafety authority approval came five years ago, a marketing deal was agreed in 2007, but demand for the product depended on EU import clearance. That arrived last year.

Other approvals came for GM crops in 2015. Brazil provisionally approved several lines across various crops.

They included soybean products such as the stacked herbicide-tolerant LibertyLink (A5547-12) and the Balance GT (FG72) soybeans line from Bayer CropScience, and two Dow AgroSciences’ herbicide-tolerant Enlist lines; Enlist (DAS68416) soybeans; and Enlist E3 (DAS44406) soybeans.

Approvals of GM maize included those for DuPont Pioneer’s multi-stacked insect-resistant Optimum Leptra (DAS1507 [TC1507] + MON810 + MIR162) and its insect-resistant and herbicide-tolerant DAS1507 + MON810 + MIR162 + NK603 lines. Dow gained biosafety approval for its Enlist (DAS40278) maize, and Monsanto for its herbicide-tolerant Roundup Ready 2LibertyLink (NK603xT25) maize. Monsanto has a cross-licensing deal with Bayer covering use of Bayer’s herbicide tolerance technologies.

The biosafety authorities further approved what would become the world’s first GM eucalyptus product. That was Brazilian company Susana Papel e Celulose’s subsidiary biotechnology company, FuturaGene Brasil Tecnologia’s (Sao Paulo), output trait H421 eucalyptus, to increase wood production.

In Argentina, Monsanto launched the final stage of its grower payment plan for use of its GM insect-resistant and herbicide-tolerant Intacta RR2 Pro (MON87701xMON89788) soybeans. It would ensure that farmers were contracted to pay royalties for use of saved seed. The method consisted of a controlled collection of a “Canon Intacta” payment plan at grain delivery points during the year’s growing season in the north of the country. It allows for those who have not paid for seed in advance.

The Ministry of Agriculture subsequently issued a decree establishing a single payment rule for the use of GM crops. It stops systems of royalty payments for the use of technology in saved seed derived from a GM crop. The Ministry is creating a registry in which growers record their second-generation seed to combat the market in illegal sale of saved GM soybean seeds.

“a Brazilian court suspended an injunction that stopped royalty payments to Monsanto for cargoes of soybeans containing its Intacta RR2 Pro technology”

That followed farmer groups that had challenged the right of soybean exporters to inspect cargoes for illegal GM produce. Some groups argued that only the state had the authority to inspect cargoes, and that the forcing of payments was illegal.

Argentina approved Intacta soybeans in 2012. The passing of an intellectual property (IP) law has faced heavy resistance. The government has been planning to recognise IP rights for agricultural biotechnology products in a bid to tempt Monsanto into introducing its second-generation GM soybeans. It and Monsanto had previously been parties to long legal battles as far as in the EU over payment for royalties on earlier Monsanto technology.

Meanwhile, a Brazilian court suspended an injunction that stopped royalty payments to Monsanto for cargoes of soybeans containing its Intacta RR2 Pro technology. The Rio Grande do Sul state Tribunal of Justice decision makes the charging of royalties legal.

Argentina approved five products. They included three of soybeans: Dow’s Enlist 3, the Argentine soybean development consortium Bioceres’ HB4 drought-tolerant trait and DuPont Pioneer’s stacked high oleic acid content and herbicide-tolerant combination of Plenish (DP305423) and Monsanto’s Genuity Roundup Ready (MON4032) soybeans. There was also a cotton event approved, Bayer’s stacked herbicide-tolerant GlyTol LibertyLink (GHB614 + LL25) cotton (GHB614). The fifth approval came for a GM potato, the Argentine Conicet developed virus-resistant SY233 line.

A Mexican court overturned an injunction that barred the authorities from approving the use of genetically modified maize. Two years ago, a court ordered the Ministries of Agriculture and of the Environment not to grant further authorisations for trials, pilot planting and commercialisation of GM maize. Last year’s ruling follows findings that the suspension order contravened the application of biosafety legislation.
China’s pesticide companies endured a trying first three quarters, with 14 out of 25 of the country’s stock market-listed agrochemical companies seeing nine-month profits fall year-on-year. Profits fell at seven out of 24 listed agrochemical companies during the first half of 2015.

Three of the 25 companies made an operating loss during the period. The worst hit were the glyphosate majors, with Zhejiang Wynca Chemical recording a 3% drop in total sales and posting a loss of some Yuan 152 million ($23.1 million at the current rate). Eleven companies saw profits slide by over 20%, as exports slowed and stricter environmental regulations increased pressure on manufacturers.

Herbicide exports, which accounted for over half of exports, dropped 20% in value terms during the first nine months of the year. Exports total of herbicide formulations as well as technical material fell in value terms for the first time. Volume exports of the herbicide, glyphosate, fell 15% in the nine-month period, while value exports of the active ingredient dropped almost 40%.

A decline in prevailing prices during the year led to a tough market environment for Chinese companies. The country’s average pesticide prices saw significant drops in the first half of 2015, with the average price index for June dropping 18.2 points year-on-year.

The decline was led by herbicide products, which fell 26.5 percentage points year-on-year. The average transaction price for glyphosate in the first half of this year was Yuan 19,600/tonne ($3,000/tonne at the current rate), down 51.7% on the highest price in 2013, and a 36.4% drop on the average price for the first half of 2014. There were rumours of some sale prices falling below cost level, and tens of thousands of tonnes of glyphosate lying in storage at the port of Shanghai.

The difficulties of manufacturers were compounded by a significant increase in operating costs. The implementation of stringent environmental regulations, with pesticide technical material and intermediates being classified as dangerous chemicals, resulted in transportation costs increasing by over 20% on average. Labour costs for pesticide formulators also increased by as much as 30% in some areas.

The situation does not look promising even during 2016 as members of China’s glyphosate manufacturers’ consortium saw no grounds for optimism in the market outlook. The group stressed the need to streamline the industry by lowering costs and via continued consolidation.

The country had planned to reduce the number of pesticide companies by 30% during the period of its 12th five-year plan (2011-2015). Over the past few years, it encouraged companies to engage in mergers and acquisitions in a bid to reduce its number of pesticide operators, which was at over 1,800 in 2010.

"the average transaction price for glyphosate in the first half of this year was Yuan 19,600/tonne ($3,000/tonne), down 51.7% on the highest price in 2013"

But the target is unlikely to have been met at the end of the plan. A total of 21 companies have been reported to have left the market in 2015. China is already beginning to draw up plans for the 13th five-year plan (2016-2020) and expectations are that targets would again be set on completing the goals that were first mooted in the 12th five-year plan. Those would include reducing the number of Chinese pesticide companies by 30% by 2020, and for the sales of technical material from the top 20 pesticide companies to account for over half of the industry total. The country’s two state-owned chemical giants, ChemChina and Sinochem, each own stakes in some of the country’s largest pesticide companies, and have as yet been unable to consolidate all of these businesses into one single entity.

Indications for the domestic market in 2016 are positive among expectations of outbreaks of plant diseases and insect pests to hit crops harder. This year’s outbreaks are expected to be heavy, affecting some 367 million ha of crops in the country.

India

In India, the year started with the country’s new Environment Minister expressing his commitment to the conduct of field
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trials of genetically modified crops. That was viewed as a positive signal in the country where GM crop trials have been a thorny political issue in the country for the last few years, leaving the industry in a state of limbo more often than not. But there was little progress in the granting of approvals for trials by the Genetic Engineering Appraisal Committee.

Meanwhile, Monsanto spent most of the year embroiled in a royalty dispute with many Indian seed companies that refused to pay royalties for using its GM insect-resistant Bollgard Bt traits. The trouble arose from the fixing of seed prices by state governments in some of the main cotton-growing states in India, which seed companies claimed squeezed their royalties. Monsanto’s Indian joint venture, Mahyco-Monsanto Biotech (MMB), initiated legal proceedings against the companies.

But towards the end of the year, the government issued a gazette notification stating its intention to fix a uniform maximum retail price from March 2016 on all cotton seeds including those of GM lines. That will comprise the seed value and licensee fee including royalty or trait value. Towards the end of December, MMB moved the Delhi High Court challenging the government’s notification.

**Bangladesh**

After having commenced the commercial cultivation of GM insect-resistant Bt aubergines, Bangladesh’s first GM crop, in 2014, the country approved field trials of five lines of GM crops. Those included two lines of vitamin A-enriched rice (Golden rice), two lines of potatoes and one line of insect-resistant Bt cotton.

**Philippines**

But in the Philippines, GM crops faced a stumbling block when the Supreme Court temporarily prohibited the approval of any application for the contained use, testing, propagation, commercialisation and importation of GMOs until a new administrative order is promulgated. The Court invalidated the Department of Agriculture’s Administrative Order No 08-2002, which contained rules for regulating the use of GMOs, for being insufficient in guaranteeing compliance with international biosafety standards. The order thus expanded the 2013 order by the Philippine Court of Appeal to halt field trials of GM insect-resistant Bt aubergines. Field trials on the GM lines were approved in 2011. GM maize has been cultivated in the country since 2002, when Monsanto received initial approval for the commercial planting of its insect-resistant MON810 line.

**Australia**

The Australian Pesticides and Veterinary Medicines Authority (APVMA) prioritised five agrochemicals or groups of compounds for detailed review scoping during 2016. The list was drawn up following extensive consultations during 2015 on prioritising 19 chemicals or groups under a planned overhaul of the review process. The majority of the 39 chemicals on the existing priority chemical review list were nominated some 20 years ago when the APVMA’s review programme was established in 1995. The overhaul of the programme followed legislative changes in 2014 that included the introduction of prescribed timeframes for chemical reviews and the requirement for a work plan for each review to be provided to registration holders.

The Authority completed 81% of pesticide registration applications within statutory timeframes in the 12 months to June 30th 2015. That compared with 96% in the previous fiscal year when the 90% target was exceeded. The APVMA attributed the performance to the effort required to implement new legislation that came into effect on July 1st 2014. There was a concerted effort to minimise the number of applications that would transition to the new legislation. That meant finalising applications received before that date that were already outside timeframes at the beginning of the period, the Authority pointed out.
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<td>Thiamethoxam, Fipronil</td>
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<td>Emamectin, Abamectin</td>
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Mergers, acquisitions and deals in 2015

By Andy Beer

JANUARY

- Swiss biopesticide company Andermatt Biocontrol acquired a 21% stake in South African biological farming products firm Madumbi Sustainable Agriculture, taking its holding to a majority 61% share.

- Bayer CropScience agreed to acquire the seed business of the Brazilian agricultural business, Cooperativa Central Gaúcha. The deal was completed in March.

- Dow AgroSciences completed the acquisition of Brazilian seed business Coodetec. The purchase was agreed in July 2014.

- FMC agreed to make a limited introduction of its 3rive 3D pesticide application technology in the US in partnership with US equipment company Emerge Application Solutions.

- Monsanto and FMC extended their US herbicide promotion deal to include FMC's insecticide, Hero (zeta-cypermethrin).

- French contract research company Staphyt acquired the French field trials company, Astria 59.

- Staphyt acquired the Italian contract research firm, Agrobiocontrol.

FEBRUARY

- US agrochemical and fine chemical company Albaugh’s European subsidiary, Albaugh Europe, acquired the Slovenian agrochemical firm, Pinus TKI.

- Bayer CropScience extended an earlier Brazilian seed technology deal with UK plant health company Plant Impact (PI) to ten years and obtained exclusive commercialisation rights to PI’s current and future pipeline of products for soybeans throughout the Americas.

- Mitsui & Co agrochemical distribution company Certis Europe agreed with UK-based soft chemical company Bio-D to acquire the outstanding global formulation rights and all other associated technology for the maltodextrin-based insecticides, Eradicoat and Eradicoat T.

- The analytical testing company, Eurofins Scientific, acquired the US seed and plant tissue testing firm, BioDiagnostics.

- FMC acquired global rights to a novel, unnamed, proprietary herbicide from Kumiai Chemical and its sister company, Ihara Chemical.

- The US agrochemical and specialty chemical company, Platform Specialty Products, completed the acquisition of Arysta LifeScience for some $3,510 million.

- Israeli biopesticide company Stockton entered into a distribution agreement with South Korean agrochemical company Atlotech for Stockton’s biofungicide, Timorex Gold (Melaleuca alternifolia extract).

- Japanese conglomerate Sumitomo Corporation agreed to acquire a 65% stake in Brazilian agricultural inputs distributor Agro Amazônia Produtos.

- The Belgian Tessenderlo Group’s US subsidiary, Tessenderlo Kerley Inc, acquired the herbicide, Solicam (norflurazon), from Syngenta.

MARCH

- The US agrochemical company, Albaugh, entered into an agreement with the Indian chemical company, Yashashvi Rasayan, to construct and operate a dicamba herbicide manufacturing facility in India.

- Dow AgroSciences and the Chinese Academy of Agricultural Sciences signed a memorandum of understanding for collaborative research, including negotiating a licence to Dow’s Exzact gene insertion platform.

- The US-based, UK-listed bioproducts company, Plant Health Care, entered into a distribution agreement for its disease resistance activator Harpin αβ technology with US agrochemical distributor T H Agri-Chemicals.

- UPL agreed to acquire a 40% stake in Brazilian farm inputs distributor Sinagro Produtos Agropecuarios. The deal was completed in July.
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■ Israeli biopesticide company Stockton agreed a distribution deal with Syngenta in Argentina for its Melaleuca alternifolia extract-based biofungicide, Timorex Gold.

■ Sumitomo Chemical’s US-based biopesticides and biorational products subsidiary, Valent BioSciences, acquired the US company, Mycorrhizal Applications.

APRIL
■ US agrochemical company American Vanguard acquired ChemChina subsidiary Adama Agricultural Solutions’ European Nemacur (fenamiphos) insecticide/nematicide business assets.

■ American Vanguard acquired DuPont’s global business assets for the herbicide, bromacil.

■ Arysta LifeScience’s (part of Platform Specialty Products) Japanese subsidiary, Arysta Japan, signed a renewed collaboration agreement with Dutch bioproducts company Koppert Biological Systems.

■ The US agrochemical company, Brandt, agreed to market and distribute US company Proptera’s rhamnolipid-based biofungicide, Zonix, throughout the US.

■ French genomics company Cellectis’ US subsidiary, Cellectis Plant Sciences, signed a global licensing agreement with the University of Minnesota over its CRISPR gene editing technology.

■ Dow AgroSciences entered into a research and development agreement with the US genomics company, Radiant Genomics, to discover natural ingredients for use in crop protection products.

■ Dow AgroSciences entered into an agreement to develop and commercialise novel genetically modified soybean lines with the Verdeca joint venture between US agricultural biotechnology company Arcadia and the Argentine soybean development consortium, Bioceres.

■ DuPont agreed to acquire the US microbial genomics company, Taxon Biosciences.

■ The US biopesticide company, EcoPesticides, signed a cooperative research and development agreement with the USDA’s Agricultural Research Service to further validate its microencapsulation technology.

■ FMC completed its acquisition of Cheminova from its Danish parent company, Auriga Industries, for $1,800 million. The deal was agreed in September 2014.

■ The US-based, UK-listed bioproducts company, Plant Health Care, signed an agreement with an unnamed “major industry player in the agricultural space” to evaluate its Innatus 3G peptide platform.

■ French contract research company Staphyt acquired French GEP trial company Phytex.

■ Israeli biopesticide company Stockton appointed Canadian agrochemical company Engage Agro as its exclusive distributor of the biofungicide, Timorex Gold (Melaleuca alternifolia extract), in Canada for fruit, vegetables and specialty crops.

■ Syngenta and Argentine forage seed company Forratec entered into an agreement for the supply of premium forage seeds using Syngenta’s seed treatment technology under the Plenus brand.

■ Syngenta signed a licensing agreement with UK-based product design and development firm Cambridge Consultants to evaluate its Vortik spray technology.

■ An agreement between Canadian fertiliser company Agrium’s Brazilian subsidiary, Utilifertil, to distribute Bayer CropScience’s products across Brazil was approved by the country’s competition authorities. The deal was agreed in December 2014.

■ Sumitomo Chemical’s US-based biopesticides and biorational products subsidiary, Valent BioSciences, and Swiss sustainable company Evolva agreed to co-develop and commercialise active ingredients for use in “next-generation agricultural bioactives”.

■ Sumitomo Chemical subsidiary Valent USA Corporation took over the marketing and sales of Sumitomo subsidiary MGK’s agricultural insecticide range in the US.

MAY

■ Bayer CropScience and venture capital firm Flagship Ventures launched a partnership to invest in agricultural technologies and start-up companies.

■ UK company Eden Research signed an agreement with Syngcam and its Spanish subsidiary, Syngcam Iberia, to evaluate two of Eden’s terpene-based biofungicides.

■ Dow Chemical agreed to divest the majority of its post-harvest agrochemical AgroFresh business to Boulevard Acquisition Corporation for some $860 million. The deal was completed for $810 million in July.
EASTCHEM CO., LTD.

EASTCHEM, as the headquarters located in Changzhou, Jiangsu, covers two factories Nantong Weiike Chemical Co., Ltd and Jiangsu LionChem Co., Ltd, as technical and formulation base in Yangkou Coastal Economic Development Zone, Nantong, Jiangsu. The company aims at supplying pesticide via research and development, production, sale and registration, also developing new environmental pesticides, and will try the best to satisfy the customers.

PRODUCT LIST

INSECTICIDE
- Acephate
- Chlorfluazuron
- Fipronil

SAFENER
- Fenclorim
- Cloquintocet-mexyl
- Mefenpyr-diethyl

FUNGICIDE
- Fenpropidin
- Tridemorph
- Fenpropimorph

HERBICIDE
- 2,4D
- Cyhalofop-butyl
- Pretillachlor
- Pyribenzoxim

MOLLUSCICIDE
- Niclosamide
- Metaldehyde

PERSERVATIVE
- 1-Methylcyclopene (1-MCP)

Address:
Floor 26, Hangxuan Mansion, No.256, Middle Tongjiang Road, Changzhou, Jiangsu, China.
Tel: +86-519-68796986
Fax: +86-519-85194395
E-mail: Zhu@eastchem.net
Website: www.eastchem.net

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Welcome to meet us at Booth NO. 1E15-1F15 in CAC 2016 Shanghai China.
Monsanto extended its long-term licensing agreement with the US horticultural and garden products company, Scotts Miracle-Gro, for Monsanto's herbicide, Roundup (glyphosate), for lawn and garden use in the US and certain international markets.

Nufarm signed a heads of terms agreement with UK agrochemical research and development company Pangaea Agrochemicals for its anti-resistance technology.

UK non-crop pesticide manufacturer PelGar acquired the UK pesticide firm, Agropharm.

Chinese company Rainbow Chemical acquired a 73% stake in the Chinese firm, Ningxia Grenada, which manufactures pesticide intermediates.

French contract research company Staphyt’s seed subsidiary, Staphyt Seeds, acquired Austrian seed trial company Agrotest.

Syngenta agreed a deal with the Argentine fertiliser supplier, Crinigem, to jointly offer a combination fungicide and growth promoter to Argentine wheat growers.

JUNE

ChemChina subsidiary Adama Agricultural Solutions agreed a deal to be the preferred business partner of Israeli agricultural technology company Phytech’s PlantBeat System.

Bayer CropScience entered into a five-year partnership with the Australian Grains Research and Development Corporation targeting the development of herbicides with new modes of action and herbicide safeners.

Bayer entered into a three-year, Aus$1.1 million (US$840,950) collaboration with the University of Western Australia to combat herbicide-resistant annual ryegrass (Lolium multiflorum).

DuPont seed subsidiary DuPont Pioneer entered into a licensing and research collaboration with the University of Vilnius, Lithuania on genome editing technology.

Chinese chemical company Hebang Group agreed to acquire a 51% stake in Israeli biopesticide firm Stockton for $90 million.

Chinese company Jiangsu Huifeng Agrochemical agreed to acquire a 51% stake in Chinese chemical and agrochemical firm Shijiazhuang Ruikai Chemical for Yuan 269 million ($43.4 million).

Nufarm gained non-exclusive distribution rights to Sumitomo Chemical’s crop protection product range in the UK and Ireland.

The US-based, UK-listed bioproducts company, Plant Health Care, signed an agreement with a second unnamed “major industry player” to evaluate its Innatus 3G peptide platform.

The US-based contract research companies, SynTech Research and Symbiotic Research, formed an exclusive strategic alliance to gain access to each other’s services.

JULY

The US agricultural biotechnology company, AgBiome, formed a strategic partnership with the France-based KWS/Limagrain joint venture, Genective, to accelerate the discovery of new generations of insect control traits.

US agricultural biotechnology company Arcadia Biosciences agreed to develop soybean varieties incorporating the HB4 stress tolerance trait in collaboration with the Argentine soybean development consortium, Bioceres, and Brazilian company Tropical Melhoramento e Genetica.

Arysta LifeScience’s (part of Platform Specialty Products) regional business for Africa, India and the Middle East agreed to launch UK plant health company Plant Impact’s stress-tolerant Banzai biofungicide in West Africa.

The US subsidiary of French genomics company Cellectis, Calyxt, entered into an exclusive licensing agreement with UK early-stage investment company Plant Bioscience for a bread wheat trait generated using gene editing.

Calyxt acquired exclusive worldwide rights to gene targeting technology from the US University of Minnesota.

US-based specialty products manufacturer Douglas Products agreed to acquire Dow AgroSciences’ sulfuryl fluoride-based fumigants, ProFume and Vikane, along with a manufacturing facility.

Contract research company Eurofins Agroscience Services acquired the Spanish contract research firm, Trialcamp.

The US analytical and testing services company, Evans Analytical Group, acquired US contract research firm Analytical Bio-Chemistry Laboratories.

The US agribusiness companies, Land O’Lakes and United Suppliers, agreed to merge their crop input operations.

Brazilian biological crop protection company Promip acquired the Brazilian bioproducts company, Insecta Agentes Biologicos.

Chinese chemical company Rainbow Chemical acquired a majority stake in the Argentine pesticide company, Green Crop.

Sumitomo Chemical decided to merge the Chilean operations of its biopesticide and biorational products subsidiary, Valant BioSciences, with its post-harvest crop protection company, Pace International.
ANNUAL REVIEW
2015

CORPORATE ACTIVITY

■ The US agrochemical distributor, Wilbur-Ellis, acquired the seed company, The Seed House.

AUGUST
■ The US technology company, Cibus Global, and the Chinese agrochemical company, Rotam, agreed to co-operate on the development of non-genetically modified sulfonylurea herbicide-tolerant rapeseed in China.
■ Contract research company Eurofins Agroscience Services acquired the Dutch independent research institute, De Bredelaar.
■ Chinese agrochemical company Hubei Sanonda offered to acquire ChemChina subsidiary Adama Agricultural Solutions. Both are controlled by China National Agrochemical Corporation.
■ Indian company Indian Farmers Fertiliser Cooperative and Japanese company Mitsubishi Corporation agreed to form a joint venture called IFFCO-MC Crop Science for the sale and distribution of agrochemicals in India.
■ The US synthetic biology company, Intrexon Corporation, agreed to acquire the UK biotechnology company, Oxitec.

■ The Swiss chemical company, Lonza, acquired the New Zealand agrochemical company, Zelam.
■ Sumitomo Chemical and the non-profit UK-based Innovative Vector Control Consortium agreed to start testing a new insecticide active ingredient in Africa for the control of malaria-spreading mosquitoes.
■ Syngenta and Israeli biotechnology company Evogene extended the scope of an existing collaboration to allow the validation of candidate plant genes related to soybean cyst nematode resistance.

SEPTEMBER
■ US agrochemical and fine chemical company Albaugh’s Brazilian subsidiary, Atanor do Brasil, agreed to acquire FMC’s Brazilian generic pesticide business, Consagro Agroquimica.
■ Belgian company Belchim Crop Protection acquired 20% of its own shares held by FMC.
■ Dow AgroSciences licensed its Plextein protein detection technology to the US contract research company, Critical Path Services.
CORPORATE ACTIVITY

- The Indian agricultural inputs company, Godrej Agrovet, agreed to acquire a majority stake in Indian agrochemical company Astec Lifesciences.

- Dutch bioproducts company Koppert Biological Systems acquired Mitsui & Co agrochemical distribution business Certis Europe's beneficial insects business in the UK, France and Italy.

- Koppert formed an Indian joint venture with Indian biocide company Som Phytopharma.

- Japanese agrochemical company Nihon Nohyaku raised its shareholding in Sipcam Europe from 10% to 20%.

- Monsanto and FMC extended their US agrochemical promotion deal to include FMC's soil-applied maize herbicide, Capture LFR (bifenthrin).

- Koppert formed an Indian joint venture with Indian biopesticide company Som Phytopharma.

- Monsanto granted Albaugh a royalty-bearing licence to manufacture certain formulations of the herbicide, glyphosate, in the US, Canada and Europe.

- The US-based, UK-listed bioproducts company, Plant Health Care, signed two more agreements with “major industry players” to evaluate its Innatus 3G peptide platform.

- French contract research companies Staphyt and Ambrosi Scientific Consulting decided to conduct a “strategic merger”.

- Sumitomo Corporation’s subsidiary, Sumi Agro Europe, and Sipcam raised their mutual shareholdings in their respective intermediate holding companies, Sipcam Europe and Sumi Agro, from 10% to 20%.

- The US technology development investment company, Technology Acceleration Partners, entered into an exclusive licensing deal with Kansas State University for a patent covering double-stranded RNA-based nanoparticles for insect gene silencing.

- Sumitomo Chemical subsidiary Valent USA Corporation entered into an agreement with US information solutions firm Ifers.

OCTOBER

- Chinese company CEFC Petro agreed to acquire all of Chinese chemical conglomerate CEFC Anhui International’s agrochemical businesses, including Anhui Huaxing.

- Dow AgroSciences agreed to co-operate with the UK bioengineering company, Synthace, on improving technology through accelerated development of fermentation-based production of crop protection products.

- DuPont acquired a minority stake in the US genomics company, Caribou BioSciences, and the parties entered into a cross-licensing and multi-year research collaboration on gene editing technology.

- DuPont and Monsanto expanded their joint agrochemical offerings to soybean and canola growers in western Canada.

- DuPont seed subsidiary DuPont Pioneer gained regulatory approval for Pioneer Hi-Bred (Zimbabwe) to acquire the assets and liabilities of Pannar Seed Zimbabwe.

- The US agribusiness co-operative, Land O’Lakes, acquired a 52.5% stake in South African agrochemical company Villa Crop Protection.

- Monsanto and the German seed company, KWS Saat, extended their collaboration on the development of genetically modified sugar beet to cover crops with tolerance to the herbicides, glyphosate, glufosinate-ammonium and dicamba.

- The US agricultural inputs company, Pinnacle Agriculture Holdings, acquired eight US regional seed companies: AgVenture/GroMor; AVN Seeds Partners; Corn Capital Genetics; ProSelect; ProSelect; Scherr’s Seed; Seed Services of Nebraska; and Teays Valley Farms/Pureline.
Environmental Risk Assessment for Plant Protection Products 2016

23 March 2016 | Rothamsted Centre for Research and Enterprise | Harpenden, UK

A must attend event focused on the assessment of environmental risks for pesticides.

This one day conference will provide a good platform for regulatory scientists, risk assessors and risk managers to discuss and share experiences with the ever increasing demands for sustainable, intensive, agricultural productivity.

Taking place at the newly purpose built Rothamsted Centre for Research and Enterprise in Hertfordshire, this conference will cover a range of topical issues, all delivered by experts in environmental regulatory science:

Professor Lorraine Maltby (Sheffield University), Dr. Robin Sur (Bayer CropScience), Ton van der Linden (RIVM), Dr. Andreas Focks (Alterra - Centre for Water and Climate), Mick Hamer (Syngenta Ltd), Dr. Marco Candolfi (Eurofins), Dr. Sabine Beulke (Enviresearch), Andy Newcombe (Arcadis) and Frank Bakker (Mitox)

Professor Juliet L Osborne (Environment & Sustainability Institute, University of Exeter) will also demonstrate BEEHAVE - The latest ecological model for evaluating pesticides and bee colonies

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Syngenta expanded its maize trait licensing collaboration with German seed company KWS and French seed company Limagrain and their joint ventures, AgReliant Genetics and Genective.

Syngenta acquired the US farm management software company, Ag Connections.

The Belgian Tessenderlo Group’s US subsidiary, Tessenderlo Kerley Inc, agreed to acquire certain parts of DuPont’s global hexazinone herbicide business, including its hexazinone/diuron mixture product business, but excluding assets in Brazil.

The US-based contract research company, SynTech Research, acquired UK-based field trials company Suffolk & Cambridge Crop Station.

American Vanguard subsidiary Amvac Chemical licensed the established herbicide, Scepter (imazaquin), from BASF for use on soybeans and turf in the US and its territories.

The Chinese company, Beijing Nutrichem, agreed to acquire Dow AgroSciences’ oxyfluorfen herbicide business.

Dow AgroSciences entered into a licensing agreement with US technology company Coherent Ag Solutions to form and internet-based crop protection stewardship tool for farmers.

German market research company GfK agreed to sell its global animal and crop health division to a consortium consisting of private equity investor Inflexion and the current management.

Syngenta and Dutch life sciences firm DSM Food Specialties agreed a partnership to develop microbial-based agricultural solutions, including biological controls, biopesticides and biostimulants.

UPL and its seed subsidiary, Advanta, agreed to merge.

ChemChina subsidiary Adama Agricultural Solutions agreed to enter into a commercial collaboration with five Chinese agrochemical companies that are part of the ChemChina group.

The UK subsidiary of European agrochemical distributor and consultancy Agroviesta acquired the UK seed company, John Ebbage Seeds.

Arysta LifeScience North America (part of Platform Specialty Products) formed a partnership with Canadian company Vive Crop Protection to market Vive’s proprietary technology with Arysta’s agrochemical active ingredients.

BASF and Israeli biotechnology company Evogene signed a three-year collaboration for the discovery and development of novel herbicides.

BASF and Sumitomo Chemical agreed to collaborate on research into more sustainable testing of agrochemicals and other products.

French genomics company Cellestis’ US subsidiary, Calyxt, signed a research collaboration and option to exclusive licences with UK investment company Plant Bioscience for crops developed using gene editing by the Chinese Academy of Sciences’ Institute of Genetics and Developmental Biology.

UK-based specialty chemical company Croda agreed to acquire Dutch seed treatment company Incotec.

Dow AgroSciences and US plant biotechnology company Arcadia BioSciences agreed to collaborate on the development and commercialisation of genetically modified maize lines.

DuPont and Dow AgroSciences’ parent company, Dow Chemical, agreed to combine their businesses in an “all stock merger of equals”.

Contract research company Eurofins Agroscience Services acquired the French contract research firm, Phyliae.

US agrochemical company Gowan agreed to acquire Dow’s global dinitroaniline herbicide business.

Dutch seed treatment company Incotec entered an agreement with the Bangladeshi NGO, Bangladesh Rural Advancement Committee, for collaboration in seed film coating technology.

Swiss company Mecteam acquired the Swiss seed treatment machinery company, NoroGard.

The US private equity company, Paine & Partners, acquired a majority stake in the Australian biopesticide firm, AgBiTech.
After yet another successful Eastern Europe Regulatory Conference on the registration of plant protection products, which was well attended by both industry professionals and representatives from across Europe, we will return to Budapest in 2016.

Latest speakers include:
- Dr. Gábor Tőkés (National Food Chain Safety Office, Directorate of Plant Protection, Soil Conservation and Agri-Environment, Hungary),
- Aurélie Dhaussy (European Crop Protection Association),
- Tracy Roberts (TSGE Consulting),
- Ian Indans (UK Chemicals Regulation Directorate (CRD), Health and Safety Executive),
- Louise Brinkworth (Dow AgroSciences),
- Jeroen Meeusen (EU Minor Use Co-ordination Facility) and
- Willem Ravensburg (IBMA).

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New active ingredients registered or launched in 2015

By Andy Beer

<table>
<thead>
<tr>
<th>Company &amp; active ingredient</th>
<th>Use</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>FUNGICIDES</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>BAYER CROPSCIENCE</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>fluopyram</td>
<td>Grapevines, lettuces &amp; ornamentals</td>
<td>Proposed approval in Australia as Luna Privilege; launched in Colombia as Luna Tranquility (with pyrimethanil); launched in Spain as Luna Sensation (with trifloxystrobin)</td>
</tr>
<tr>
<td><strong>DOW AGROSCIENCES</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>meptyldinocap</td>
<td>Grapevines</td>
<td>Approved in EU</td>
</tr>
<tr>
<td><strong>DUPONT/SYNGENTA</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>oxathiapiprolin (trade-marked by DuPont as Zorvec)</td>
<td>Food crops, turf &amp; ornamentals</td>
<td>Approved in US as Zorvec Enicade &amp; Zorvec Epicaltrin, &amp; for Syngenta as Orondis; approved in Canada as Zorvec Enicade &amp; Zorvec Epicaltrin, &amp; for Syngenta as Orondis &amp; OXTP 200 SC; proposed approval in Australia as Zorvec Enicade</td>
</tr>
<tr>
<td><strong>ISHIHARA SANGYO KAISHA</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>cyazofamid</td>
<td>Potatoes &amp; onions</td>
<td>Approved in New Zealand &amp; Australia as Ranman</td>
</tr>
<tr>
<td>isofetamid</td>
<td>Almonds, lettuces, grapevines, low-growing berries &amp; rapeseed</td>
<td>Launched in US by Summit Agro USA as Kenja following proposed approval in US</td>
</tr>
<tr>
<td><strong>SUMITOMO CHEMICAL</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>fenpyrazamine</td>
<td>Grapevines, strawberries &amp; protected crops</td>
<td>Approved in New Zealand &amp; UK as Prolectus</td>
</tr>
<tr>
<td>mandestrobin</td>
<td>Oilseed rape</td>
<td>Approved in EU</td>
</tr>
<tr>
<td><strong>SYNGENTA</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>benzovindiflupyr (trade-marked as Solatenol)</td>
<td>Food crops, turf &amp; ornamentals</td>
<td>Approved in Canada as Aprovia, A15457, Elatus/Mural (with azoxystrobin), A18993 (with propiconazole), Aprovia Top/Ascernity (with difenoconazole) and Instrata II (twin-pack with difenoconazole &amp; fludioxonil); approved in US as Aprovia, A15457 LG, A18126/A1826 LG/Mural (with azoxystrobin), A18993 (with propiconazole), A19334/Ascernity (with difenoconazole) (with difenoconazole) and Instrata II (twin-pack with difenoconazole &amp; fludioxonil); approved in US as Aprovia, A15457 LG, A18126/A1826 LG/Mural (with azoxystrobin), A18993 (with propiconazole), A19334/Ascernity (with difenoconazole)</td>
</tr>
</tbody>
</table>
## INSECTICIDES/ACARICIDES/NEMATICIDES

<table>
<thead>
<tr>
<th>Company</th>
<th>Active Ingredient</th>
<th>Applications</th>
<th>Approval Details</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ADAMA AGRICULTURAL SOLUTIONS</strong></td>
<td>fluensulfone</td>
<td>Cucurbits, melons, tomatoes, peppers, chillies, aubergines &amp; okra</td>
<td>Approved in Israel, Australia &amp; Mexico as Nimitz</td>
</tr>
<tr>
<td><strong>AGNOVA TECHNOLOGIES/MITSUI CHEMICALS AGRO</strong></td>
<td>dinotefuran</td>
<td>Cotton</td>
<td>Proposed approval in Australia as Starkle 200 SG</td>
</tr>
<tr>
<td><strong>BASF/NIHON NOHYAKU</strong></td>
<td>metaflumizone</td>
<td>Ant bait</td>
<td>Proposed approval in Australia as Siesta Granular Ant Bait</td>
</tr>
<tr>
<td><strong>BAYER CROPSCIENCE</strong></td>
<td>fluopyram</td>
<td>Cotton, peanuts &amp; greenhouse vegetables</td>
<td>Approved &amp; launched in US as Velum Total (with imidacloprid); launched in Italy as Velum Prime</td>
</tr>
<tr>
<td></td>
<td>flupyradifurone</td>
<td>Fruit, vegetables &amp; arable crops</td>
<td>Approved &amp; launched in US as Sivanto; approved in Canada as Sivanto Prime &amp; BYI 02960 480 FS; approved &amp; launched in Mexico as Sivanto Prime; approved in EU</td>
</tr>
<tr>
<td><strong>CHEMINOVA [FMC]</strong></td>
<td>gamma-cyhalothrin</td>
<td>Wheat &amp; barley</td>
<td>Approved in EU</td>
</tr>
<tr>
<td><strong>DOW AGROSCIENCES</strong></td>
<td>spinetoram</td>
<td>Soybeans &amp; horticultural crops</td>
<td>Launched in Brazil as Exalt &amp; Delegate</td>
</tr>
<tr>
<td></td>
<td>sulfoxaflor (trade-marked as Isoclast)</td>
<td>Cereals &amp; vegetables</td>
<td>Approved in EU</td>
</tr>
<tr>
<td><strong>DUPONT/SYNGENTA</strong></td>
<td>cyantraniliprole</td>
<td></td>
<td>Launched by Syngenta in China as Fuliang (with thiamethoxam)</td>
</tr>
<tr>
<td><strong>ISHIHARA SANGYO KAISHA</strong></td>
<td>flonicamid</td>
<td>potatoes &amp; horticultural crops</td>
<td>Approved in New Zealand as Mainman</td>
</tr>
<tr>
<td><strong>NIHON NOHYAKU</strong></td>
<td>pyflubumide</td>
<td>Fruit, vegetables, grapevines, tea &amp; ornamentals</td>
<td>Approved in Japan as Danicong flowable &amp; Doubleface flowable (with fenpyroximate)</td>
</tr>
<tr>
<td><strong>NIPPON KAYAKU</strong></td>
<td>chromafenozide</td>
<td>Apples</td>
<td>Approved in EU</td>
</tr>
<tr>
<td><strong>SUMITOMO CHEMICAL</strong></td>
<td>momfluorothrin</td>
<td>Non-agricultural</td>
<td>Approved in US &amp; Canada as S-1563, MGK 29871, MGK 29872 (all with d-phenothrin), MGK 29811 (with cypermethrin) &amp; MGK 29831 (with piperonyl butoxide)</td>
</tr>
<tr>
<td><strong>SUMITOMO CHEMICAL/VALENT USA CORPORATION</strong></td>
<td>etoxazole</td>
<td>Greenhouse tomatoes &amp; ornamentals</td>
<td>Approved in Canada as TetraSan</td>
</tr>
<tr>
<td><strong>USDA BEE RESEARCH LAB</strong></td>
<td>oxalic acid dihydrate</td>
<td>Beehives</td>
<td>Approved in US</td>
</tr>
</tbody>
</table>
# Active Ingredients

## Herbicides/PGRs

<table>
<thead>
<tr>
<th>Company</th>
<th>Active Ingredient</th>
<th>Uses</th>
<th>Approval Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bayer CropScience</td>
<td>indaziflam</td>
<td>Turf</td>
<td>Proposed approval in Australia as Specticle</td>
</tr>
<tr>
<td>Dow AgroSciences</td>
<td>halaxifnen-methyl (trade-marked Arylex)</td>
<td>Wheat, barley &amp; forage brassicas</td>
<td>Approved in Australia as GF-2685 &amp; as Paradigm Arylex with florasulam &amp; ForageMax Arylex with aminopyralid; approved in EU</td>
</tr>
<tr>
<td>Fine Agrochemicals</td>
<td>prohydrojasmon</td>
<td>Apples</td>
<td>Proposed approval in Canada as Blush</td>
</tr>
<tr>
<td>Syngenta</td>
<td>bicyclopyrone</td>
<td>Maize &amp; sugar cane (US import)</td>
<td>Approved in US &amp; Canada as SYNA16003 &amp; Acuron (with mesotrione, atrazine &amp; metolachlor)</td>
</tr>
<tr>
<td>Flumetralin</td>
<td>Tobacco</td>
<td></td>
<td>Approved in EU</td>
</tr>
</tbody>
</table>

## Biopesticides & Others

<table>
<thead>
<tr>
<th>Company</th>
<th>Microorganism</th>
<th>Uses</th>
<th>Approval Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anatis Bioprotection</td>
<td>Beauveria bassiana strain ANT-03</td>
<td>Fruit, vegetables, field crops, turf &amp; ornamentals</td>
<td>Approved in US as Bioceres</td>
</tr>
<tr>
<td>Andermatt Biocontrol</td>
<td>Autographa californica nucleopolyhedrovirus strain FV11</td>
<td>Greenhouse-grown cucumbers, peppers &amp; tomatoes</td>
<td>Proposed approval in Canada as Loopex</td>
</tr>
<tr>
<td></td>
<td>Cydia pomonella granulosis virus strain V22</td>
<td>Pome &amp; stone fruit &amp; walnuts</td>
<td>Approved in France as Madex Twin; approved in Australia as Grandex Biological Insecticide</td>
</tr>
<tr>
<td>Andermatt Biocontrol</td>
<td>Helicoverpa armigera nucleopolyhedrovirus</td>
<td>Soybeans, sweet corn, cotton, berries, vegetable &amp; ornamentals</td>
<td>Launched in Brazil by FMC as Helicovex; approved in US</td>
</tr>
<tr>
<td>BASF</td>
<td>Trichoderma asperelloides strain JM41 R</td>
<td>Soil &amp; growing media in greenhouses</td>
<td>Proposed approval in US as TrichoPlus</td>
</tr>
<tr>
<td>Bayer CropScience</td>
<td>terpenoid blend QRD 460</td>
<td></td>
<td>Approved in EU</td>
</tr>
<tr>
<td>Bioprodex</td>
<td>Tobacco mild green tobamovirus strain U2</td>
<td>Pastures &amp; wooded areas</td>
<td>Approved in US as SolviNix LC</td>
</tr>
<tr>
<td>Certis USA</td>
<td>Bacillus amyloliquefaciens strain D747</td>
<td>Fruit, vegetables, grapevines &amp; soybeans</td>
<td>Approved &amp; launched in Mexico as Double Nickel; approved in Canada as Double Nickel 55 &amp; Double Nickel LC</td>
</tr>
</tbody>
</table>
### DE CEUSTER
- **Peepino mosaic virus strain CH2 isolate 1906** [viral pesticide]
  - **Tomatoes**
  - Approved in EU

### ECOLOGIA Y PROTECCION AGRICOLA
- **Rescalure** [attractant]
  - **Citrus fruit**
  - Approved in EU

### EDEN RESEARCH
- **Eugenol/geraniol/thymol** [biofungicide]
  - **Grapevines**
  - Approved in Malta & Greece

### FMC
- **BLAD** [biofungicide]
  - **Grapevines, strawberries, tomatoes, almonds, stone fruit & ornamentals**
  - Approved in Canada as Fracture

### JOHN I HAAS BETATEC HOP PRODUCTS
- **Potassium salts of hop beta acids** [biochemical acaricide]
  - **Beehives**
  - Proposed approval in US as HopGuard

### KOPPERT BIOLOGICAL SYSTEMS
- **Trichoderma harzianum strain T22** [biofungicide]
  - **Field crops, greenhouse crops & greenhouse ornamentals**
  - Approved in Canada as Trianum G & Trianum WG

### MEIJII SEIKA
- **Lactobacillus plantarum** [biofungicide]
  - **Vegetables & potatoes**
  - Approved in Japan as Lactoguard WP

### MITSUI & CO
- **Bacillus amyloliquefaciens subsp plantarum D747** [biofungicide]
  - **Grapevines**
  - Approved in EU

### SILVAR TECHNOLOGIES (ANDERMATT)
- **Autographa californica NPV** [bioinsecticide]
  - **Greenhouse tomatoes, cucumbers & peppers**
  - Approved in Canada as Loopepx

### STOCKTON
- **Melaleuca alternifolia extra Mexico** [biofungicide]
  - **Coffee, grapevines, fruit & vegetables**
  - Approved in Macedonia, South Korea, Colombia & the Philippines as Timorex Gold

### SYNGENTA
- **Pasteuria nishizawai PN1** [bionematicide]
  - **Soybeans**
  - Approved & launched in Canada as Clariva

### VALENT BIOSCIENCES
- **Bacillus thuringiensis subsp aizawai strain ABTS-1587** [bioinsecticide]
  - **Fruit, vegetables, oilseeds & ornamentals**
  - Approved in Canada as XenTari WG

### ZELAM
- **Aureobasidium pullulans** [biobactericide]
  - **Pome fruit**
  - Approved in New Zealand as Blossom Protect
In 2016 new visual identity and new signature for STAPHYT

Staphyt, leading CRO in agro-sciences in Europe, presents its new visual identity and announces the launch of its new website in January 2016.

The modern design of the new web site reflects the new image of Staphyt, whilst keeping the fundamental values of the company as a key partner for its worldwide clients.

This new website serves professionals in the fields of plant protection, nutrition and breeding with direct access to each of the three activity areas from the home page.

The « About us » page presents the company and its commitments, with a definite focus to excellence, global management of projects and to control of time constraints.

The complete range of services offered is explained in the « our services » page and is organized around the key-central knowledge: the plants.

- regulatory consultancy and project management
- field studies
- lab- and glasshouse studies
- residue studies
- ecotox studies
- agro-food processing studies
- seed studies

A more user-friendly « Applicant area » allows a quick access to job offers and allows applicants to apply on-line easily. With a private and secured access, the “Customer center” allows our clients to have access to their data 24h a day via PHYTNET interface.

A section “Our Research & Innovation” also presents the new innovations: indeed, in order to ensure a continuous improvement of our activities and to best anticipate the new technical and regulatory issues, Staphyt invests each year in Research & Development. The website illustrates the recent innovations set up by our teams in either lab and fields and more specifically about bioproducts.
Plant biotechnology patents published in 2015 are likely to have a profound impact on the traditional pesticide market because the herbicide tolerance traits have greatly reshaped needs of herbicides such as 2,4-D, dicamba and glufosinate-ammonium, while pest resistance traits are being aimed at pests such as sucking insects, and resistance to soybean rust could impact the fungicide sector.

During 2015, there were 51 crop protection-related plant biotechnology patents released via the US Patent and Trademark Office. The big six crop protection companies claimed some 75% of those filed patents, continuing their dominance over plant biotechnology innovations. BASF led with 13 filings, followed by DuPont/DuPont Pioneer with 12, Monsanto with ten, Bayer CropScience with two and Dow AgroSciences with one filing (Table 1). Sorted by 11 targeted crops, soybeans topped with 20 filings (42%), followed by maize with 16 filings (33%), sunflowers with four filings (8%), rice with three filings (6%), and alfalfa/lucerne, brassicas, citrus, cotton, potatoes, tobacco and wheat each with one. Sorted by three main trait categories, herbicide tolerance traits dominated with 20 filings (40%), followed by pathogen resistance traits with 17 filings (33%), and insect resistance traits with 14 filings (27%).

Within herbicide tolerance traits, acetolactate synthase/acetohydroxyacid synthase (ALA/AHAS) inhibitor herbicide tolerance traits were most patented with ten filings, followed by stacked traits with three filings, hydroxyphenyl-pyruvate dioxygenase (HPPD) inhibitor herbicide tolerance traits with two, protoporphyrinogen oxidase (PPO) inhibitor herbicide tolerance traits with two, and glyphosate and metribuzin tolerance each with one. As glyphosate-tolerant crops have been widely adopted for more than 30 years, it is understandable that weed resistance issues have forced companies to shift their research to other herbicides with different modes of action. Among insect resistance traits, coleopteran insect resistance traits ranked number one with seven filings, followed by lepidopteran insect resistance traits with four filings. Bt maize and Bt cotton have been the great tools to control lepidopteran insects, such as corn borers and bollworms in the last 30 years. Logically, traditional Bt toxins have reshaped harmful insect population dynamics. For instance, the secondary pests, corn rootworms, have evolved into primary pests. The trend of plant biotechnology innovation on coleopteran insect resistance reflects the need of crop protection. Regarding the pathogen resistance traits, the soybean rust diseases (Phacosporaceae) were most filed with seven filings, followed by Fusarium spp with two filings, and bacterial diseases with two.

In terms of the molecular means employed, most of claims were achieved by transgene expression with 43 filings (84%) and the rest were obtained by quantitative trait locus (QTL) mapping/plant breeding.

Shuyou Han received his PhD in plant molecular biology from the University of Ottawa in 2009 and did a post-doctorate from Agriculture and Agri-Food Canada. He can be reached by email at hanshuyou@gmail.com
The Crop Protection Related Plant Biotech Patents Published in 2015

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* Dr Shuyou Han received his PhD in plant molecular biology from the University of Ottawa in 2009, and did a post-doctorate at Agriculture and Agri-Food Canada. He can be reached by email at hanshuyou@gmail.com.
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