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Contents

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03 Neonics, NBTs and rules revamp in focus in the EU

05 Herbicides in the dock in US

08 Hopes of recovery in Latin America’s major agchem market rose in 2018

13 Chinese exports remained strong despite US tariff dispute

15 Global crop protection market up 4% in 2018

17 Mergers, acquisitions and deals in 2018

23 New active ingredients registered or launched in 2018

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Neonics, NBTs and rules revamp in focus in the EU

By Sanjiv Rana

Neonicotinoid insecticides occupied centre stage in the EU during the first half of 2018. The stage was set when the European Food Safety Authority (EFSA) came out with its conclusion in March that most uses of neonicotinoid insecticides represented a risk to wild bees and honey bees. The conclusion came in the Authority’s long-awaited updates of its risk assessments of clothianidin, imidacloprid and thiamethoxam, which had been delayed due to the need to consider large volumes of data.

The new assessments updated previous evaluations in 2013 that prompted the European Commission to suspend uses of the three active ingredients on certain crops. The Commission viewed the conclusions as strengthening the scientific basis for its proposals to ban all outdoor uses of those aias.

The Commission’s belief received further impetus when the General Court of the European Court of Justice ruled in May that the use suspensions placed on the same aias in 2013 were legally valid. However, the court annulled some of the restrictions on fipronil because they were imposed without a prior impact assessment. The ruling related to three lawsuits brought by Bayer’s Crop Science division for clothianidin and imidacloprid, ChemChina subsidiary Syngenta for thiamethoxam, and BASF for fipronil.

Finally, at the end of May, the Commission legislated that EU product approvals for outdoor uses of all three neonicotinoid insecticides would be withdrawn by September 19th. The new approval conditions for the aias only allowed uses in permanent greenhouses, either as insecticides or for the treatment of seeds of crops grown in greenhouses.

But certain uses of the aias were viewed as indispensable and many member states kept issuing emergency authorisations for their use. In July, member states were urged to stop granting unjustified emergency authorisations of neonicotinoid insecticides after an investigation by the EFSA discovered that many emergency authorisations granted by seven member states in 2017 were not justified because alternative control methods were available.

Just a few days before the withdrawal deadline in September, France went a step further and banned five neonicotinoid insecticides. The insecticides were: imidacloprid, clothianidin, thiamethoxam, thiacloprid and acetamiprid. The country’s government went on to say that it wanted to go further and included in its new Food Bill, the forthcoming prohibition of two other aias, which it said had a mode of action identical to that of neonicotinoids: DowDuPont’s insecticide, sulfoxaflor (trade-marked as Isoclast), and Bayer’s Crop Science division’s insecticide, flupyradifurone.

New mutagenesis techniques
The second half of the year began with a controversial Court ruling on new breeding techniques. In July, the European Court of Justice (ECJ) ruled that new mutagenesis techniques for plant breeding are subject to EU laws on genetically modified organisms. The Court said that the existing exemption for plants produced by mutagenesis only applied to techniques that have conventionally been used in a number of applications and have a long safety record. However, the ECJ said that even those plants were GMOs and “in principle” subject to the EU GMO registration Directive (2001/18). The ruling was in response to a request for clarification from a French court and was expected to influence the long-running review of whether new breeding techniques (NBTs) should be regulated under the Directive.

The ruling alarmed the industry as well as the scientific community, which warned that the ruling could lead to a de facto ban of innovative crop breeding, depriving farmers of more climate-resilient and nutritious varieties. In November, the Commission’s group of chief scientific advisers from its Scientific Advisory Mechanism service cautioned that new scientific knowledge and technical developments have made the EU GMO registration Directive (2001/18) no longer fit for purpose and it should be revised to bring it up to date.

A positive note emanated from the Commission at the beginning of this year when it stated that it had no plans to propose new legislation on GMOs nor amendments for existing rules in response to the ECJ ruling.

PEST committee
At the beginning of the year, the European Parliament set up a special committee on pesticides, called PEST committee, to investigate the agrochemical authorisation procedure. It was prompted by concerns over the five-year renewal of glyphosate herbicide in December 2017.

In September, a draft report by two members of the committee recommended...
that more information should be gathered on the long-term effects of agrochemical use, in applications for approval and via post-market monitoring. Amendments should be made to the EU agrochemical registration Regulation (1107/2009) to include data requirements regarding the long-term toxicity of products and further routes of exposure such as wind and water erosion of soil, it said.

In December, MEPs voted on over 1,000 amendments to the draft report and a “large amount of compromises” were negotiated. Since then, the European Parliament overwhelmingly backed calls for a shake-up of agrochemical rules to increase transparency and independence of evaluations and approvals.

A severe criticism of EU agrochemical rules was published later in September, when a briefing paper commissioned by the PEST committee highlighted that EU rules on the registration of agrochemicals have “on balance” had a negative impact on innovation and development of alternatives and new products. The decline of new ais is due to escalating costs in the face of increasing data requirements and test guidelines with “ill-defined terminologies, unrealistic end-points and inadequate validation”, the paper said.

The briefing paper looked at the impact of the EU agrochemical registration Regulation (1107/2009) on innovation. Under the previous registration Directive (91/414), there were on average eight to nine ais approved per year, but that has fallen to three to four ais in the two previous registration Directive (91/414), (1107/2009) on innovation. Under the EU agrochemical registration Regulation (1107/2009), the paper said. In the two years to March 2018, no application for three to four ais, the paper said. In the two approved per year, but that has fallen to three to four ais, the paper said. In the two previous registration Directive (91/414), (1107/2009) on innovation. Under the EU agrochemical registration Regulation (1107/2009).

In September, the Commission issued draft timetables for applicants to submit additional data on endocrine disrupting properties of agrochemical ais as part of their applications to renew EU approvals. It proposed amendments to Regulation 844/2012, which covers renewal procedures, to bring it in line with new criteria for identifying endocrine disruptors.

In November, the Commission issued a new strategy for regulating endocrine disruptors “comprehensively and consistently in a broader range of areas”.

Endocrine disruptors
In April, new criteria for identifying agrochemical ais, safeners or synergists, were published in Regulation 2018/605, which came into force on May 10th and was applied in the EU from November 10th. The Regulation amended the data requirements Annex of the EU agrochemical registration Regulation (1107/2009).

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France
In November, France’s Ministers of Agriculture and of Ecology confirmed their intention to achieve the goal set by the French President to phase out the main uses of glyphosate within three years. They did point out that the goals would be achieved while ensuring that farmers would not be left without solutions.

But moves to put the elimination of glyphosate within law were unsuccessful. In September, the National Assembly rejected a move to write into law a ban on glyphosate within three years. That was the second time such an attempt to include the provision in the country’s Agriculture and Food Bill had failed within the Assembly, the previous attempt having failed in May.

In November, France began a public consultation on its Ecophyto II+ plan, which is the latest version of the Ecophyto plan launched in 2008 to halve pesticide usage in the country. The 2008 Ecophyto plan aimed to halve pesticide usage by 2018, but was deemed a failure. A revised plan, called Ecophyto II, was launched in 2016 with the aim of halving usage of pesticides in the country by 2025.

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Legal disputes over herbicides took centre stage in the US last year. A landmark ruling saw a huge damages award to an individual who claimed that his cancer was caused by exposure to Bayer legacy company Monsanto’s Roundup (glyphosate). Meanwhile, challenges over the registrations of dicamba and 2,4-D choline-based herbicides on genetically modified crops continued through the US legal system.

In August, a jury at the US Superior Court of California awarded school groundskeeper Dewayne Johnson $289 million in damages after finding that exposure to glyphosate was responsible for his non-Hodgkin’s lymphoma. The award included some $39 million in compensatory damages and $250 million in punitive damages. Monsanto appealed the decision, claiming that the plaintiff had failed to provide evidence to support the allegations.

In October, California Superior Court Judge Suzanne Bolanos denied Monsanto’s bid to overturn the verdict but reduced the punitive damages award to $39 million. Mr Johnson accepted that decision. His lawyers voiced frustration about Judge Bolanos’ ruling but noted that it did preserve the jury’s finding that Monsanto had failed to warn the plaintiff of the cancer risks from its glyphosate-based herbicides. Bayer faces claims from some 8,700 plaintiffs in federal and state courts who contend that they have developed cancer because of exposure to Monsanto’s herbicides.

Meanwhile, a federal judge imposed an indefinite stay on litigation challenging the state of California’s decision to place glyphosate as a cancer-causing chemical on its Proposition 65 listing. Judge William Shubb granted California Attorney General Xavier Becerra’s request for a stay, agreeing that the litigation should be put on hold until rulings were made in two other cases. California added glyphosate to its Prop 65 list in 2017 based on the UN WHO’s International Agency for Research on Cancer’s (IARC) 2015 declaration that the herbicide was a probable human carcinogen. Monsanto and various agricultural groups filed suit in 2017, questioning the independence of the IARC declaration and challenging it on free speech grounds.

In February, a judicial panel decided to consolidate an array of lawsuits filed in several states against Monsanto, BASF and DowDuPont for alleged harm to non-target crops from dicamba herbicides. The class actions would be transferred to the US District Court for the Eastern District of Missouri in St Louis. The plaintiffs contended that the companies knew that their herbicides (Monsanto’s XtendiMax, BASF’s Engenia and DowDuPont’s FeXapan), intended for use on Monsanto’s GM dicamba-tolerant soybean and cotton crops, would volatilise and harm other crops. The companies denied the claims, arguing that any alleged damage was caused by illegal applications of older dicamba products or by individuals who had failed to follow the label instructions.

Challenges to the EPA’s registration of the herbicides continued through the courts. The Agency had approved XtendiMax in November 2016. However, problems with drift and damage to non-target crops in 2017 prompted the EPA to adopt industry-recommended label changes that reclassified XtendiMax, Engenia and FeXapan as “restricted use” and imposed
A number of states imposed restrictions on dicamba for the 2018 season: Arkansas, Louisiana, Missouri, North Dakota and Tennessee. Additional training requirements. Those registrations were due to expire in November 2018.

A coalition of environmentalists and farmworker advocates called for the herbicides to be pulled from the market, arguing that the EPA had failed to consider human health and environmental risks in violation of the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA) and the Endangered Species Act (ESA). However, the agrochemical industry pressed the EPA to renew the approvals, noting that many farmers were keen on the Xtend cropping system and had planted more than 50 million acres (20.2 million ha) of the GM soybeans and cotton in 2018.

The EPA decided to extend the registrations for a further two years and imposed additional restrictions aimed at addressing off-site movement. They included a prohibition on over-the-top applications of dicamba on soybeans 45 days after planting and cotton 60 days after planting. The maximum number of applications would be reduced from four to two for cotton, while remaining at two for soybeans. Applications would be allowed only from one hour after sunrise to two hours before sunset.

Environmentalists claimed that the revised registrations still fell short. The US Court of Appeals for the Ninth Circuit heard oral arguments to their challenge of the original registrations in August but had yet to weigh in on the dispute. Monsanto urged the Court to toss out the lawsuit, arguing that the new registrations rendered the litigation pointless. It contended that there were clear differences between the 2018 registration for XtendiMax and the 2016 registration targeted by the lawsuit and said that the environmentalists who filed the original litigation were inaccurately characterising the EPA's actions.

Environmentalists urged the US Court of Appeals for the Ninth Circuit to vacate the registration of DowDuPont’s Enlist Duo (glyphosate + 2,4-D choline), arguing that the EPA's review of the product was inadequate. A coalition led by the Center for Food Safety argued that the Agency had failed to support its decision with substantial evidence required by the FIFRA and ignored its obligations under the ESA. The EPA rebuffed the allegations, arguing that it had complied with federal law and that the environmentalists lacked standing to challenge the registration.
DowDuPont argued that the complaint failed on jurisdictional grounds and maintained that there was no merit to the environmentalists’ claims that the EPA had failed to comply with federal law when it approved the use of the herbicide on GM maize, cotton and soybeans in 34 states. The company argued that the petitioners were really targeting “glyphosate and ordinary 2,4-D” and not Enlist Duo. The latter represents a significant improvement over the former, which would remain registered regardless of the outcome of the litigation, DowDuPont argued. It also maintained that the complaint failed on jurisdictional grounds because the environmentalists lacked standing and missed the deadline to file their complaint within 60 days of the Agency’s registration decision.

DowDuPont also remained embroiled in a long-running dispute over the organophosphate insecticide, chlorpyrifos. In August, the US Court of Appeals for the Ninth Circuit ordered the EPA to revoke all tolerances and cancel all registrations of the insecticide within 60 days. A three-judge panel vacated former EPA Administrator Scott Pruitt’s March 2017 order that denied a 2007 petition calling for a ban of chlorpyrifos. A coalition of environmentalists and farmworker advocates had sued the EPA in 2017, alleging that Mr Pruitt’s order had violated federal law. The Trump administration appealed against the Court’s ruling, arguing that it did not have jurisdiction to issue the order and lacked the authority to compel the revocation of food tolerances or the cancellation of registrations for chlorpyrifos. DowDuPont supported the appeal and requested that the full 22-judge Ninth Circuit consider and reverse the panel’s decision. However, environmentalists and farmworker advocates called on the Court to deny the Trump administration’s bid to overturn the order.

Meanwhile, the California EPA’s Department of Pesticide Regulation (DPR) recommended that local officials adopt interim restrictions on the use of chlorpyrifos while it considered a plan to impose permanent limits on the insecticide. The interim measures included a ban on all aerial applications, more extensive buffer zones and a mandatory setback from houses, businesses and schools. The DPR also urged county officials to discontinue many uses and only allow “critical uses” on crops for which there are “few if any alternative pesticides”.

A long-running legal dispute over neonicotinoid insecticides remained in play during the year. It began in January with US District Court Judge Maxine Chesney considering whether to pull 59 neonicotinoids from the market following a 2013 lawsuit by environmentalists and beekeepers. In 2017, the Judge found that the EPA had violated the ESA when it approved clothianidin and thiamethoxam products. Later in 2018, she extended a stay on the litigation to give the Agency, environmentalists and three registrants (Bayer’s Crop Science division, ChemChina subsidiary Syngenta and Sumitomo Chemical subsidiary Valent USA) more time to potentially settle the dispute.

Environmentalists urged the US Court of Appeals for the Ninth Circuit to vacate the registration of DowDuPont’s Enlist Duo (glyphosate + 2,4-D choline), arguing that the EPA’s review of the product was inadequate

Other lawsuits over alleged ESA violations continued through the courts. Three registrants of organophosphate insecticides challenged the US National Marine Fisheries Service’s (NMFS) Biological Opinion (BiOp) for chlorpyrifos, diazinon and malathion. DowDuPont, FMC and ChemChina subsidiary Adama complained that the wildlife agency had failed to follow its own scientific guidelines and violated federal environmental and administrative laws. A coalition of environmentalists were keen to intervene in the case, arguing that they had a right as they filed the original lawsuit in 2007 that forced the NMFS to complete the underlying BiOp. The registrants sought to deny the environmentalists’ intervention.

A scaled-back version of the pesticide “mega-suit” was kept alive by a federal judge, but he warned environmentalists that their claims needed more specificity if the complaint was to survive the EPA’s bid for summary judgement. The amended complaint sought to vacate or restrict registrations for 35 ais, arguing that the EPA had failed to adequately assess the potential harm the pesticides would have on more than 100 species listed under the ESA. Judge Joseph Spero issued an order in June rejecting the EPA’s motion to dismiss the lawsuit, concluding that the claims were sufficient at the pleading stage of the litigation.

Away from the courts, the US agrochemical industry braced itself for the potential loss of hundreds of millions of dollars due to the threat of increased tariffs on Chinese agrochemical and other imports. President Trump threatened to raise tariffs from 10% to 25% on a long list of ais and chemicals used by US pesticide manufacturers. The move was due to take effect on January 1st 2019. However, the US agreed not to raise tariffs in exchange for China promising to purchase other products to reduce the trade imbalance between the two countries.

The Canadian authorities proposed the phase-out of most uses of the neonicotinoid insecticides, clothianidin and thiamethoxam, following special reviews of the ais. The Pest Management Regulatory Agency (PMRA) had initiated reviews in 2016 due to concerns over risks to aquatic invertebrates. The Agency called for restrictions on the neonicotinoid insecticide, imidacloprid, because of concerns over risks to bees and other pollinators. That followed the publication of the PMRA’s updated pollinator risk assessment. Towards the end of the year, the PMRA initiated a cumulative risk assessment of N-methyl carbamate insecticides.
Hopes of recovery in Latin America’s major agchem market rose in 2018

By Robert Birkett

Signs grew of a rebound in the Latin American market in 2018. A scan of market conditions in Brazil half-way through the year suggested that the multi-year slump would end. This included then financial results of major companies indicating that the Brazilian market was likely to come out of a three-year recession.

First-half financial results of companies including Adama, Arysta, BASF, Bayer, FMC and Syngenta indicate that higher volumes of agrochemicals, especially insecticides and fungicides, were sold in Brazil. Furthermore, the glut of inventory in the distribution channel, which had been one of the main causes of declining sales, is showing signs of normalising.

Some evidence of this continued into the key third quarter of major company reporting of business. BASF reported higher prices and sales volumes in the region, particularly for fungicides and insecticides, while DowDuPont cited volume and price gains in Latin America for its strong quarter and FMC grew by 9% on a pro forma basis to $379 million, boosted by strong growth in the cotton acreage in Brazil and higher prices. In contrast, Bayer reported a large drop in sales on an adjusted basis. However, it cited the bulk of the loss to “accounting measures” in Brazil.

Another leading indicator of a potential upturn was reported later in the year. Consultancy Datagro, which collected data from soybean-growing states such as Paraná and Rio Grande do Sul, calculated how many bags of soybean produce would pay for the major required inputs such as seed, agrochemicals and fertiliser. The situation in the year to August was trending in growers’ favour. That was despite a rise in agrochemical prices, as the value of soybeans had grown faster.

Detections of Asian soybean rust (*Phakopsora pachyrhizi*) in Brazil were earlier than usual in the latest planting season of late 2018. The disease is by far Brazil’s major source of concern for growers who purchase crop protection products. The market for soybean rust fungicides has been estimated in recent years at $1,500-2,000 million.

Last year, Phillips McDougall reported a decline of 5% in Latin American agrochemical market to $12,664 million, with the drop largely attributable to Brazil. The market fall was the country’s third year in a row.

The Brazilian biological crop protection market was valued at R$528 million ($144 million), according to a study from the Brazilian biological control enterprises association, the ABCBio, and market consultancy Informa FNP late last year. Further findings included that 10 million ha were treated with biologicals across soybeans, sugar cane, coffee, fruit and vegetables.

Almost two out of five (39%) of Brazilian growers used biological crop protection products for at least part of their crops, but more than half (57%) were unaware of the technology. Nevertheless, the acceptance of the products by users was “almost total”, with 98% of those using the products in the reporting season intending to use them again.

The Ministry of Agriculture has since reported that 2018 saw a record year for approvals of biological crop protection products after a 30% rise to 52 registrations.

Approvals of other agrochemicals were also up at the Ministry by some 9% to 398. That was a more than three-fold increase since 2015.

Registration regimes

Brazil’s three agrochemical product competent authorities signed a co-operation deal with the Brazilian institute of cotton grower association, the IBA, to create a new and unified agrochemicals approval system late last year. They are to provide co-operative technical assistance in developing the integrated system on pesticides, called SIA, to facilitate a reduction in registration times for new active ingredients and for generic products. The new system should be operational within two years. The competent authorities are the Ministry of Agriculture, the environmental agency, the Ibama, and the national health surveillance agency, the Anvisa.

The authorities made a combined proposal to amend agrochemical registration rules
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in October. That included the intention that the regulation would set criteria for evaluation of priority products with the aim of improving the efficiency in the registration process.

Changes to speed up approvals of agrochemicals became an increasingly political issue in Brazil. In June, the lower house of Parliament’s agriculture select committee backed draft legislation PL 6299/02 from Luis Nishimori MP and a group of draft bills on a similar theme, such as PL 3200/15. It gained other backers, including the Ministry of Agriculture and Syngenta, and the industry more widely. The Ibama indicated its opposition to the parliamentary bill, as did the Anvisa, which subsequently issued its counter proposals to accelerate toxicology assessments. They would provide for two forms of evaluation: by analogy and integral. Registration by analogy, according to the FAO, is a basic approach to registration in which a comparison is made between a product submitted for evaluation and a similar product already approved in one or more reference countries.

Anvisa management has since claimed that the parliamentary efforts to bring the approval process under one body instead of three, could be achieved under existing structures.

The political upheaval following the election of a controversial national President is expected to result, among other things, in strong support for the agribusiness sector. The incoming Minister of Agriculture in Brazil has confirmed an anticipated prioritising of a deregulated agrochemical registration process, with reports that she is backing Mr Nishimori’s bill.

**Glyphosate**

A federal judge in Brazil ordered the suspension of new registrations of glyphosate-based herbicides and other pesticide products in August. The suspension was to run until the Anvisa had completed its overdue planned toxicological evaluations on ais including abamectin insecticide and glyphosate. In September, another Brazilian court overturned the ruling. In 2017, the agency had extended the reassessment of glyphosate until 2019.

The Brazilian public prosecutor’s office submitted evidence later last year challenging the agrochemical industry’s testimony in support of the continued use of the herbicide.

In October, the Argentine plant and animal health inspection service, the Senasa, ordered bans on five agrochemical ais. It banned the manufacture and import of the insecticide/acaricide, diazinon, the insecticide/acaricide/nematicide, carbofuran, carbosulfan and aldicarb, and the acaricide, dicofol, and formulations based upon them. The ais were used in seed treatments. The Senasa also banned the import, marketing, and use of trichlorfon and dichlorvos with a 180-day phase out.

The political upheaval following the election of a controversial national President is expected to result, among other things, in strong support for the agribusiness sector.

The Brazilian phase-out of uses for the carbamate insecticide/acaricide/nematicide, carbofuran, ended in April. Sales of paraquat herbicide in Brazil were to initiate registrations in a computerised system from March. The aim of the move was to guarantee the restrictions that the Anvisa had imposed on the product with the publication of Resolution RDC 177/2017.

The previous year, the herbicide was given a three-year phase-out.

In December, authorities in Brazil, Canada and the US agreed to workshare on agrochemical assessments for products destined for use on minor crops.

Colombia adopted global harmonised classification and labelling of chemical products including of pesticides. The Ministry of Work issued Decree 1496/2018 in August to adopt the globally harmonised system (GHS) for the classification and transport of hazardous products. Uruguay issued a resolution setting EU and US agrochemical competent authority as a reference point for outstanding national residue limit approvals. The country ended all agricultural uses of the herbicide, atrazine, after issuing a phase out the previous year.

**GMOs**

Genetically modified crop adoption was reported to still be strong in Argentina and Brazil. The latter remained the second major adopter of GM crops globally in the previous planting season, topping 50 million ha with an adoption rate of 94%.

Brazil was followed by neighbour, Argentina, with a 100% adoption rate for GM crops, despite a slight dip in plantings to 23.6 million ha in 2017.

A world first came in Brazil early in the year. GM insect-resistant Bt sugar cane was commercially planted for the first time. Some 400 ha of Brazilian company and Bt cane developer Centro de Tecnologia Canavieira (CTC - Piracicaba) cane borer (Diatraea saccharalis)-resistant sugar cane were planted.

The political upheaval following the election of a controversial national President is expected to result, among other things, in strong support for the agribusiness sector.

The Argentine government issued a decree to regulate the 2007 promotion of modern biotechnology law. It aims to “promote the development and production of modern biotechnology”.

The stated aim of the Law is to bring a series of tools to facilitate those who want to invest, research or develop biotechnology. It provides a financing fund for new ventures, and tax benefits for projects submitted by established national biotechnology companies (the Law states that the promotion will be by project, not by sector).

In November, Argentina presented a “declaration” advocating the adoption of gene editing at the WTO in Geneva, Switzerland, while indicating that they should not be regulated as GM crops. The statement was presented on behalf of a group of countries including Australia, Brazil, Canada, Paraguay and the US, delegates of each of whom backed the presentation from the floor of the WTO event.

Late in the year, Argentina was reportedly close to approving a GM wheat line. The drought-resistant HB4 line from the Argentine Bioceres group is one step away from being available to Argentinean farmers. The developers were waiting for the findings of a report from the Agroindustry Secretariat on the foreign and domestic markets impact of HB4 wheat.

**Approvals**

Approvals of GM crops maintained a
healthy pace, and even accelerated in some countries. However, in Mexico, bans on GM crop trials approvals remained in place while a moratorium on planting in Peru was also still in force.

Brazil’s biosafety authority, the CTNBio, recommended the approval of at least ten GM products in 2018. They included a GM sugar cane, and others of cotton, maize and soybeans, notably (then Monsanto’s and since Bayer acquired) insect-resistant and herbicide-tolerant Intacta 2 Xtend (MON87751xMON87708x MON87701 xMON89788) soybeans, while the authority sought opinions on its recommendation to approve Dow AgroSciences’ herbicide-tolerant and insect-resistant PowerCorex MIR162xEnlist (MON 89034xTC1507x MIR162xNK603xDA540278) maize.

Argentine authorities approved its first GM drought-tolerant soybean technology. The Ministry of Agriculture authorised Argentine Bioceres group’s affiliate, Indear’s, herbicide-tolerant and drought-resistant IND00410xMON04032 soybeans. The country had already approved eight other products in the year.

**Intacta payment disputes**

Early last year, Brazil’s industrial property agency, the INPI, found that Monsanto’s patent for its Intacta RR2 Pro soybean technology should be declared void. The attorney general’s office has since filed a petition requesting that the patent be declared void. The patent runs until 2022.

In July, a Brazilian court ruled that Monsanto deposit royalties on its Intacta RR2 Pro soybean technology into an escrow account. The money is to be deposited until the outcome is known of the case brought against Monsanto’s royalty charges by the grower groups. Previously, another judge ruled that Monsanto’s collection of royalties on Intacta RR2 Pro soybean technology was legal, after a plaintiff had sought a refund of the amount paid in the post-planting of saved seeds that are reserved for their own use.

A Brazilian judge denied an application by Bayer legacy company Monsanto to suspend licensing of its Intacta RR2 soybeans to a bankrupt Brazilian company. The Bayer business sought to hinder licensing to privately owned seed maker Sementes Talismã, which filed for bankruptcy protection in January.

**A scan of market conditions in Brazil**

Half-way through the year suggested that the multi-year slump would end.

In mid-2018, the Brazilian Senate’s environment committee approved the support of a Senator to a parliamentary bill to remove a warning label on foods containing GMOs. The move was to back a lower house of Parliament bill that seeks to remove labels marked with a “T” in a yellow triangle. The T stands for “transgenicos” – or GMOs. The bill will go to a plenary session of the Senate.

The Brazilian public prosecutor’s office, the MPF, filed a civil action to suspend the commercial use of GM glyphosate herbicide-tolerant crops. The targets included products that had been approved by the CTNBio, while the Anvisa’s toxicological reassessment of the herbicide was pending.
Chinese exports remained strong despite US tariff dispute

By Sanjiv Rana

The tariff dispute between the US and China that began in August threatened to cast a shadow on the pesticide industry in both countries when the US imposed the 10% tariffs on $200 billion worth of Chinese goods. They included a long list of pesticide active ingredients and chemicals used by US manufacturers, on September 24th.

The impact was somewhat muted initially as the number of lines that were to come under the tariff net were scaled back from 6,301 lines to 5,745. That meant that while all formulated pesticide product imports attracted the 10% tariff, the imports of some widely-used a.i.s, including the herbicides, glyphosate, 2,4-D, dicamba and glufosinate-ammonium, and the insecticide, chlorpyrifos, were not included in the list. While details of individual a.i. exports from China to the US are not available, the US was the top destination for Chinese exports in terms of a.i. in 2017 at $821.2 million. But in terms of formulation exports, the country ranked fifth at $147.8 million.

The escalation of the dispute with the raising of tariffs to 25% on January 1st was averted in early December when a deal was reached between the two countries resulting in a temporary truce. The US agreed to leave the tariffs at the 10% rate in exchange for China promising “to purchase a not yet agreed upon, but very substantial, amount of agricultural, energy, industrial, and other products from the US to reduce the trade imbalance between our two countries”. China undertook to start purchasing agricultural product from the US immediately. Both parties agreed that they would endeavour to have the transaction completed within the next 90 days failing which, the 10% tariffs would be raised to 25%.

CropLife America had warned that the imposition of 25% tariffs could increase the industry’s costs by more than $590 million annually. Many of the chemicals imported from China are not easily sourced elsewhere and changing suppliers is a costly and laborious process for US pesticide companies.

Pesticide exports during the first nine months of 2018 rose by 19.8% to $5,810 million compared with the same period during 2017

Five new import approvals granted by China for genetically modified along with the renewal of import approval for 26 GM lines in early January is being viewed as part of the de-escalation of the tariff war.

Chinese exports

China’s pesticide industry continued the export growth trend that began in 2017 when two difficult years of export declines were overcome. Pesticide exports during the first nine months of 2018 rose by 19.8% to $5,810 million compared with the same period during 2017, according to figures from the country’s Institute for the Control of Agrochemicals, Ministry of Agriculture (ICAMA). Export volumes, however, decreased by 6.3% to 1 million tonnes during the first three quarters of 2018.

FOB prices for the most-exported a.i., glyphosate, remained in the range of $3.40-$4.00/kg in 2018. Lower prevailing prices for crude oil made production costs cheaper. But a loosening of environmental inspections in the latter half of the year, ostensibly to mitigate adverse impacts on Chinese companies from the US tariff was, led to an increase in production of the a.i. That is likely to have an impact on prices in 2019.

India

Following the trend of the past few years, controversy surrounding genetically modified crops held centre stage in India during 2018. The approval for the commercial cultivation of high-yielding Dhara Mustard Hybrid 11 (DMH-11), which looked imminent in 2016, did not come about in 2018 as well.

India’s Genetic Engineering Appraisal Committee (GEAC) initially cleared the GM hybrid in September 2016. Following the receipt of public comments in 2017, it was referred back to the Committee, which again came back with a positive recommendation in May 2017. But with a new Environment Minister coming into place, further representations from various stakeholders were received and the issue was again referred to the GEAC in October 2017.

In October 2018, the GEAC approved an application by the developer, the University of Delhi’s Centre for Genetic Manipulation of Crop Plants, for conduct of field demonstration studies on honeybees and other pollinators at two locations. The trials are to be conducted at Punjab Agriculture University, Ludhiana, and Indian Agricultural Research Institute, New Delhi.

In November 2018, the Indian Supreme Court asked the central government to
clarify its stand on the field trials of the GM hybrid.

Controversy seems to stem from the fact that it is being touted as the first food crop to be approved in the country, with mustard oil contributing a large part of the vegetable oil used for cooking. That was the reason why a moratorium was imposed upon GM insect-resistant brinjals (aubergines) in 2010. But the claim of GM mustard being the first GM food crop to be commercialised is not entirely true. While mustard contributed to a majority of edible oil production within the country, a sizeable portion of edible oils also comes from cotton seed, over 95% of which comprises GM lines. The GEAC has also pointed out that mustard oil does not contain any proteins, ruling out the probability of oil extracted from DMH-11 or any other future hybrids to have any of the three proteins expressed by the introduced genes.

Bt brinjals (aubergines)

In October, the GEAC asked the Indian Institute of Horticultural Research to obtain relevant information and data on the post commercial release effects of Bt brinjals in Bangladesh from the Bangladesh Agricultural Research Institute. The action came during the GEAC’s hearing of a request by Indian company Mahyco (developer of transgenic brinjal) seeking permission for large-scale environmental release and demonstration of the Bt lines.

India has not approved any other GM crop since Bt cotton received the go ahead in 2002. But that too has been at the centre of dispute between Bayer legacy company Monsanto and Indian seed companies.

Royalty dispute

Since 2015, Monsanto has been embroiled in royalty disputes with many Indian seed companies that have refused to pay royalties for using its Bollgard Bt traits. Monsanto initially entered into sub-licence agreements with Indian seed companies in 2004 for a period of ten years. After a one-year extension, the agreement was terminated in November 2015 because of disputes regarding payment of a licence fee that arose from a price control regime introduced by the government.

In April 2018, Monsanto received a setback when the Delhi High Court ruled the company’s patent on its Bt cotton as “unpatentable” under the Indian Patents Act. But that decision was overturned at the beginning of this year when the Supreme Court ruled that the company can claim patents on its GM cotton seeds. The relief to Bayer/Monsanto from the Supreme Court is expected to restore confidence among biotechnology companies and spur investment.

Australia

The Australian Pesticides and Veterinary Medicines Authority (APVMA) completed 63% of pesticide product registrations within statutory timeframes in the 12 months to June 30th 2018. That compared with just 45% in fiscal 2017. The industry association, CropLife Australia, welcomed the recovery in performance but was concerned that it had plateaued at a level that was still well below statutory requirements. The association had been critical of the disrupting effect of the planned relocation of the APVMA from Canberra, Australian Capital Territory to Armidale, New South Wales. The APVMA addressed some of those concerns by deciding to retain an office in Canberra.
Global crop protection market up 4% in 2018

by Robert Birkett

Global chemical-based crop protection sales rose by 4.2% to $56,500 million at the ex-manufacturer level in 2018, according to figures from Phillips McDougall. These are preliminary estimates, the consultancy emphasises.

Sales of all pesticides, including non-crop products, were 4.1% higher at $64,038 million. Growth was slightly weaker for non-crop pesticide sales, which were up 3.1% at $7,538 million.

Recovery in the Brazilian market, the largest in the world, is the major driver of last year’s growth, the consultancy says. The “excessive” crop protection inventories which resulted in the 2017 decline have been addressed and are no longer such an issue, it explains.

Phillips McDougall also highlights generally high crop protection prices, resulting partly from supply shortages. In particular, it notes higher prices of products originating from China as a result of the environmental pressures and consolidation in the national industry. Prices were also driven higher by the tariffs imposed by the US on some Chinese chemical imports. It cites agrochemical companies Albaugh and FMC reporting that that they had increased their prices partly as a result of the higher tariffs.

Eight active ingredients debuted in 2018, the “highest level of new product introductions since 2012”

Eight active ingredients debuted in 2018, the “highest level of new product introductions since 2012”. They include: three insecticides, Nippon Kayaku’s flometoquin, BASF/Meiji Seika Pharma’s afidopyropen (trade-marked as Inscolis), and DowDuPont’s triflumezopyrim (trade-marked as Pyraxalt); one acaricide/insecticide, Nissan Chemical’s fluxametamide; three herbicides, Kumiai Chemical’s fenquinotrione, DowDuPont’s florpyrauxifen-benzyl (trade-marked as Rinskor), and FarmHanong’s tiafenacil; as well as one fungicide, Nihon Nohyaku’s pyraziflumid.

Regions
Crop protection sales rose in every reporting region. They were led by Latin America, with the Middle East/Africa region lagging others.

Asia saw growth of just under 5% with “good weather” boosting sales in India and China. “High” product prices, which increased by 10-20%, buoyed the Chinese market, as did a move towards newer, lower rate and more expensive products, partly in response to the government’s “zero growth” policy of reducing or flattening pesticide use in the country. Thailand had a “strong” year, including for rice. In contrast, droughts in Australia and Indonesia, and “excessive” inventory in Vietnam depressed those national markets. The Japanese market was essentially flat, increasing by just 0.1% in the year to September.

Phillips McDougall anticipates that growth of 6% will be recorded for Latin America, led by Brazil. Most leading companies have reported growth in this region. However, Argentina experienced some problems with drought impacting on sales there. Relatively low disease pressure and glyphosate herbicide resistance issues were further drags on the market.

The European market was a tale of two halves with negative weather in major western EU countries being more than offset by growth in new member states in the east, and the major ex-Soviet nations, notably Russia and Ukraine. Those markets continued “to boom”, with most of the cereal-growing areas driven by rising exports.

The consultancy reports “strong prices” in North America. Part of this derives from a

Global agrochemical market ($ million)

<table>
<thead>
<tr>
<th>Market segment</th>
<th>2017¹</th>
<th>% change</th>
<th>2018²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crop protection</td>
<td>54,219</td>
<td>4.2</td>
<td>56,500</td>
</tr>
<tr>
<td>Non-crop pesticides</td>
<td>7,311</td>
<td>3.1</td>
<td>7,538</td>
</tr>
<tr>
<td>Total agrochemicals</td>
<td>61,530</td>
<td>4.1</td>
<td>64,038</td>
</tr>
</tbody>
</table>

¹ includes 2016-17 southern hemisphere season; ² includes 2017-18 southern hemisphere season. Source: Phillips McDougall.
product mix effect as glyphosate share continues to decline and more expensive herbicides replace it. The other factor was price hikes from China. The area of genetically modified dicamba-tolerant soybeans doubled from 25 million acres (10 million ha) to around 50 million acres in the US, with expected boosts for more expensive treatments.

The market across the Middle East and Africa rose by just under 2%.

**Outlook**

On balance, Phillips McDougall estimates a “relatively flat” market in 2019. It reports a strong start to the planting season in the southern hemisphere. This is partly in response to Chinese tariffs on US soybean imports in retaliation for those in the opposite direction. That benefited soybean exporters mainly in Argentina and, to some extent, in Brazil. This augurs well for crop protection sales early in the year, the consultancy estimates.

There are reports of the el Niño phenomenon – albeit “weak” compared with 2015/16 – that would boost the soybean harvest in Brazil. Any developing El Niño conditions have the potential to impact production in Asia Pacific with the region having historically experienced generally dry conditions with reduced monsoon rainfall under such circumstances.

Industry innovation looks like it could be similar to that in 2018 with six new ais ear-marked for debuts

Industry innovation looks like it could be similar to that in 2018 with six new ais ear-marked for debuts. They include: BASF’s sterol biosynthesis inhibitor isopropylazole fungicide, mefentrifluconazole (trade-marked as Revysol); Bayer’s Crop Science division’s diamide insecticide, tetraniliprole; Bayer legacy company Monsanto’s nematicide, tioxazafen; FMC’s broad-spectrum fungicide, F9650; and DowDuPont’s fungicide, fenpicoxamid.

The consultancy anticipates increased demand for “higher value” herbicides than glyphosate following the rising adoption of traits conferring tolerance to such herbicides. They include, “notably”, dicamba and 2,4-D.

### Crop protection product sales by region ($ million)

<table>
<thead>
<tr>
<th>Region</th>
<th>2017(^1)</th>
<th>% change</th>
<th>2018</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asia Pacific</td>
<td>16,300</td>
<td>+4.6</td>
<td>17,050</td>
</tr>
<tr>
<td>Latin America(^2)</td>
<td>12,665</td>
<td>+6.0</td>
<td>13,425</td>
</tr>
<tr>
<td>Europe</td>
<td>12,374</td>
<td>+3.2</td>
<td>12,770</td>
</tr>
<tr>
<td>NAFTA</td>
<td>10,761</td>
<td>+3.2</td>
<td>11,105</td>
</tr>
<tr>
<td>Middle East/Africa</td>
<td>2,110</td>
<td>+1.9</td>
<td>2,150</td>
</tr>
<tr>
<td><strong>Total (world)</strong></td>
<td><strong>54,223</strong></td>
<td><strong>+4.2</strong></td>
<td><strong>56,500</strong></td>
</tr>
</tbody>
</table>

\(^1\) calculated from 2018 growth figure; \(^2\) excluding Mexico. Source: Phillips McDougall.
Mergers, acquisitions and deals in 2018

By Andy Beer

JANUARY

• Platform Specialty Products’ agrochemical business, Arysta LifeScience, and Italian agrochemical company Isagro agreed a deal for the distribution of Isagro’s fluindapyr-based fungicide mixtures for use in soybeans and other row crops in Brazil.

• German business BayWa subsidiary BayWa Venture and Austrian investment company RWA Invest acquired a 2.5% stake each in Italian agricultural information system start-up Evja.

• Japanese company Mitsui & Co’s US biopesticide subsidiary, Certis USA, entered into a global licensing agreement with the Hungarian University of Szeged for a novel, patented biopesticide strain, Bacillus mojavensis strain R3B.

• UK specialty chemical company Croda acquired marine biotechnology company Nautilus Biosciences Canada.

• FMC agreed a partnership with Brazilian agriculture data analysis company Agronow.

• Dutch genomics company KeyGene and the US University of Wisconsin-Madison entered into a service licence agreement to practise KeyGene’s patented Sequence Based Genotyping methods.

• US biopesticide company Marrone Bio Innovations agreed an exclusive Philippine distribution deal with national agricultural inputs supplier Great Harvest Agri Chemicals Corporation.

• Nanjing Red Sun agreed to acquire a 60% stake in Argentine agrochemical and seed distribution company Ruralco.

• Nihon Nohyaku raised its ownership of its Indian subsidiary Hyderbad Chemical to 99.94%.

• Nihon Nohyaku agreed to acquire the Colombian agrochemical company, Adnicol.

• UK crop enhancement company Plant Impact and Belgian research institute VIB agreed a research and development collaboration on VIB891, a newly identified molecule and its analogues proven to increase plant biomass.

• Saudi Arabian chemical company Sabic acquired a near-25% holding in German speciality chemical company Clariant.

• The US biostimulant and biofertiliser company, Sigma Agriscience, acquired a controlling stake in the international marketer and distributor of agricultural products, AM-AG.

• Syngenta (owned by ChemChina) and Israeli genomics technology company NRGene extended their agreement for Syngenta to use NRGene’s GenoMagic cloud-based software package to accelerate trait discovery and breeding.

• The US biological pesticide and fertiliser company, Vegelab US, exercised an option to acquire US company The Agronomy Group.

FEBRUARY

• Bayer’s Crop Science division and Chilean precision agriculture company LB-Track agreed to co-operate on the development of methods for the detection of herbicide-resistant weeds.

• UK specialty chemical company Croda’s European subsidiary, Croda Europe, agreed to acquire UK crop enhancement company Plant Impact.

• Danish forage and turf seed supplier DLF acquired the assets of Argentine seed company Gapp Semillas.

• Mitsui Chemicals Agro and Bayer agreed a licensing deal for the development and marketing of Mitsui’s new fungicide, quinofumelin.

• Nufarm completed the acquisition of certain cereal herbicides in Europe from FMC. The deal was agreed in November 2017.

• Swiss inspection, verification, testing and certification company SGS acquired the German company, TraitGenetics.

• Syngenta (owned by ChemChina) completed the acquisition of Argentine seed supplier Nidera Semillas. The deal was agreed in November 2017.

• Syngenta acquired the US satellite imagery company, FarmShots.

• Syngenta entered into a global seed treatment licensing agreement for...
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Japanese company Nippon Soda’s new fungicide, picarbutrazox.

**MARCH**
- BASF and Chinese small molecule discovery company HitGen agreed a research collaboration to identify leads for targets of agrochemical interest to BASF.
- BASF entered into exclusive talks with Bayer’s Crop Science division to acquire its vegetable seeds business.
- Bayer’s Crop Science division and the Brazilian Chapadão Foundation agreed to promote a research collaboration.
- DowDuPont agriculture division Corteva Agriscience’s US software business, Granular, entered into a three-year agreement with the US aerospace and data analytics company, Planet.
- Japanese company Mitsui & Co’s European subsidiaries, Certis Europe and Spiess Urania Chemicals, are to merge into one company, Certis Europe.
- Monsanto entered into a research and licensing deal with the US crop protection products discovery company, AgriMetis.
- Monsanto reportedly acquired a holding of some 5% in Argentine seed and agrochemical supplier Bioceres group.
- Monsanto entered into a research collaboration with the US plant gene editing company, Pairwise Plants.
- Nihon Nohyaku’s US subsidiary, Nichino America, entered into an agreement with Japanese agrochemical and fertiliser company Otsuka AgriTechno Agro (OAT Agro) to market and sell OAT Agro’s fungicide, Gatten (flutianil), in the US and Canada.
- Nufarm completed the acquisition of a range of crop protection products in the European Economic Area from ChemChina subsidiaries Adama and Syngenta. Following that, Syngenta transferred certain crop protection products and distribution rights to Adama. The deals were agreed last year.
- US biological crop protection company Omnia agreed to acquire the Cayman Islands-based biologicals business of Oro Agri. The deal was completed in June.
- Syngenta (owned by ChemChina) has agreed to acquire Brazilian digital agriculture management firm, Strider.

**APRIL**
- Platform Specialty Products’ agrochemical business, Arysta LifeScience, agreed to acquire the New Zealand company, Etec Crop Solutions. The deal was completed in June.
- Arysta LifeScience agreed a licensing deal with Japanese company Meiji Seika Pharma to develop and commercialise formulations of Meiji’s insecticide, flupyrimin, for applications in rice in India.
- BASF agreed to acquire Bayer’s Crop Science division’s digital farming business.
- BASF agreed to acquire further assets from Bayer’s Crop Science division including its global vegetable seeds business, certain seed treatments, its Australian oilseed rape business, the research platform for wheat hybrids, certain glyphosate-based herbicides in Europe, and three research projects.
- Bayer’s Crop Science division linked up with precision irrigation specialist Netafim, the UN World Bank’s International Finance Corp and risk transfer supplier Swiss Re Corporate Solutions to supply sustainable crop production products and services to smallholders in developing countries.
- French seed company Deleplanque & Compagnie and German seed processor SUET Saat- und Erntetechnik acquired the German seed company, Strube group.
- The US biopesticide company, Marrone Bio Innovations (MBI), agreed a deal with Israeli crop protection supplier Lidorr Chemicals to distribute MBI’s portfolio in Israel.
- Monsanto entered into a research collaboration with US agricultural technology company RNAgri for RNA interference applications for agriculture and bee health.
- Monsanto collaborated with US company Adjuvants Unlimited to develop an agricultural sprayer system designed to deactivate the herbicide, dicamba.
- Israeli biopesticide company STK (previously Stockton) and BASF agreed a distribution deal in Brazil for STK’s biofungicide, Timorex Gold (Melaleuca alternifolia extract).
- Syngenta (owned by ChemChina) acquired US vegetable seed company Abbot & Cobb.
- Singapore-based investment house Temasek agreed to acquire a 3.6% stake in Bayer, bringing its holding to around 4%.

**MAY**
- DowDuPont’s agriculture division, Corteva Agriscience, and the Brazilian agricultural research corporation, the Embrapa, agreed to collaborate on genomics research to improve crop tolerance to pests and drought.
- Monsanto licensed its next generation of genetically modified insect-resistant maize to DowDuPont’s agriculture division, Corteva Agriscience, in the US and Canada. The licence covers Monsanto’s RNAi-based Corn Rootworm III (MON87411) trait and MON89034, both components of SmartStax Pro.
- Monsanto agreed to collaborate with the US charitable group, 2Blades Foundation, to discover new sources of resistance to Asian soybean rust (Phakopsora pachyrhizi). 2 Blades aims to deliver resistance gene in partnership with the UK Sainsbury Laboratory and the Brazilian Universidade Federal de Viçosa.
- Portuguese company Sapec Agro subsidiary Tradecorp acquired the Spanish biotechnology company, Idai Nature.

**JUNE**
- German consulting company GAB Consulting and French field testing company Promo-Vert teamed up to create the joint venture, Acceres.
- US agrochemical company American Vanguard subsidiary Amvac Chemical acquired Bayer’s Crop Science division’s bromacil herbicide business in the US and Canada.
• US generic pesticide company Atticus acquired US company Tacoma Ag.

• BASF signed a distribution deal with Brazilian seed company Biotrigo Genetica for its non-genetically modified herbicide-tolerant Clearfield wheat in Brazil.

• Bayer completed its acquisition of Monsanto. The deal was agreed in September 2016.

• Swiss biopesticide company Andermatt Biocontrol and German biologicals company Trifolio-M became shareholders in Polish biologicals company Biocont Poland.

• Japanese company Mitsui & Co’s US biopesticide subsidiary, Certis USA, entered into an exclusive sales and marketing deal with US company Omnilytics for the latter’s bacteriophage-based AgriPhage product line.

• FMC agreed a five-year extension to its collaboration with Danish bioscience company Chr Hansen to develop and commercialise biopesticides.

• Monsanto entered into an extended licensing agreement for its genetically modified dicamba and glyphosate herbicide-tolerant Roundup Ready 2 Xtend soybeans with DowDuPont’s agriculture division, Corteva Agriscience, in the US and Canada.

• Nufarm entered into an alliance with the Canadian digital agriculture company, Farmers Edge.

• Brazilian biologicals company Santa Clara Agrociencia signed a deal with Brazilian public sector bodies to develop plant extract-based nematicides.

• Sipcam-Oxon acquired the Swiss biopesticide company, Sofbey.

• Contract research company Eurofins Agroscience Services acquired the German field trial company Agrartest.

• Israeli plant biotechnology company Evogene and the Brazilian state of Mato Grosso cotton institute, the IMArmt, agreed a research and validation deal in the field of insect resistance traits in cotton.

• UK-based enabling technology company Exosect licensed its Entostat technology to Monsanto for use with certain “agricultural biologicals” as seed treatments.

• German company Helm’s US generic agrochemical subsidiary, Helm Agro, agreed to acquire BASF’s herbicide, Extreme (imazethapyr + glyphosate).

• UPL agreed to acquire Platform Specialty Products’ agrochemical business, Arysta LifeScience, for $4.2 billion.

• Japanese company Sumitomo Corporation acquired a 51% stake in the Ukrainian agricultural input supplier companies, Spectr-Agro and Spectr-Agrotechnika.

• Syngenta (owned by ChemChina) acquired UK flower and home garden vegetable seed breeder Floranova.

• Syngenta (owned by ChemChina) and the Italian agrochemical and farmers confederation, the CAI, renewed a two-year collaboration aimed at training and information activities for all CAI members.

• Syngenta (owned by ChemChina) and Brazilian start-up company Perfect Flight extended a deal using the latter’s digital technology for precise aerial applications of agrochemicals.

JULY

• Contract research company Eurofins Agroscience Services acquired the German field trial company Agrartest.

• Israeli plant biotechnology company Evogene and the Brazilian state of Mato Grosso cotton institute, the IMArmt, agreed a research and validation deal in the field of insect resistance traits in cotton.

• US agribusiness company J R Simplot gained a non-exclusive licence to DowDuPont agriculture business Corteva Agriscience and US non-profit Broad Institute of MIT and Harvard’s CRISPR-Cas9 and related gene editing tools for agricultural use.

• Nihon Nohyaku’s US subsidiary, Nichino America, and US agrochemical company PBI-Gordon agreed a supply deal for PBI to market and sell the fungicide, Pedigree (flutolanil).

• Portuguese company Sapec Agro subsidiary Tradecorp acquired the French plant nutrition and adjuvants supplier, SDP.

• Sumitomo Chemical decided to merge its Indian subsidiaries, Excel Crop Care and Sumitomo Chemical India.

• Chinese company Yangnong Chemical agreed to acquire Chinese company Crop Science division, including genetically modified herbicide-tolerant LibertyLink products and glufosinate-ammonium herbicide. It also completed the purchase of Bayer’s vegetable seed business. The deals were agreed in October 2017 in April 2018.

• DowDuPont’s agriculture division, Corteva Agriscience, and the commercial arm of the Australian state of Victoria’s agriculture department, Agriculture Victoria Services (AVS), agreed a licensing deal covering a novel source of blackleg (Leptosphaeria maculans) resistance in canola developed by AVS.

AUGUST

• The Adama group (owned by ChemChina) consolidated its partnership in Brazil with distributor Foro Agronegocios.

• The US agricultural biotechnology company, AgBiome Innovations, and Sipcam-Oxon’s US business, Sipcam Agro USA, entered into a joint development project focusing on innovative combination products for US crop markets.

• The US crop improvement company, Benson Hill Biosystems, and US agricultural biotechnology company Agribody Technologies entered into an agreement to deliver non-genetically modified yield and sustainability traits for seed companies working on a range of crops.

• BASF completed its acquisition of a range of businesses and assets from Bayer’s
Sinochem International’s subsidiaries, Sinochem Crop Protection and Shenyang Pesticide Chemical Research and Development.

- The US agricultural technology company, Yield10, received a non-exclusive research licence to CRISPR-Cas9 gene editing technology by DowDuPont agriculture business, Corteva Agriscience, and the US non-profit Broad Institute of MIT and Harvard.

SEPTEMBER
- Brazilian agrochemical company Agrototal’s proposed acquisition of Agro Ferrari was approved by the country’s competition authority, the Cade.

- BASF and DowDuPont’s agricultural business, Corteva Agriscience, agreed a licensing deal for BASF’s imidazolinone herbicide tolerance Clearfield Plus technology for sunflowers.

- Bayer’s Crop Science division in India and Indian company Crystal Crop Protection agreed a collaborative project to develop crop protection solutions for the control of brown plant hoppers (Nilaparvata lugens) in rice.

- Bayer’s Crop Science division and Swiss software solutions supplier Genedata extended a partnership focused on storage and processing of genome data.

- Brazilian agricultural co-operative business Cotrijal inaugurated an industrial seed treatment machine via a partnership with Bayer’s Crop Science division.

- French crop protection company De Sangosse acquired Spanish bio-stimulant companies Biologicas Canarias and Biotecnologia del Mediterraneo and created a new company, Biológica Nature.

- US agrochemical company Gowan agreed to acquire the Brazilian agrochemical company, Cross Link.

- Dutch bioproducts company Koppert Biological Systems agreed to acquire the biological crop protection activities of Dutch company Horticoop with effect from November 1st.

- The US biopesticide company, Marrone Bio Innovations (MBI), entered into an agreement with the Vietnamese Hop Tri Investment Corporation to introduced three MBI biopesticides to Vietnam and Cambodia.

- Japanese agrochemical company Nihon Nohyaku became a 51%-owned subsidiary of Japanese company Adeka Corporation.

The two companies agreed the deal in November 2017.

- Acceres’ French field testing company, Promo-Vert, acquired the field testing activities of French company Phyteurop.
- French contract research company Staphyrt acquired the UK-based regulatory and development consultancy, Agchem Project Consulting.
- Sumitomo Chemical and Nufarm agreed to collaborate on the introduction of Sumitomo’s new fungicide, metyltetraprole (trade-marked as Pavecta), for key European cereal markets.
- The US agricultural technology company, Yield10 Bioscience, granted a non-exclusive research licence to Land O’Lakes subsidiary Forage Genetics International to evaluate five novel yield traits in forage sorghum.

**OCTOBER**

- BASF agreed a global, non-exclusive licensing deal with US non-profit research organisation Broad Institute of MIT and Harvard for the use of CRISPR-Cpf1 genome editing technology for agricultural and industrial microbiology use.
- DowDuPont’s agricultural business, Corteva Agriscience, entered into a multi-year agreement with the International Rice Research Institute on collaborative rice breeding.
- UK company Eden Research entered into an exclusive distribution agreement with Sipcam-Oxon for Eden’s biofungicide, 3AEY, in Australia and New Zealand.
- Investment company Longhan acquired shares in Chinese agricultural biotechnology company Origin Agritech.
- Indian company Mahindra Agri Solutions and Japanese company Sumitomo Corporation agreed to form a 60:40 joint venture, Mahindra Summit Agriscience.
- Italian agrochemical companies Oxan Italia and subsidiary Sipcam approved the incorporation of Sipcam into Oxan Italia.
- Japanese company Sumitomo Corporation acquired the remaining 35% in Brazilian agribusiness company Agro Amazônia Produtos Agropecuários that it did not already own.

**NOVEMBER**

- US agrochemical company American Vanguard agreed to acquire the US-based, UK-listed life sciences company, TyraTech.
- The Canadian company, Bee Vectoring Technologies, entered into a global technology sharing agreement with Belgian biological pest control company Biobest.
- The Indian company, Crystal Crop Protection, acquired three pesticide brands from ChemChina-owned Syngenta.
- The US biopesticide company, Marrone Bio Innovations (MBI), signed an exclusive distribution agreement with the Turkish agricultural inputs supplier, AMC-TR, covering two MBI biopesticides.
- UPL agreed to acquire the Bioquim Group comprising the Costa Rica-based agrochemical company, Industrias Bioquim Centroamericana, and other group companies located in Costa Rica, Dominican Republic, Nicaragua and Panama.
- Chinese company Sichuan Fuhua acquired a 29.2% stake in Chinese company Nantong Jiangshan from Sinochem International.
- The US agricultural technology development investment company, TechAccel, entered into a biopesticide research collaboration with US agricultural biotechnology company AgroSpheres.

**DECEMBER**

- BASF and Dutch satellite-derived data company VanderSat agreed to collaborate on providing satellite data-based recommendations to growers globally on applying agricultural inputs.
- BASF and the US aerospace and data analytics company, Planet, agreed a deal to deliver satellite imagery and data to European farmers to enable more effective agronomic decision making.
- Bayer’s Crop Science division and Chinese small molecule discovery company HitGen agreed a research collaboration to identify novel small molecule leads for targets of interest.
- Belgian biological pest control company Biobest acquired a stake in the Australian pest management company, Bugs for Bugs.
- German specialty chemical company Clariant and US specialty chemical firm Eastman agreed a distribution deal for Eastman’s agrochemical solvent, Tamisolve NxC.
- Israeli plant biotechnology company Evogene and Brazilian plant breeder Tropical Melhoramento & Genética agreed to collaborate on the development of non-genetically modified nematode-resistant soybeans.
- The US agricultural products company, Indigo Ag, acquired US satellite imagery company TellusLabs.
- Belgian biological pest control company Biobest’s German affiliate, IVOG, acquired a majority stake in Turkish pest control company BKS from its parent company, Antilan.
- The US precision agriculture company, Raven Industries, agreed to acquire US agricultural logistics software company AgSync.
- Sipcam-Oxon exercised its option to distribute UK company Eden Research’s first biofungicide, Mevalonone, based on the terpene active ingredients, eugenol, geraniol and thymol, in several markets.
- Syngenta (owned by ChemChina) took up its licensing option for industrial biotechnology company Ingenza’s technology to aid the development of crop protection products.
New active ingredients registered or launched in 2018

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>
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<tr>
<td>Bayer CropScience</td>
<td></td>
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<tr>
<td>bixafen</td>
<td>Cotton</td>
<td>Pre-marketing launch in Brazil as Fox Xpro (with prothioconazole and trifloxystrobin)</td>
</tr>
<tr>
<td>DuPont</td>
<td></td>
<td></td>
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<tr>
<td>oxathiapiprolin (trade-marked as Zorvec)</td>
<td>Potatoes, vegetables, grapevines &amp; other specialty crops</td>
<td>Planned launches in Belgium, Ireland, Italy &amp; UK as Zorvec Encade &amp; in Italy as Zorvec Zelavin 100 OD &amp; Approved in Poland as Zorvec Encade &amp; Belarus as Zorvec Encantia (with famoxadone)</td>
</tr>
<tr>
<td>fenpicoxamid (trade-marked as Inatreq)</td>
<td>Cereals</td>
<td>Approved in EU</td>
</tr>
<tr>
<td>FMC/Bayer</td>
<td></td>
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<tr>
<td>bixafen</td>
<td>Cereals (except rice), soybeans, peanuts, root vegetables, and tuberous &amp; corm vegetables</td>
<td>Proposed approval in US as F96521-1 (with iprodione), F9654-1 (with flutriafol), F9653-1 (with azoxystrobin) &amp; F9651-2 (with tebuconazole)</td>
</tr>
<tr>
<td>Ishihara Sangyo Kaisha</td>
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<tr>
<td>isofetamid</td>
<td></td>
<td>Launched in Japan (as Kenja Flowable), South Korea, the EU &amp; Mexico</td>
</tr>
<tr>
<td>pyriofenone</td>
<td></td>
<td>Approved &amp; launched in Peru</td>
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<tr>
<td>Otsuka AgriTechno Agrio</td>
<td></td>
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<tr>
<td>flutianil</td>
<td>Apples, cantaloupes, cherries, cucumbers, grapevines, squash &amp; strawberries</td>
<td>Proposed approval in US as Gatten</td>
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<tr>
<td>Otsuka AgriTechno Agrio</td>
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<tr>
<td>flutianil</td>
<td>Apples, cantaloupes, cherries, cucumbers, grapevines, squash &amp; strawberries</td>
<td>Proposed approval in US as Gatten</td>
</tr>
</tbody>
</table>
Fungicides and Disease Control 2018

Registrations | Active Ingredients | Bio Fungicides | Company Profiles | Sector Progress

Key Insights

- Next generation fungicides
- New and next generation active ingredients
- Developments in bio fungicides
- Company profiles

Download our latest report, Fungicides and Disease Control 2018, to discover vital developments within this important industry.

Since we last reported, 14 active ingredients have been given ISO common names, which indicates the progress made in the industry.

This report guides you through the new fungicide active ingredients that are either registered or seeking registration in the EU, the US, or both. The potential next-generation of fungicides are listed as well as those coming out of patent protection.

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<tr>
<th>Company &amp; active ingredient</th>
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</thead>
<tbody>
<tr>
<td><strong>Syngenta (owned by ChemChina)</strong></td>
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<tr>
<td>benzovindiflupyr (trade-marked as Solatenol)</td>
<td>Cereals</td>
<td>Launched in Spain as Elatus Era (with prothioconazole)</td>
</tr>
<tr>
<td>isopyrazam (trade-marked as IZM)</td>
<td>Apples &amp; pears</td>
<td>Proposed approval in Australia as Seguris Flexi</td>
</tr>
<tr>
<td>pydiflumetofen (trade-marked as Adepidyn)</td>
<td>Canola, grapevines &amp; potatoes</td>
<td>Proposed approval in Australia as Miravis</td>
</tr>
<tr>
<td></td>
<td>Maize, soybeans, wheat, peanuts, grapevines, potatoes &amp; vegetables</td>
<td>Approved in US as Miravis, Miravis Ace (with propiconazole), Miravis Tap (with difenoconazole), Miravis Prime (with fludioxonil) &amp; Miravis Neo (with propiconazole and azoxystrobin)</td>
</tr>
<tr>
<td></td>
<td>Field crops, fruit, vegetables, turf &amp; ornamentals</td>
<td>Approved in Canada as A19649, A19649TO, A20259 (with difenoconazole), A20560 (with fludioxonil) &amp; A21461 (with azoxystrobin and propiconazole)</td>
</tr>
<tr>
<td><strong>INSECTICIDES/ACARICIDES/NEMATICIDES</strong></td>
<td></td>
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<tr>
<td><strong>Adama (owned by ChemChina)</strong></td>
<td></td>
<td></td>
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<tr>
<td>fluensulfone</td>
<td>Maize, soybeans, cotton &amp; other crops</td>
<td>Approved &amp; launched in Brazil as Nimitz</td>
</tr>
<tr>
<td><strong>BASF/Meiji Seika Pharma</strong></td>
<td></td>
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<tr>
<td>afidopyropen (trade-marked as Inscalis)</td>
<td>Brassica vegetables, celery, cucurbits, fruiting &amp; leafy vegetables, parsley, potatoes, sweet potatoes, ginger &amp; cotton</td>
<td>Approved in Australia as Versys</td>
</tr>
<tr>
<td></td>
<td>Cotton &amp; vegetables</td>
<td>Approved in India as Sefina</td>
</tr>
<tr>
<td></td>
<td>Cotton, soybeans, fruit, vegetables &amp; ornamentals</td>
<td>Proposed approval in US as Versys, Sefina &amp; Ventigra</td>
</tr>
<tr>
<td></td>
<td>Fruit, nuts, vegetables &amp; ornamentals</td>
<td>Approved in Canada as Versys &amp; Sefina</td>
</tr>
<tr>
<td><strong>Bayer Crop Science</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>flupyradifurone</td>
<td>Bananas &amp; macadamias</td>
<td>Proposed approval in Australia as Sivanto Prime</td>
</tr>
<tr>
<td><strong>Bayer/Novel Textiles &amp; Treatments</strong></td>
<td></td>
<td></td>
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<tr>
<td>transfluthrin</td>
<td>Non-crop indoor use</td>
<td>Proposed approval in US as Personal Insect Repellent Kit</td>
</tr>
<tr>
<td><strong>DowDuPont</strong></td>
<td></td>
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<tr>
<td>cyantraniliprole (trade-marked as Cyazypyr)</td>
<td>Oilseed rape</td>
<td>Approved in Romania as Lumiposa</td>
</tr>
<tr>
<td>sulfoxaflor (trade-marked as Isoclast)</td>
<td>Crops including citrus fruit, cotton, maize, rice, soybeans &amp; wheat</td>
<td>Proposed approval in Brazil</td>
</tr>
<tr>
<td><strong>FMC/Cheminova</strong></td>
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<tr>
<td>cyantraniliprole (trade-marked as Cyzypyr)</td>
<td></td>
<td>Launched in Italy as Exirel</td>
</tr>
<tr>
<td><strong>Ishihara Sangyo Kaisha</strong></td>
<td></td>
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<tr>
<td>cyclaniliprole</td>
<td>Apples</td>
<td>Approved in Japan as Teppan SL &amp; Souheki SL (with flonicamid)</td>
</tr>
<tr>
<td>Company &amp; active ingredient</td>
<td>Use</td>
<td>Status</td>
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<tr>
<td><strong>Monsanto (now Bayer)</strong></td>
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<tr>
<td>tioxazafen</td>
<td>Maize &amp; soybeans</td>
<td>Approved in Canada as MON 102133 SC</td>
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<tr>
<td><strong>Nissan Chemical</strong></td>
<td></td>
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<tr>
<td>fluxametamide</td>
<td></td>
<td>Approved &amp; launched in South Korea as Gracia</td>
</tr>
<tr>
<td><strong>Adama (owned by ChemChina)</strong></td>
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<tr>
<td>metamitron</td>
<td>Apples</td>
<td>Approved in Australia as Brevis Fruit Thinner</td>
</tr>
<tr>
<td><strong>DowDuPont</strong></td>
<td></td>
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<tr>
<td>florpyrauxifen-benzyl (trade-marked as Rinskor)</td>
<td>Rice</td>
<td>Approved in Australia as GF-3301</td>
</tr>
<tr>
<td>halaxifen-methyl (trade-marked as Arylex)</td>
<td>Cereals</td>
<td>Approved &amp; launched in Italy as Zypar (with florasulam)</td>
</tr>
<tr>
<td><strong>FarmHannong (owned by LG Chem)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>tiafenacil (trade-marked as Terrad’or)</td>
<td>Apples &amp; non-crop use</td>
<td>Approved &amp; launched in South Korea as Terrad’or Plus (with glyphosate)</td>
</tr>
<tr>
<td><strong>FarmHannong/Kaken</strong></td>
<td></td>
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</tr>
<tr>
<td>metamifop</td>
<td></td>
<td>Launched in Japan as Todome MF</td>
</tr>
<tr>
<td><strong>FarmHannong/FMC</strong></td>
<td></td>
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<tr>
<td>metamifop</td>
<td>Rice</td>
<td>Launched in Thailand as Pyzero</td>
</tr>
<tr>
<td><strong>Ishihara Sangyo Kaisha</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>flazasulfuron</td>
<td>Grapevines, conifers &amp; industrial vegetation management sites</td>
<td>Approved in Canada as Flazasulfuron 25WG</td>
</tr>
<tr>
<td><strong>Kumiai Chemical</strong></td>
<td></td>
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<tr>
<td>fenquinotrione (trade-marked as Effeeda)</td>
<td></td>
<td>Approved in Japan</td>
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<tr>
<td><strong>Janssen Pharmaceutica</strong></td>
<td></td>
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<tr>
<td>1-methylcyclopropene</td>
<td>Apples</td>
<td>Approved in Australia as Fysium</td>
</tr>
<tr>
<td><strong>Petro-Canada Lubricants (dba Intelligro)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>calcium disodium ethylenediaminetetraacetic acid dehydrate</td>
<td>Spot treatment in lawns</td>
<td>Proposed approval in US as VNT Selective Herbicide Ready-to-use (with indole-3-butyric acid)</td>
</tr>
<tr>
<td><strong>BIOPESTICIDES &amp; OTHERS</strong></td>
<td></td>
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<tr>
<td><strong>AgBiTech</strong></td>
<td></td>
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<tr>
<td>Chrysodeixis includens nucleopolyhedrovirus isolate 460 [bioinsecticide]</td>
<td></td>
<td>Approved in Canada as Helicovex</td>
</tr>
<tr>
<td><strong>BASF</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Beauveria bassiana strain PPRI 5339 [bioinsecticide/acaricide]</td>
<td>Greenhouse ornamentals &amp; vegetables</td>
<td>Approved in Canada as Velifer</td>
</tr>
<tr>
<td></td>
<td>Fruit, vegetables, herbs, spices &amp; ornamentals</td>
<td>Proposed approval in US as Velifer</td>
</tr>
<tr>
<td>Company &amp; active ingredient</td>
<td>Use</td>
<td>Status</td>
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</tr>
<tr>
<td><em>Bacillus amyloliquefaciens</em> strain MBI 600 [biofungicide]</td>
<td>Grapevines</td>
<td>Proposed approval in Canada as Serifel MB 600</td>
</tr>
<tr>
<td><em>Bacillus subtilis</em> strain BU1814 [biofungicide]</td>
<td>Maize, soybeans &amp; wheat</td>
<td>Approved in Canada as BAS 154 U ST, BAS 100 U ST, Velondis Plus, Velondis Flex &amp; Velondis Extra</td>
</tr>
<tr>
<td><strong>Bayer Crop Science</strong></td>
<td></td>
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</tr>
<tr>
<td><em>Bacillus amyloliquefaciens</em> strain QST 713 [biofungicide]</td>
<td>Grapevines</td>
<td>Approved in Australia as Serenade Opti QST 713</td>
</tr>
<tr>
<td><strong>Brandt iHammer</strong></td>
<td></td>
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<tr>
<td><strong>De Cuester</strong></td>
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<tr>
<td>pepino mosaic virus strain CH2 isolate 1906 [virus defence]</td>
<td>Greenhouse tomatoes</td>
<td>Proposed approval in Canada</td>
</tr>
<tr>
<td></td>
<td>Greenhouse tomatoes</td>
<td>Proposed approval in US</td>
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<tr>
<td><strong>Envera</strong></td>
<td></td>
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</tr>
<tr>
<td><em>Bacillus amyloliquefaciens</em> strain ENV503 [biofungicide]</td>
<td>Fruit, vegetables, vine crops, herbs, spices &amp; grasses</td>
<td>Proposed approval in US as ENV503</td>
</tr>
<tr>
<td><strong>FMC</strong></td>
<td></td>
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<tr>
<td><em>Bacillus subtilis</em> strain FMCH002 + B licheniformis strain FMCH001 [biofungicide/nematicide]</td>
<td>Crops including maize, soybeans &amp; sunflowers</td>
<td>Proposed approval in Canada as F4018-4</td>
</tr>
<tr>
<td><strong>Gowan</strong></td>
<td></td>
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<tr>
<td><em>Swinglea glutinosa</em> extract [biofungicide]</td>
<td>Outdoor &amp; greenhouse food &amp; non-food crops</td>
<td>Approved &amp; launched in US as EcoSwing</td>
</tr>
<tr>
<td><strong>Koppert Biological Systems</strong></td>
<td></td>
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<tr>
<td><em>Metschnikowia fructicola</em> strain NRRL Y-27328 [biofungicide]</td>
<td>Fruits &amp; berries</td>
<td>Proposed approval in US as KM1110 WDG</td>
</tr>
<tr>
<td></td>
<td>Stone fruit, strawberries &amp; grapevines</td>
<td>Approved in EU</td>
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<tr>
<td><strong>Marrone Bio Innovations</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Bacillus amyloliquefaciens</em> strain F727 [biofungicide]</td>
<td>Cucurbits, legume vegetables, potatoes, grapevines, canola &amp; sunflowers</td>
<td>Approved in Canada as MBI-110 EP</td>
</tr>
<tr>
<td><strong>Monsanto (now Bayer)</strong></td>
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<tr>
<td>lipochitooligosaccharide SP104 [plant growth regulator]</td>
<td>Maize &amp; canola</td>
<td>Approved in US as Acceleron B-360 ST</td>
</tr>
<tr>
<td>Company &amp; active ingredient</td>
<td>Use</td>
<td>Status</td>
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<tr>
<td><strong>OmniLytics</strong></td>
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<tr>
<td><em>Xanthomonas citri</em> subsp <em>citri</em> bacteriophage [bactericide]</td>
<td>Citrus trees</td>
<td>Approved in US as AgriPhage-Citrus Canker</td>
</tr>
<tr>
<td><strong>Erwinia amylovora</strong> bacteriophage [bactericide]</td>
<td>Apples &amp; pears</td>
<td>Approved in US as AgriPhage-Fire Blight</td>
</tr>
<tr>
<td><strong>Phyllom Bios</strong></td>
<td></td>
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<tr>
<td><em>Bacillus thuringiensis</em> subsp <em>galleriae</em> strain SDS-502 [bioinsecticide]</td>
<td>Turf &amp; ornamentals</td>
<td>Proposed approval in Canada as GrubGONE!, GrubHALT!, BeetleGONE! &amp; BeetleJUS!</td>
</tr>
<tr>
<td><strong>Syngenta (owned by ChemChina)</strong></td>
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<tr>
<td><em>Pasteuria nishizawae</em> Pn1 [bionematicide]</td>
<td>Sugar beet</td>
<td>Approved in EU</td>
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<tr>
<td><strong>Verdesian Life Sciences</strong></td>
<td></td>
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<tr>
<td>calcium salts of phosphorous acid/calcium phosphite [fungicide/systemic acquired resistance activator]</td>
<td>Fruit, vegetables, trees, nuts, ornamentals &amp; turf</td>
<td>Proposed approval in US as Fungi-Phite Ca</td>
</tr>
</tbody>
</table>
Agrow Biostimulants 2018

Markets | Regions | Companies | Products | Key Drivers

Key Insights
• Market analysis
• Legislation
• Research and Development
• Crops
• Formulations

We are pleased to bring you our latest report, which consolidates fundamental information of the global biostimulant market.

The global biostimulant market is at an early stage, but growing rapidly with a CAGR of over 10%. This growth is driven by the need to increase agricultural production together with an increasing concern about the environment. This thriving sector is attractive to new investors as well as expansion by current key players.

The report provides qualitative information which equips the reader with detailed and reliable insights into the latest product, company and legislative news.

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**HERBICIDE**

- Flumioxazin
- Isoxaflutole
- Mesotrione
- But oxydim
- Penoxsulam
- Diclosulam
- Cloransulam
- Flumetsulam
- Florasulam
- Imazethapyr
- Imazamox
- Imazapic
- Imazapyr
- 2,4-D
- 2,4-DB
- 2,4-DP-p
- Dicamba
- MCPA
- MCPB
- MCP-P
- Clopyralid
- Clethodim
- Metribuzin
- Fomesafen
- Oxyfluorfen
- Acethlo
- Metazachlor
- Metolachlor
- S-Metolachlor
- Cyhalofop
- Clodinafop
- Fenoxaprop
- Quizalofop
- Haloxypop

**INSECTICIDES**

- Thiamethoxam
- Clothianidin
- Dinotefuran
- Chlorfenapyr
- Methoxyfenozide
- Indoxacarb
- Pyretrozone
- Bifenthrin
- Lufenuron
- Profenofos
- Acephate
- Chlorpyrifos
- Imidacloprid
- Acetamiprid
- Ethiprole
- Fipronil
- Diafenthiuron
- Pyriproxyfen
- Methomyl
- Oxamyl
- Abamectin
- Emamectin
- Bifentrazole
- Lambda-cyhalothrin

** FUNGICIDES **

- Azoxystrob in
- Pyraclostrob in
- Trifloxystrobin
- Picoxystrobin
- Prothioconazole
- Cyproconazole
- Difenconazole
- Epoxiconazole
- Fluazinam
- Boscalid
- Fludioxonil
- Cyprodinil
- Tebuconazole
- Propiconazole
- Isoprothiolane
- Dimethomorph
- Benomyl
- Carbendazim
- Pyrimethanil
- Spiroxamine
- Captan
- Chlorothalonil
- Mancozeb
- Propineb

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