

June 13, 2026

N ° 83

Cultivar[®] *Semanal*

A detailed close-up photograph of a beetle's head, showing its green and brown textured exoskeleton, large compound eyes, and two prominent antennae. The beetle is positioned centrally, with its head facing forward.

**New
frontiers in
biocontrol**

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Parasitoid venom opens new fronts in biocontrol

Research points to proteins capable of modulating the immunity, development, and metabolism of insect pests

12.06.2026 | 10:37 (UTC -3)

Schubert Peter, Cultivar Magazine



Photo: Paul Langlois / USDA

Proteins from parasitoid insect venom have moved beyond a role solely focused on immunosuppression. Research describes these compounds as systems for manipulating the host's physiological processes. They act on melanization, the prophenoloxidase cascade, cellular and humoral immunity, development, metabolism, and behavior. The experimental basis largely comes from members of the order Hymenoptera. Outside of this group, the parasitoid beetle *Dastarcus helophoroides* emerges as one of the most promising comparative models. The study compiled data on the identification, function, evolution, and potential use of these proteins in biological control. The researchers highlight a shift in

concept. The venom not only protects eggs and larvae against encapsulation, melanization, hemocytes, and antimicrobial peptides, but it also prepares the host as a resource for parasitoid development.

Six lines of action

Scientists identify six main axes of action. The proteins can block melanization and the prophenoloxidase cascade. They can also disrupt cellular immunity, suppress humoral responses, interrupt development, redirect metabolic flows, and alter neuromuscular or behavioral functions. This set supports the interpretation of the venom as a multifunctional system of effectors.

Molecular knowledge remains focused on parasitoid wasps. Systems such as *Nasonia vitripennis*, *Pteromalus puparum*, *Microplitis mediator*, *Habrobracon hebetor*, *Pachycrepoideus vindemmiae*, *Sclerodermus guani*, *Leptopilina* spp. and *Cotesia* spp. provide most of the mechanistic evidence. In many cases, individual proteins have already had their function validated by recombinant assays, RNA interference, transgenic expression, or biochemical analyses.

Examples of uses

In *Pteromalus puparum*, for example, the venom reduces the expression of cecropine and lysozyme in *Pieris rapae*. A single injection suppresses 113 transcripts

in hemocytes and 221 transcripts in the fat body in one hour. In *Habrobracon hebetor*, the venom halves capsule melanization, decreases phenoloxidase activity to one-third of the controls on the second day, and reduces hemocyte scattering capacity from sixty-seven percent to thirty-three percent in one hour.

The case of *Dastarcus helophoroides* expands the discussion to Coleoptera. The larva acts as an ectoparasitoid of cerambycids, among them *Monochamus alternatus*. Following parasitism, melanization of the host's hemolymph is inhibited in the early stages.

Phenoloxidase activity exhibits a biphasic dynamic, with transient stimulation at four hours, inhibition at twelve hours, and

subsequent return to baseline levels. Antibacterial activity decreases within the first hour. Total hemocyte abundance falls below half that of controls at seventy-two hours.

Molecular level

At the molecular level, scientists have recorded fifty candidate proteins that are venom-like factors in newborn larvae of *Dastarcus helophoroides*. The set includes nineteen arginine kinases, ten chitinases, and twenty-one proteases or protease inhibitors. The salivary gland emerges as a possible source or storage site, since the larva paralyzes and feeds on the host through its mouthparts, not by ovipositor. This hypothesis still lacks anatomical

confirmation.

The predominance of arginine kinases is noteworthy. Seventeen of the nineteen proteins in this group appear in greater abundance in neonate larvae than in late-stage larvae. Researchers associate this difference with the possibility of their involvement in the initial paralysis of the host; however, they remain cautious. Because the study used whole-body proteomics, some of the candidates may represent abundant proteins without secretory function.

Chitinases also open up a hypothesis linked to an ectoparasitoid lifestyle. They may participate in cuticle degradation or modification of the feeding site. This mechanism would be consistent with the

larva's external feeding through the host's integument. Confirmation requires identification of the secretory tissue, gland-resolved transcriptome, recombinant assays, and RNA interference on priority candidates.

Practical application

Practical application still depends on intermediate steps. Scientists indicate greater viability in the use of venom proteins as synergists in integrated pest management, rather than as isolated broad-spectrum biopesticides. The most sustained uses involve increasing the susceptibility of pests to microbial agents, altering host development, and interfering with competition between parasitoids in

mass rearing or augmentative release programs.

Dastarcus helophoroides already has an operational history in forest management in China. Mass releases have achieved up to 91.48 percent corrected control of *Monochamus alternatus* in felled trees. Other studies have reported corrected population reductions between eighty-two and eighty-six percent, with adjustment for the proportion and timing of release. In *Massicus raddei*, releases with egg cartons resulted in a corrected reduction of eighty-eight point six percent.

Four central points

Translating these findings into molecular products or tools faces four key challenges. The first involves delivery. Many venom proteins need to reach the hemocoel or hemocytes and do not function like classic oral toxins. The second involves specificity and safety for non-target organisms. The third involves the evolution of resistance. The fourth involves positioning within integrated pest management.

The researchers also point to scientific bottlenecks. Different collection methods generate different proteomic profiles. Reservoir content, whole-body extracts, artificial host collection, and whole-body larval extracts do not produce equivalent results. In the case of *Dastarcus helophoroides*, whole-body proteomics has

allowed progress in the face of the small size of the larvae, but it does not replace anatomical sampling of secretory tissue.

The genome of *Dastarcus helophoroides* already provides support for the next step. The chromosome-level assembly has 609 megabases, 14,890 predicted coding genes, and 13 chromosomes. Thus, the main bottleneck no longer involves only genomic resources. It now involves locating the secretory tissue, generating a transcriptome of that tissue, and experimentally validating individual effectors.

Further information at
doi.org/10.3390/insects17060608

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Seed vigor enhances tomato's competitiveness against weeds

A greenhouse study evaluated directly sown tomato plants against *Setaria viridis* and *Datura stramonium*

12.06.2026 | 09:35 (UTC -3)

Schubert Peter, Cultivar Magazine

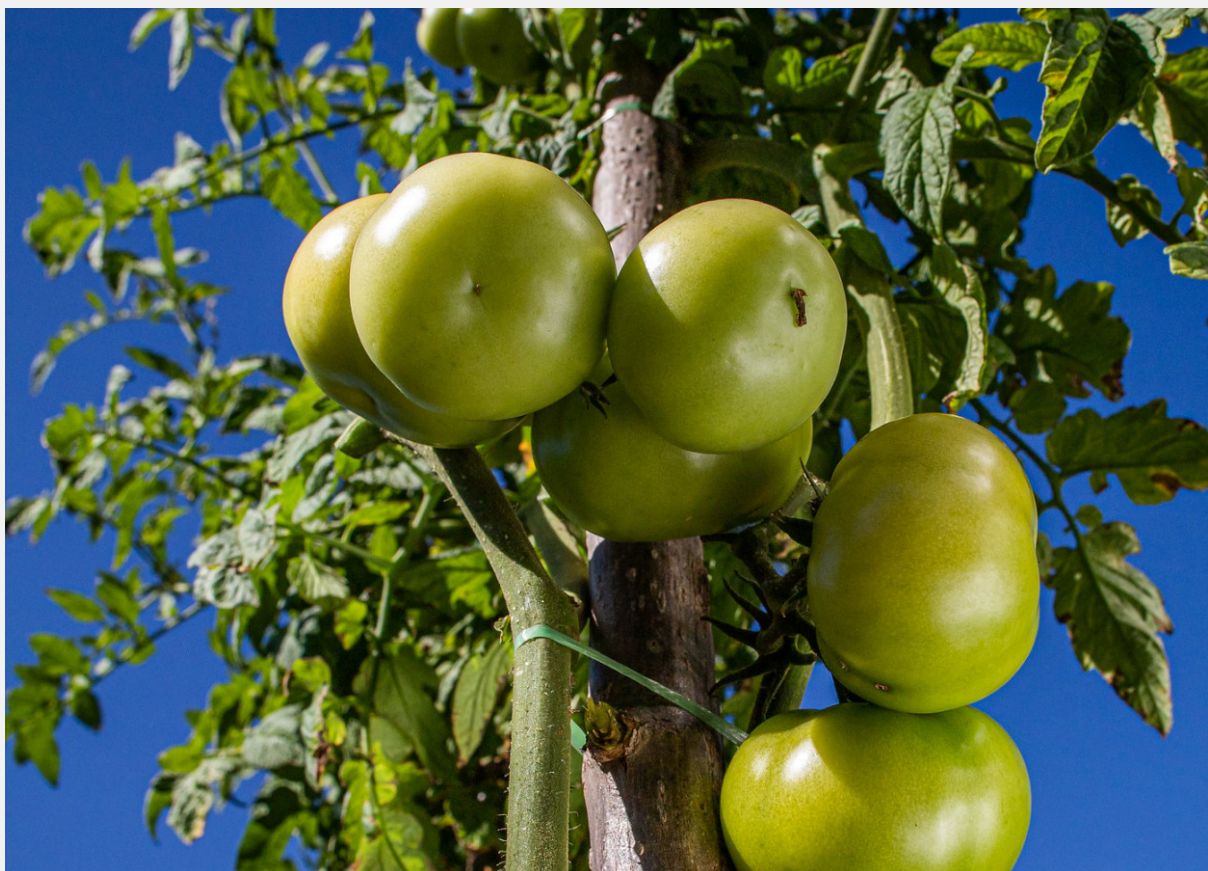


Photo: Wenderson Araujo / CNA

Tomato seeds with high vigor increased the initial competitive capacity of seedlings with *Setaria viridis* and *datura stramonium*. The effect was most pronounced in competition for soil resources. The result indicates seed vigor as a strategic component in integrated weed management in no-till processing tomatoes.

The study evaluated high-vigor tomato seeds, with 91 percent germination, and low-vigor seeds, with 60 percent germination. The researchers obtained the low-vigor batch through accelerated aging, with a temperature of 42 degrees Celsius and relative humidity close to 100 percent for 72 hours.

Two weed species

The study compared the performance of tomatoes against two weed species.

Setaria viridis, known as green foxtail grass, exhibited rapid growth and strong root development. *Datura stramonium*, known as the devil's fig tree, represented a broad-leaved species with a different resource acquisition strategy.

High-vigor tomato seeds achieved 83 percent emergence in the greenhouse. Low-vigor seeds reached 56 percent. The average emergence time did not differ statistically between the two tomato batches. High-vigor seeds emerged in 6,0 days. Low-vigor seeds emerged in 7,2 days.

Even without a statistically significant difference at this point, the high-vigor group showed a numerical advantage in the initial phase. Seedlings in this group accumulated 8,5 milligrams of dry mass. Those with low vigor accumulated 7,1 milligrams. This difference suggests a greater potential for initial growth.

Weeds before

The weeds emerged before the tomatoes. *Datura stramonium* showed an average emergence time of 2,4 days. *Setaria viridis* It took 3,0 days. This initial advance favored the so-called priority effect, in which the plant that emerged first occupies space and captures resources before the crop.

The growth analysis showed a significant advantage for *Setaria viridis*. At 40 days after emergence, the species reached approximately 80 centimeters in height. The high-vigor tomato, the low-vigor tomato, and *Datura stramonium* were close to 40 centimeters apart.

The most significant difference occurred in the roots. *Setaria viridis* produced approximately 1.200 milligrams of root dry matter 40 days after emergence. The other plants produced between 200 and 250 milligrams. This pattern indicates a high capacity for exploiting water and nutrients in the soil.

Tomato yield

In replacement series trials, the high-vigor tomato maintained relative leaf and root yield within the expected range when competing with *Datura stramonium*. The low-vigor tomato plant experienced low-level weed suppression, with a decrease in relative root yield below the adopted statistical limit.

The competition with *Setaria viridis* had a more severe effect. Low-vigor tomatoes lost their ability to occupy root niches in all proportions evaluated. In a mixture with 75 percent of *Setaria viridis*, the relative yield of low-vigor tomato roots fell to values ??between 0,10 and 0,15.

High-vigor tomatoes also suffered competition with *Setaria viridis*, however it maintained superior performance. The

researchers interpreted this result as an indication of physiological dampening promoted by seed vigor.

Aerial and underground

The separation between aboveground and belowground competition confirmed this difference. In treatments with belowground competition, high-vigor plants produced 0,25 grams of root mass per plant. Low-vigor plants produced 0,15 grams per plant.

The results reinforce the importance of seed physiological quality in no-till systems. According to the study, high-vigor seed lots can reduce the vulnerability of tomatoes at the beginning of their cycle.

This phase defines part of the competitive relationship with weeds.

The researchers highlight the need for field studies. The research was conducted in a greenhouse. Trials under varying agronomic conditions are still needed to confirm the effects on final productivity and on integrated weed management programs.

Further information can be found at doi.org/10.3390/seeds5030033

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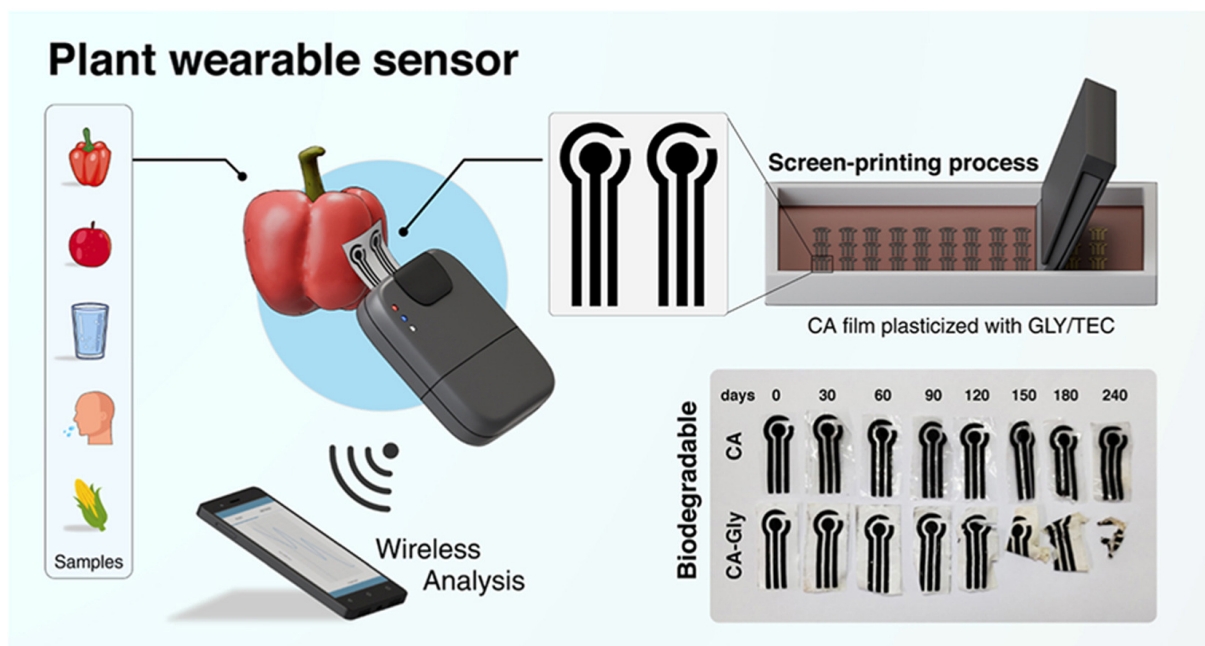
SUA MÁQUINA DE TRABALHO

Biodegradable sensor measures pesticides in three minutes

USP device uses cellulose acetate and electrochemical analysis to detect diquat, carbendazim, and diphenylamine

12.06.2026 | 07:57 (UTC -3)

Schubert Peter, Cultivar Magazine



doi.org/10.1016/j.biosx.2026.100758

Scientists at the University of São Paulo have developed biodegradable wearable sensors to detect pesticides in plants and

food quickly, non-destructively, and on-site. The device uses carbon ink printed by screen printing on flexible cellulose acetate films. The platform identifies [diquat](#), [carbendazim](#) and diphenylamine in three minutes and twenty-eight seconds.

The sensor can adhere to irregular, wavy, and curved plant surfaces. Application occurs directly on leaves, stems, peels, apples, and peppers. The wearable design allows for decentralized analysis, eliminating the need to take samples to a laboratory. The system delivers real-time results via a portable wireless potentiostat connected via Bluetooth to a cell phone, computer, or tablet.

Two units

Each device comprises two sensor units. One uses square wave voltammetry to measure diquat. The other uses differential pulse voltammetry to detect carbendazim and diphenylamine. The study reports the use of a single sample drop and sequential operation on the same chip. Diquat reading occurs within the first fifty-two seconds. Simultaneous measurement of carbendazim and diphenylamine takes an additional one hundred and ninety-seven seconds.

The device costs less than \$0,077 per unit. The low cost matters because the sensors are for single use. According to Paulo Augusto Raymundo-Pereira, a professor at the São Carlos Institute of Physics at USP (University of São Paulo), the proposal

combines speed, low environmental impact, and field analysis.

Sensor base

The sensor base uses cellulose acetate. This material is of plant origin and can come from agricultural waste. The study also evaluated plasticizers. The best results were obtained with cellulose acetate plasticized with 5,4 millimoles of glycerol. This formulation showed better dynamic range, linearity, and sensitivity compared to films plasticized with triethyl citrate.

In the tests, the sensors detected diquat in the range of 0,1 to 1,0 micromolar. For carbendazim, the range was between 0,2

and 2,0 micromolar. For diphenylamine, the range was between 2,5 and 25 micromolar. The detection limits reached 3,2 nanomolar for diquat, 180 nanomolar for carbendazim, and 1,34 micromolar for diphenylamine.

Field use

The team simulated a field use condition. Pesticide solutions were sprayed onto the peel of apples and bell peppers at a concentration of 1.000 micromolar. The products were allowed to dry for five hours. Then, the sensor was attached to the surface. The reading was taken using a 500 microliter drop of phosphate buffer solution to allow for electrical conduction and a chemical response from the

electrode.

The study also tested human saliva and tap water with added pesticides. In these samples, the system detected all three targets in the same 150-microliter droplet. The results indicated potential use in food, water, and biological samples, as well as agricultural monitoring.

The platform demonstrated selectivity in the face of potential interfering substances. Tests included nitrate, sulfate, glucose, urea, fenitrothion, thiabendazole, dopamine, linuron, methyl parathion, ascorbic acid, and proline. The sensor also withstood vertical, horizontal, and diagonal bending cycles with little alteration in voltammetric responses.

Biodegradation of devices

The study evaluated the biodegradation of the devices over 240 days. Sensors made with cellulose acetate plasticized with glycerol degraded completely within this period. Devices made only with cellulose acetate remained intact. The image on page eleven of the article shows a visual comparison between the two formulations throughout the degradation period.

The team also calculated green analytical chemistry metrics. The method scored 0,77 on the AGREE approach and 81 on the Analytical Eco-Scale. The Blue Applicability Grade Index reached 77,5, a value cited by the researchers as

indicative of analytical applicability.

The study was conducted by Samiris Côcco Teixeira, Nathalia O. Gomes, Sergio AS Machado, Taíla Veloso de Oliveira, Nilda FF Soares, and Paulo A. Raymundo-Pereira.

Further information is available at doi:
[10.1016/j.biosx.2026.100758](https://doi.org/10.1016/j.biosx.2026.100758)

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Octavio Nakano, a leading figure in Brazilian entomology, has died

A professor at Esalq/USP has dedicated more than four decades to research, teaching, and training specialists in plant protection

11.06.2026 | 16:59 (UTC -3)

Cultivar Magazine



Professor Octavio Nakano, one of the leading names in Brazilian entomology and

a reference in the training of professionals and researchers who contributed to the advancement of national agriculture, passed away this Thursday (June 11). A retired professor from the Department of Entomology and Acarology at the Luiz de Queiroz Higher School of Agriculture (Esalq/USP), Nakano left a legacy marked by research, teaching, and the dissemination of knowledge in plant protection.

A graduate of the University of São Paulo (USP) in 1956, he built a distinguished academic career spanning more than four decades dedicated to Esalq. In 1969, he obtained his doctorate in Entomology from USP, consolidating a career marked by scientific excellence and the training of new generations of specialists.

In addition to his work in teaching and research, Nakano contributed to the dissemination of technical knowledge through various publications. Among them, the works "Agricultural Entomology" and "Insect Traps," published by the Luiz de Queiroz Foundation for Agrarian Studies (Fealq), stand out and have become references for students, researchers, and professionals in the sector.

The wake will be held this Friday (June 12th), from 8 am to 5 pm, in the Diamond Room of the Memorial Metropolitan Crematorium Funeral Home in Piracicaba (SP). The cremation will take place later.

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From steam to AI: how the evolution of machines transformed the Brazilian countryside

By Lucas Zanetti, Product Marketing Manager at Massey Ferguson

11.06.2026 | 16:01 (UTC -3)



For decades, tractors were seen only as machines of brute force in the field. Today,

however, they have transformed into true technological platforms capable of connecting productivity, operational efficiency, sustainability, and data management in a single operation.

The evolution of tractors paralleled the transformation of agriculture itself. At the end of the 19th century, the first steam-powered models were immense, heavy, and inefficient. Their use was restricted to large farms due to high energy consumption and operational difficulties.

At the beginning of the 20th century, the arrival of internal combustion engines brought about a significant change. Equipment became more compact, accessible, and efficient, expanding access to agricultural mechanization.

Meanwhile, the popularization of diesel engines established a new level of power, reliability, and durability, allowing for more intensive operations and greater productivity in the field.

Another important milestone occurred with the development of the three-point hitch system, created by Irish engineer Harry Ferguson, a technology that revolutionized the interaction between tractors and agricultural implements and paved the way for more efficient and versatile operations.

Over the decades, evolution has shifted its focus from just power to incorporating factors such as comfort, safety, and ergonomics. Enclosed cabins, air conditioning, sound insulation, and more efficient hydraulic systems have

completely changed the operator experience, especially during long work shifts.

More recently, precision agriculture has accelerated a new revolution. GPS, sensors, onboard computers, and connectivity have transformed tractors into equipment capable of performing operations with extremely high levels of precision, reducing waste and increasing operational efficiency.

Now, technologies such as autopilot, intelligent maneuver management, automated implement control, telemetry, and remote monitoring are part of the daily routine for many farmers. In addition to increasing productivity, these solutions directly contribute to reducing operational

costs and environmental impact.

The benefits are practically evident in the day-to-day operations of agriculture.

Intelligent transmission systems, for example, automatically adjust engine speed according to the required load, maintaining a constant working speed with lower fuel consumption and less wear on components.

Similarly, automated implement maneuvering and control solutions help reduce operating time, increase efficiency at headlands, and decrease soil compaction. The operator can work with greater precision, comfort, and safety, maintaining full focus on the operation.

Connectivity has also become a key element in the field. Digital platforms allow

for planning activities, sending work orders directly to machines, monitoring execution in near real-time, and analyzing performance indicators for the entire agricultural operation. This technological advancement is directly linked to the main demands of the modern farmer: producing more, reducing costs, and making the activity more sustainable.

In practice, the results are significant. In planting operations, embedded technologies can reduce seed and fertilizer waste, optimize fuel consumption, and lower maintenance and labor costs. Furthermore, features that improve planting quality, such as depth control, seed singulation, and reduced overlap, contribute to greater crop uniformity and increased productivity.

The future points to even smarter machines. Artificial intelligence, advanced sensors, automation, operational autonomy, and alternative fuels, such as ethanol, biodiesel, biomethane, and electric solutions, should accelerate a new transformation in agriculture.

Per **Lucas Zanetti, Product Marketing Manager at Massey Ferguson*

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Brandt appoints senior director of International Marketing

Flavio Cotrin leaves South American operations and takes over strategy for product launches, communication, and brand management

11.06.2026 | 15:41 (UTC -3)

Cultivar Magazine



BRANDT

Brandt announced the promotion of Flavio Cotrin to the position of Senior Director of International Marketing, a role created to

strengthen the company's global growth strategy. Effective July 1st, he will be based in Tampa, Florida (USA), and will be responsible for product launch strategy, communication, and brand management across all of the company's international operations.

In his new role, Cotrin will report directly to Brandt's Marketing Director and his mission will be to expand the integration of marketing actions in the markets where the company operates.

A member of the Brandt Brasil team since 2023, the manager was part of the company's leadership in South America. As Director of Marketing, Research & Development (R&D) and Innovation, he led the company's marketing strategy

throughout the South American region.

Before joining Brandt, Cotrin held leadership positions in companies in the agricultural inputs and specialty chemicals sector, including Lonza, Bayer, and Syngenta.

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Rovensa Next will distribute Novonesis biosolutions in the US

The agreement begins in the 2027 crop season and includes products for soybeans, corn, pulses, peanuts, fruits, and vegetables

11.06.2026 | 14:22 (UTC -3)

Cultivar Magazine, based on information from Anna Comellas



novonesis

Novonesis and Rovensa Next have announced a distribution agreement for agricultural biosolutions in the United States. Rovensa Next will assume the

marketing of selected Novonesis products starting with the 2027 crop season.

The agreement expands Rovensa Next's portfolio in the country. The company will now offer solutions for seed treatment, nutrition, biofertilization, biostimulation, biocontrol, and adjuvants. The product line covers stages from planting to post-harvest.

Novonesis will continue manufacturing the products. The company claims to have 130 years of experience in biosolutions.

According to the company, the agreement aims to expand access to the technologies for retailers and producers.

René Garza, Senior Vice President of Planetary Health at Novonesis, highlighted products for soy, such as Optimize,

NodPro, and Cell-Tech XC with ProPort Technology. He also mentioned TagTeam BioniQ and Cell-Tech Multi-Pulse for pulses.

Rovensa Next has expanded its presence in the United States in recent years. The company has integrated operations such as Oro Agri, Agro-K, and Cosmocel. The country ranks third in revenue for the company.

Under the agreement, Rovensa Next will assume direct commercial responsibility for products focused on soybeans, corn, pulses, and peanuts. The list includes Optimize, NodPro, Torque, Ratchet, BioniQ, TagTeam, QuickRoots, Cell-Tech, and JumpStart.

For fruits and vegetables, Rovensa Next will distribute Actinovate alongside its biocontrol portfolio. Novonesis will maintain selected segments, including the Optimize and Nitragin forage portfolio for alfalfa and clover.

Chuck Broughton, head of Rovensa Next in North America, stated that producers are looking for easy-to-use, field-proven solutions with a return on investment. According to him, the combination of portfolios targets critical problems in agricultural production.

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Research evaluates microalgae for fertilizer production

UPF study seeks to recover nutrients from mineral waste for use in agriculture

11.06.2026 | 14:10 (UTC -3)

UPF, Cultivar Magazine edition



Research being conducted at the University of Passo Fundo (UPF) is investigating the potential of microalgae for the production of fertilizers and agricultural

biostimulants by recovering nutrients present in mineral waste. The study, carried out in the Postgraduate Program in Civil and Environmental Engineering (PPGEng), seeks to use microalgae to solubilize phosphorus and potassium contained in rock powder, making these nutrients more available for absorption by plants.

The research is being developed by postdoctoral researcher Alan Rempel, master's student Julia Lorenzato, and doctoral candidate Viviane Simon, under the guidance of Professor Luciane Maria Colla, with support from researchers in the Postgraduate Program in Agronomy (PPGAgro).

According to Rempel, the proposal is to take advantage of the metabolism of microalgae to incorporate nutrients into the biomass produced, generating products with potential agricultural use. "We intend to develop more sustainable biofertilizers and biostimulants, reducing dependence on conventional fertilizers and promoting the use of waste generated by other productive activities," he explains.

Circular economy

The initiative aligns with the principles of the circular economy by seeking to add value to mineral waste that typically has low economic potential. Activities include chemical and mineralogical analyses of the materials, as well as the cultivation of

different microalgae species, such as *Scenedesmus obliquus*, *Spirulina platensis* and *Chlorellasp.*, to assess its ability to grow in the presence of residues and make nutrients available to plants.

During the experiments, researchers monitor indicators such as cell growth, available phosphorus concentration, enzymatic activity, protein production, and synthesis of bioactive compounds.

After the laboratory phase, the materials produced are tested on seeds and plants to evaluate their effects on germination, root development, vegetative growth, and productivity.

Potential for agriculture

In addition to providing nutrients, microalgae produce compounds such as amino acids, vitamins, antioxidants, and plant hormones, which can act as biostimulants and promote crop growth.

According to researchers, the application of these products can contribute to improved nutrient absorption, increased plant resistance to stress conditions, and reduced need for chemical fertilizers.

For Rempel, technology can represent an important alternative in the face of the challenges faced by agriculture, such as production costs, dependence on imported fertilizers, and the search for more sustainable production systems. "In addition to the economic and environmental benefits, research can contribute to food security, reducing

external dependence on fertilizers, and strengthening agricultural practices aligned with sustainability," he emphasizes.

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Conab projects a record harvest of 358,6 million tons.

Grain prices are up 1,8 percent for the 2025/26 crop year, driven by soybeans, first-crop corn, and sorghum.

11.06.2026 | 10:23 (UTC -3)

Cultivar Magazine, based on information from Conab



Brazil's 2025/26 grain harvest is expected to reach 358,6 million tons, the largest volume ever harvested in the country,

according to the ninth survey by the National Supply Company (CONAB). The estimate indicates a 1,8 percent increase over the previous cycle, equivalent to 6,4 million tons. The result reflects an increase in planted area and favorable weather conditions during the cycle.

The cultivated area totals 83,5 million hectares. This number exceeds the area of ??the previous harvest by 2,2 percent. The increase corresponds to 1,8 million hectares. Soybeans lead the expansion, with a growth of 2,6 percent, or 1,2 million hectares. Corn gained 3,4 percent, equivalent to 744 hectares. Sorghum advanced 31,7 percent, or 516,6 hectares.

Soybeans also saw the largest increase in production. Conab estimates 180,3 million tons of the oilseed. This volume exceeds

the previous harvest's result by 5,1 percent, reaching a difference of 8,8 million tons. The company attributes this performance to the growth in planted area, the technological package, and favorable weather conditions. Compared to the previous survey, the estimate increased by 0,1 percent, following improved yields as the harvest progressed.

Mato Grosso leads national soybean production with 51,6 million tons. Paraná follows with 21,7 million tons. Goiás accounts for 20,1 million tons. The Matopiba region, comprised of southern Maranhão, Tocantins, southern Piauí, and western Bahia, reaches 25,4 million tons. This volume represents an 11,4 percent increase.

Corn production is estimated at 140,5 million tons, considering all three harvests. This volume is 0,5 percent lower than the 2024/25 production, a reduction of 694,8 tons. The first harvest reached 29,3 million tons, with harvesting underway and 84,6 percent of the area harvested as of May 29th. The second harvest has entered its initial phase and is expected to produce 107,9 million tons. The third harvest is nearing the end of planting, with a forecast of 3,3 million tons.

The survey indicates an increase in the total estimate compared to the previous month. The positive variation reaches 0,2 percent. Conab attributes the adjustment to productivity gains observed after the completion of the first-crop bean, rice, and soybean harvests.

First-crop plantings are nearing the end of harvest. Part of the corn area remains to be harvested. Second-crop plantings are predominantly in the grain-filling, maturation, and beginning-of-harvest stages. Third-crop and winter crops are still being planted. Conab emphasizes that the final result depends on weather conditions during the remaining phases.

In seed cotton, production is expected to reach 9,6 million tons. The projection indicates a 2,5 percent decrease. This volume corresponds to approximately 4 million tons of lint. The crops are showing good development. The boll formation and maturation stages predominate.

Harvesting has begun in areas of Bahia and Mato Grosso do Sul.

The rice harvest is nearing its end.

Estimated production reaches 11,1 million tons, a 13,2 percent decrease compared to the previous cycle. Of this total, 10,4 million tons come from irrigated areas, while rainfed areas account for 703,2 tons.

The bean harvest is expected to reach 3 million tons. This estimate represents a 0,5 percent decrease compared to the previous harvest. The first harvest has been completed, reaching 976 tons. The second harvest is ongoing, with crops in the grain-filling and maturation stages. The third harvest has entered the final sowing phase. The total volume includes 1,7 million tons of colored common beans, 506,6 tons of black common beans, and 794,2 tons of cowpea, also called macaçar.

In wheat, planting is progressing in the producing regions. As of May 29, planting had reached 41,1 percent of the planned area. In Rio Grande do Sul, the largest producer, and in Santa Catarina, work remained in its initial phase. In São Paulo and Mato Grosso do Sul, planting had been completed. In the other states, the operation continued.

TABELA 1 - COMPARATIVO DE ÁREA, PRODUTIVIDADE E PRODUÇÃO POR PRODUTO

Brasil	Estimativa da produção de grãos			Safras 2024/25 e 2025/26					
Produto	ÁREA (Em mil ha)			PRODUTIVIDADE (Em kg/ha)			PRODUÇÃO (Em mil t)		
	Safra 24/25	Safra 25/26	VAR. %	Safra 24/25	Safra 25/26	VAR. %	Safra 24/25	Safra 25/26	VAR. %
	(a)	(b)	(b/a)	(c)	(d)	(d/c)	(e)	(f)	(f/e)
ALGODÃO - CAROÇO (1)	2.085,6	2.020,2	(3,1)	2.776	2.793	0,6	5.789,9	5.642,6	(2,5)
ALGODÃO - PLUMA	2.085,6	2.020,2	(3,1)	1.957	1.969	0,6	4.081,5	3.978,4	(2,5)
AMENDOIM TOTAL	280,4	281,8	0,5	4.136	4.548	10,0	1.159,7	1.281,5	10,5
Amendoim 1ª Safra	273,1	274,8	0,6	4.202	4.621	10,0	1.147,6	1.269,7	10,6
Amendoim 2ª Safra	7,3	7,0	(4,1)	1.662	1.709	2,8	12,1	11,8	(2,5)
ARROZ	1.763,9	1.517,9	(13,9)	7.233	7.299	0,9	12.757,7	11.079,0	(13,2)
Arroz sequeiro	394,6	265,4	(32,7)	2.935	2.649	(9,7)	1.158,2	703,2	(39,3)
Arroz irrigado	1.369,3	1.252,5	(8,5)	8.471	8.284	(2,2)	11.599,5	10.375,8	(10,5)
FEIJÃO TOTAL	2.693,0	2.561,1	(4,9)	1.136	1.189	4,6	3.059,9	3.045,3	(0,5)
FEIJÃO 1ª SAFRA	908,5	794,5	(12,5)	1.170	1.228	5,0	1.062,7	976,0	(8,2)
Cores	347,3	333,2	(4,1)	1.707	1.800	5,5	592,8	599,8	1,2
Preto	169,0	117,8	(30,3)	1.953	1.773	(9,3)	330,2	208,8	(36,8)
Caupi	392,2	343,5	(12,4)	356	487	36,8	139,7	167,4	19,8
FEIJÃO 2ª SAFRA	1.400,1	1.337,4	(4,5)	953	1.012	6,3	1.333,6	1.354,1	1,5
Cores	294,6	300,8	2,1	1.499	1.601	6,8	441,6	481,4	9,0
Preto	286,6	171,5	(40,2)	1.616	1.642	1,6	463,2	281,6	(39,2)
Caupi	818,9	865,1	5,6	524	683	30,4	428,9	590,9	37,8
FEIJÃO 3ª SAFRA	384,4	429,2	11,7	1.726	1.666	(3,5)	663,7	715,2	7,8
Cores	326,5	365,3	11,9	1.881	1.816	(3,5)	614,2	663,3	8,0
Preto	14,1	14,1	-	1.268	1.145	(9,7)	17,9	16,2	(9,5)
Caupi	43,8	49,8	13,7	721	720	(0,2)	31,6	35,9	13,6
GERGELIM	608,0	523,9	(13,8)	657	602	(8,3)	399,4	315,6	(21,0)
GIRASSOL	61,9	68,6	10,8	1.622	1.462	(9,9)	100,4	100,3	(0,1)
MAMONA	69,6	75,7	8,8	1.437	1.718	19,6	100,0	130,0	30,0
MILHO TOTAL	21.838,0	22.582,0	3,4	6.464	6.220	(3,8)	141.157,6	140.462,8	(0,5)
Milho 1ª Safra	3.772,6	4.126,5	9,4	6.610	7.110	7,6	24.935,8	29.338,0	17,7
Milho 2ª Safra	17.430,3	17.777,6	2,0	6.496	6.067	(6,6)	113.228,4	107.865,2	(4,7)
Milho 3ª Safra	635,1	677,9	6,7	4.714	4.808	2,0	2.993,6	3.259,6	8,9
SOJA	47.346,1	48.563,3	2,6	3.622	3.712	2,5	171.480,5	180.252,7	5,1
SORGO	1.632,0	2.148,6	31,7	3.739	3.546	(5,2)	6.102,2	7.619,6	24,9
SUBTOTAL	78.378,5	80.343,1	2,5	4.365	4.355	(0,2)	342.107,3	349.929,4	2,3

Culturas de inverno	ÁREA (Em mil ha)			PRODUTIVIDADE (Em kg/ha)			PRODUÇÃO (Em mil t)		
	2025	2026	VAR. %	2025	2026	VAR. %	2025	2026	VAR. %
	(a)	(b)	(b/a)	(c)	(d)	(d/c)	(e)	(f)	(f/e)
AVEIA	545,8	535,8	(1,8)	2.368	2.271	(4,1)	1.292,3	1.216,9	(5,8)
CANOLA	211,9	324,4	53,1	1.627	1.620	(0,4)	344,8	525,6	52,4
CENTEIO	2,1	2,3	9,5	2.381	2.261	(5,0)	5,0	5,2	4,0
CEVADA	139,2	159,0	14,2	4.358	3.940	(9,6)	606,6	626,4	3,3
TRIGO	2.445,9	2.117,0	(13,4)	3.219	2.974	(7,6)	7.873,4	6.296,8	(20,0)
TRITICALE	11,4	12,5	9,6	3.211	2.960	(7,8)	36,6	37,0	1,1
SUBTOTAL	3.356,3	3.151,0	(6,1)	3.027	2.764	(8,7)	10.158,7	8.707,9	(14,3)
BRASIL (2)	81.734,8	83.494,1	2,2	4.310	4.295	(0,3)	352.266,0	358.637,3	1,8

Legenda: (1) Produção de caroço de algodão; (2) Exclui a produção de algodão em pluma.

Fonte: Conab.

Nota: estimativa em junho/2026.

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CNH invests €21 million in simulation and logistics in Italy

The facility in Modena reduces development time by more than 30% and expands parts delivery to dealerships

11.06.2026 | 10:00 (UTC -3)

Cultivar Magazine, based on information from Marilù Brancato



CNH has inaugurated a virtual simulation ecosystem and an automated AutoStore warehouse at its San Matteo research and development center in Modena, Italy. The investment totals €21 million. The company states that the facility accelerates product development and improves parts delivery in Europe.

The new simulation system adopts a virtual methodology from the earliest stages of the project. CNH reports that the tool identifies design anomalies before physical production and reduces development time by more than 30%. The goal includes decreasing engineering risks, optimizing field validations, and reducing emissions related to testing.

three pillars

The ecosystem brings together three technological pillars. The dynamic simulator uses a six-axis immersive platform to test vehicle behavior. The Multi-Dyno cell validates advanced powertrain systems and electrical components with virtual models. The sensor test track features climate simulation to verify precision sensors and autonomous functions.

The automated logistics unit uses AutoStore robots for parts retrieval. According to CNH, the system guarantees availability within 24 hours for more than 1.200 dealerships and workshops. The retrieval time has dropped from 15 minutes

to less than 30 seconds. The capacity reaches 550 parts per hour.

The company also reports a 70% increase in storage density and an 85% reduction in physical effort. Annual energy consumption has fallen by 93% compared to the previous system.

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Chlorantraniliprole affects ion channels in *Helicoverpa armigera*

Study indicates action beyond ryanodine receptors and points to the involvement of glial cells in neurotoxicity

11.06.2026 | 09:16 (UTC -3)

Schubert Peter, Cultivar Magazine



Photo: Metin Gulesci, Leaf Tobacco, Bugwood

The chlorantraniliprole , an insecticide called diamide used to control lepidopteran pests, altered sodium and potassium channels in neurons of Helicoverpa armigera larvae. The information is contained in a scientific study, which also identified glial cell responses in the ventral nerve cord of larvae after exposure to the insecticide.

The research evaluated the neurotoxicity of chlorantraniliprole in third-instar larvae of *Helicoverpa armigera*. Scientists combined whole-cell patch-clamp electrophysiology, single-cell RNA sequencing, and RT-qPCR. This approach allowed them to observe effects on neuronal ion channels and map cell types in the ventral nerve cord.

Insecticide action

Chlorantraniliprole acts on ryanodine receptors. This action causes uncontrolled calcium release in insects and leads to muscle paralysis. The new study indicates another component in the toxic effect. At relatively high concentrations, the insecticide modulated voltage-gated sodium channels and reduced voltage-gated potassium channel currents.

Sodium channels

In sodium channels, chlorantraniliprole shifted activation and inactivation curves to more negative potentials. The product also delayed channel recovery after inactivation. According to the data, the

recovery time increased from 0,24474 milliseconds in the control group to 1,01362 milliseconds with 100 micromolar of chlorantraniliprole. This value is approximately 4,14 times that of the control.

Electrophysiological recordings also showed a reduction in the peak amplitude of the sodium current with increasing insecticide concentration. Channel activation occurred at more negative potentials after treatment. In the control group, sodium channels activated between -40 and -30 millivolts. With 100 micromolar of chlorantraniliprole, activation occurred near -80 millivolts.

Potassium channels

In potassium channels, the insecticide did not noticeably alter the activation properties. However, it reduced the peak current in a dose-dependent pattern. This effect may impair neuronal repolarization. The combination of altered sodium channels and inhibition of potassium current may compromise the electrical balance of neurons.

The researchers also constructed the first single-cell transcriptomic atlas of the ventral nerve cord of larvae of *Helicoverpa armigera*. The sequencing analyzed 10.823 high-quality cells, with an average of 1.494 genes detected per cell. After normalization and dimensionality reduction, the cells formed 18 clusters.

Cell phone note

Cellular annotation indicated neuronal and non-neuronal populations. Among neurons, the study identified markers associated with cholinergic, glutamatergic, and GABAergic systems. Among glial cells, scientists recognized perineurial glia, subperineurial glia, astrocytes, and enveloping glia. Tracheal cells, neuroblasts, and clusters without definitive annotation also appeared.

Analysis of glial cells highlighted two genes: NKCC and UGT39B1. NKCC showed predominant expression in perineurial glia. UGT39B1 appeared enriched in subperineurial glia. After exposure to chlorantraniliprole at a lethal

concentration of 30 for 24 hours, both genes showed a significant increase in expression in nervous tissue.

UGT39B1 belongs to the UDP-glycosyltransferase family. These enzymes participate in the conjugation of exogenous substances and can act in metabolic elimination. The elevation of UGT39B1 after treatment suggests a response linked to detoxification. NKCC encodes a sodium, potassium, and chloride cotransporter. Its high expression may reflect an adjustment in the ionic homeostasis of glial cells after chemical stress.

Neurotoxic action

The data support a proposed neurotoxic mechanism with two components. The first involves neuronal targets, with modulation of sodium channels and reduction of potassium currents. The second involves glial cells, with a response from genes associated with ion transport and metabolism. Scientists describe this combination as a dual-target mechanism, involving neurons and glia.

The work also indicates possible avenues for resistance management. The identification of NKCC and UGT39B1 as genes responsive to chlorantraniliprole offers candidates for studies on synergists and on strategies aimed at delaying the evolution of resistance in the insect.

Further information is available at
[DOI:10.1016/j.pestbp.2026.107206](https://doi.org/10.1016/j.pestbp.2026.107206)

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Cold-induced peptides protect pollen and productivity

Study identifies RGF pathway in tomato and rice

11.06.2026 | 08:50 (UTC -3)

Schubert Peter, Cultivar Magazine



Photo: Wenderson Araujo / CNA

Researchers have identified a small peptide signaling pathway capable of

protecting pollen development under cold conditions. The mechanism involves the SIRGF9 and SIRGF10 peptides in tomato plants. Moderate activation of this pathway recovered 33,9% to 52,2% of the yield losses caused by cold in field trials with tomatoes.

The research points to peptides from the RGF–GLV–CLEL family as cold-induced signals during pollen development. Under normal conditions, plants with loss of function of SIRGF9 and SIRGF10 did not show defects. After cold stress, they exhibited pollen abortion.

Receptor complexes

The pathway depends on the perception of peptides by receptor complexes on the cell surface. The kinases SIRGFR6 and SIERK proteins recognize cold-induced SIRGFs. This complex activates cyclic nucleotide-gated ion channels. The process promotes calcium influx.

The calcium signal acts on the anther tapetum. It regulates programmed cell death in this layer. This causes the tapetum to degrade at the appropriate time, supporting the development of microspores. Cold temperatures delay this process and promote pollen abortion.

According to the researchers, the RGF gene encodes a 13-amino acid peptide. It remains silent at normal temperatures. Under sudden cold, it activates in the

anther tapetum cells during the tetrad stage. This localized response reduces energy expenditure outside of periods of stress.

The pathway also appears to be conserved in dicotyledons and monocotyledons. In rice, increased expression of RGF homologs enhanced pollen resilience to cold and recovered 18,3% of the grain yield loss.

Researchers are now expanding the strategy to soybeans and corn.

Further information at
doi.org/10.1038/s41586-026-10603-7

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Wheat releases compounds capable of inhibiting nitrification

Study points to benzoxazinoids as candidates to reduce nitrogen losses in wheat systems

10.06.2026 | 15:43 (UTC -3)

Schubert Peter, Cultivar Magazine



Photo: Purna Kumar Khatri - Aarhus University

Researchers at Aarhus University have identified compounds released by wheat roots with the potential to inhibit nitrification. The study points to benzoxazinoids as candidates for biological nitrification inhibitors, a process known by the acronym BNI. These compounds reduced the activity of nitrifying microorganisms in assays with *Nitrosomonas europaea* and appeared in higher concentrations in wheat lines with enhanced BNI characteristics.

Nitrification converts ammonium into nitrate through microbial action. This process favors nitrogen losses through leaching and nitrous oxide emissions. Biological inhibition of nitrification aims to retain more nitrogen in the soil in forms usable by plants. This strategy depends on

the release of natural compounds by the roots.

The study evaluated 18 benzoxazinoids using a bioluminescence assay with *Nitrosomonas europaea*. Seven compounds showed strong inhibitory activity: MBOA, BOA, DIBOA, DIMBOA, APO, AAPO, and HPMA. The concentration values required to inhibit fifty percent of nitrification ranged from eight to 47 micromolar.

Chemical forms

The results differentiate chemical forms with greater and lesser effect. MBOA and BOA, two benzoxazolinones aglycones, showed values of eight and 13

micromolar, respectively. DIBOA and DIMBOA, two hydroxamic acid aglycones, showed values of 11 and 20 micromolar, respectively. Glycosylated forms had low activity or no relevant inhibitory effect.

The team also compared three genotypes of *Triticum aestivum*: the parental lineage is Roelfs F2007, and there are two Roelfs BNI lineages. These two lineages carry a chromosomal fragment of *Leymus racemosus*, a wild grass associated with increased BNI trait. The plants were grown in a hydroponic system for three weeks.

The Roelfs BNI1 and Roelfs BNI2 lines released more active benzoxazinoids than the parental line. Their root exudates showed up to twice the inhibition

compared to Roelfs F2007. This result was consistent with the higher concentration of these compounds in the exudates.

In exudates processed by rotary evaporation and collected in a medium with 0,5 millimolar ammonium sulfate, Roelfs BNI1 achieved 89,2 percent inhibition against ammonia-oxidizing bacteria. Roelfs BNI2 achieved 72,7 percent. The parental strain reached 36 percent. In an assay with ammonia-oxidizing archaea *Candidatus Nitrosocosmicus franklandianus*, Roelfs BNI1 had a performance of 29,5 percent, Roelfs BNI2 had a performance of 20 percent, and Roelfs F2007 had a performance of 3,7 percent.

Chemical analysis

Chemical analysis quantified nine benzoxazinoids in root exudates: BOA, DIBOA, DIMBOA, DIMBOA-Glc, HBOA, HBOA-Glc, HMBOA, HMBOA-Glc, and MBOA. DIMBOA appeared as the most abundant compound in exudates collected in ammonium sulfate, with values ??between 89 and 252 micrograms per gram of root dry mass per day. HMBOA ranged from six to 14 micrograms per gram of root dry mass per day. MBOA ranged from five to seven micrograms per gram of root dry mass per day.

The Roelfs BNI1 and Roelfs BNI2 lines exuded DIMBOA in twice the amount of the parental line in the medium with

ammonium sulfate. In the root tissue, the researchers quantified 15 benzoxazinoids. DIMBOA and DIMBOA-Glc were among the most abundant compounds.

Collection and preparation

The study also shows the importance of the method of collecting and preparing exudates. Acidification and the presence of salts interfered with the bioassay results. Without pH adjustment, the inhibition patterns remained inconsistent. After adjusting to pH 6,5, the difference between the BNI strains and the parental strain exceeded three times.

Researchers highlight an agronomic difference between biological inhibition and synthetic inhibitors. Synthetic inhibitors enter the system in concentrated doses. Compounds produced by the plant reach the rhizosphere gradually and locally. This dynamic can reduce non-target effects on microbial communities, although the CropSustain project is still evaluating impacts on soil microbiomes and non-target organisms.

This study positions benzoxazinoids as candidates for breeding programs focused on nitrogen use efficiency in wheat. Identifying the biosynthetic pathways involved may support the selection of cultivars with a greater capacity to exude nitrification-inhibiting compounds.

Further information at

DOI:10.1016/j.plaphy.2026.111303

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Floral strips enhance biological control in apple trees

Intercropping with *Cnidium monnieri* attracted six predators and reduced populations of *Aphis spiraeicola* in an orchard

10.06.2026 | 14:42 (UTC -3)

Schubert Peter, Cultivar Magazine



Photo: Marco de Haas - CC BY-SA 4.0

The apple tree consortium with floral strips of *Cnidium monnieri* increased the attraction of natural enemies and improved *Aphis spiraecola* suppression in an orchard managed without insecticides. The result came from a two-year field experiment conducted in an apple orchard in China, evaluating predators, volatile plant compounds, and exclusion trials with cages.

The study recorded six species of predators on flowering plants of *Cnidium monnieri*. The list includes ladybugs *Propylaea japonica*, *Harmonia axyridis* and *Hippodamia variegata*, the lacewing *Chrysoperla sinica*, the crab spider *Misumenops tricuspidatus* and the hoverfly *Episyrphus balteatus*. Between them,

Chrysoperla sinica showed the highest densities in the floral bands in both years of evaluation.

The experiment

The researchers conducted the experiment on apple trees *Malus domestica* 'Fuji 2001' trees, seven years old, were planted at a spacing of four meters by six meters. The orchard was managed organically. No pesticides were applied during the study. Pest control relied on biological and physical methods.

Installments with consortium financing received three tiers of *Cnidium monnieri* between the rows of apple trees. Each strip was approximately one meter and

eighty centimeters wide. The control plots remained with bare soil and no understory vegetation. The design used randomized complete blocks, with four replications.

In the laboratory, scientists evaluated the response of adults to *Harmony axyridis* and *Chrysoperla sinica* to the scents of leaves and flowers of *Cnidium monnieri*. The tests used a Y-shaped olfactometer. Males and females of *Harmony axyridis* preferred the scents of leaves and flowers compared to the odorless control. The species did not show a significant preference between leaves and flowers.

Chrysoperla sinica also responded to the scents of leaves and flowers. Both males and females preferred the scents of *Cnidium monnieri* in relation to the control.

When comparing leaves and flowers, the species showed a significant preference for the scents of the flowers.

Gas chromatography

Analysis using gas chromatography coupled with mass spectrometry identified volatile organic compounds emitted by leaves and flowers. Researchers detected 38 compounds in the sample set. Flowers showed 32 compounds. Leaves showed 24 compounds. Fourteen compounds occurred only in flowers. Six occurred only in leaves.

Volatile profiles differed among plant organs. This difference helps explain specific predator responses. The study

indicates the role of floral and foliar odors as chemical signals used by natural enemies to locate resources.

Result in the field

In the field, researchers conducted counts every ten days, from the end of April to the beginning of September, in 2020 and 2021. In 2020, adults of *Chrysoperla sinica* population peaked on June 28, with 32,1 individuals per square meter. On that date, the species showed a higher density compared to the other predators evaluated.

In 2021, *Chrysoperla sinica*, *Harmonia axyridis* and *Propylaea japonica* presented the highest numbers on June 8th. On June

18th and 28th, *Chrysoperla sinica* outperformed other predators in *Cnidium monnieri*.

The suppression of *aphis spiraecola* was measured by predator exclusion trials.

Researchers installed cages on apple tree branches and compared protected branches with exposed branches. Each branch received ten third-instar nymphs of *aphis spiraecola*. The counts occurred weekly.

In the parcels with *Cnidium monnieri*, branches without cages had fewer aphids on various dates. In 2020, the population of *aphis spiraecola* was higher in protected branches on May 26, June 2, June 9, and June 16. In 2021, the same pattern occurred on May 29, June 5, and June 12.

In plots with bare soil, the differences between protected and exposed branches did not reach significance on the evaluated dates. This result indicates a smaller contribution of predators to aphid suppression in areas without a floral strip.

The Relative Biocontrol Service Index also favored plots with *Cnidium monnieri*. In 2020, the index was higher in the intercropped plots on May 26. In 2021, the index was higher on May 29 and June 12.

Two functions

The results indicate two functions of the bands of *Cnidium monnieri* in the orchard. The plant attracts predators through volatiles emitted by its leaves and flowers.

It also offers floral resources and can help natural enemies remain in the ecosystem.

The researchers point out a limitation. The study did not conduct a census of predators in the apple tree canopy. The inference about the increase in biological control came from contrasts with predator exclusion and counts in the floral bands.

More information at
doi.org/10.1127/entomologia/3759

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Mixture enhances control of *Cnaphalocrocis medinalis*

Study points to synergism between spinosad and indoxacarb and describes gene response in two phases

10.06.2026 | 11:06 (UTC -3)

Schubert Peter, Cultivar Magazine



Photo: Masatoshi Sone - CC BY-SA 40

The mixture of spinosad and indoxacarb exhibited synergistic action against neonates of *Cnaphalocrocis medinalis*. The result emerged from bioassays with binary combinations of insecticides. Transcriptomic analysis indicated a two-phase mechanism. First, the mixture affected detoxification systems. Then, it activated pathways linked to autophagy, lysosomes, lipid metabolism, and midgut damage.

The insect larvae roll up rice leaves and consume mesophyll tissue. This damage reduces photosynthetic capacity and can affect grain yield and quality. The research cites broad resistance of *Cnaphalocrocis medinalis* to insecticides in rice-growing areas of China.

Researchers tested mixtures by immersing rice seedlings. The method used newly hatched larvae and assessed mortality after 72 hours. Treatments included isolated insecticides and binary combinations. The co-toxicity coefficient defined the type of interaction. Values ≥ 120 indicated synergism. Values between 80 and 120 indicated an additive effect. Values ≤ 80 indicated antagonism.

Synergism of the mixture

The combination of spinosad and indoxacarb showed synergism in different ratios. In the susceptible population, a one-

to-one ratio showed a co-toxicity coefficient of 121. A two-to-three ratio showed 123. In the YZ25 field population, a one-to-five ratio reached 182,1. The researchers chose the one-to-one mixture for the transcriptomics step.

Other mixtures

Other mixtures performed worse.

Spinetoram e abamectin, at a ratio of one to five, showed a coefficient of 59,5.

Spinetoram and emamectin benzoate, at a ratio of one to ten, registered 56,85. Both indicated antagonism. Methoxyfenozide and quinalfós also showed antagonism in both proportions evaluated. The spinosad and mixture metaflumizone It had an

additive effect at a one-to-one ratio and a synergistic effect at a two-to-one ratio.

Transcriptome analysis

Transcriptome analysis compared larvae exposed to spinosad, indoxacarb, and the mixture one-to-one. Samples were collected after six hours and 24 hours. Each treatment had four biological replicates. Each replicate included approximately 50 larvae. The solution used in the transcriptomic treatments contained 0,05 milligrams per liter of spinosad, 0,05 milligrams per liter of indoxacarb, or 0,05 milligrams per liter of the mixture.

After six hours, the mixture induced 42 differentially expressed genes. Indoxacarb

induced 33. Spinosad induced four. After 24 hours, the mixture caused more extensive transcriptional reprogramming. The combined treatment showed 687 differentially expressed genes, with 605 genes induced and 82 repressed. Spinosad alone showed 273 differentially expressed genes. Indoxacarb alone showed six.

Gene activation

In the initial phase, the data indicated activation of genes linked to detoxification, transmembrane transport, cell signaling, and innate immunity. The group treated with the mixture showed enrichment of detoxification pathways, metabolic competition, insulin signaling, MAPK,

PI3K-Akt, calcium, and apoptosis. The study interprets this pattern as a broader stress response to the combined treatment.

In the late phase, the molecular signature changed. The mixture activated lysosomal pathways, animal autophagy, glycerophospholipid metabolism, sphingolipid metabolism, and pathways associated with neuronal stress. There was also an enrichment of pathways related to protein digestion and absorption. The researchers associated this set of pathways with midgut lesions and cellular damage. These pathways did not appear with the same prominence in the isolated treatments after 24 hours.

Explanation for synergy

Scientists propose an explanation for the synergy. In the first stage, spinosad and indoxacarb compete for detoxification systems, such as cytochrome P450, esterases, glutathione S-transferases, and ABC transporters. This competition would reduce metabolic clearance and increase the persistence of the compounds. In the second stage, the mixture would lead to cellular dysfunction, with activation of autophagy, lysosomes, and lipid metabolism.

The study also points to possible markers for monitoring resistance. Genes from the CYP6 family, ABC transporters, and genes related to autophagy, such as ATG2B and

Wipi2, appear as candidates. The researchers suggest using these markers in quantitative assessments of field populations. The goal involves anticipating changes in sensitivity and adjusting management strategies.

The study also highlights limitations. Functional validation of key genes, such as CYP6B7, ATG2B, and PNPLA8, is still needed. Field trials also need to confirm the consistency of the mechanism and its effectiveness in natural populations.

Further information at
doi.org/10.3390/insects17060598

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Albaugh appoints new CFO for Brazil and Paraguay

Hélio Mota Pimentel takes over as financial director

10.06.2026 | 10:51 (UTC -3)

Cultivar Magazine, based on information from Daniel Friedlander



Albaugh announced today that Hélio Mota Pimentel will be appointed as the new Chief Financial Officer for its operations in Brazil and Paraguay. He will report directly to Cesar Rojas, President and CEO of

Albaugh Brazil and Paraguay.

Pimentel has a background in the financial sector. He has held leadership positions in large companies, including EuroChem Brazil. According to Albaugh, the executive arrives with the mission of continuing the company's strategy of sustainable growth and financial stability in the region.

The company highlighted Pimentel's experience in strategic management and resource optimization. The company considers this performance relevant to the next steps of its operations in Brazil and Paraguay.

The executive's arrival is part of a planned transition in the finance department. Luiz Guimarães, the former CFO, is beginning his retirement process. Albaugh thanked

Guimarães for his years of dedication, leadership, and contributions to the company's consolidation.

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Trichoderma reduces post-harvest rot in tomatoes

Local isolations limited lesions caused by *Alternaria alternata* and *Curvularia spicifera* in fruits

10.06.2026 | 08:13 (UTC -3)

Schubert Peter, Cultivar Magazine



Photo: Ninjatacoshell - CC BY-SA 30

Isolated locations of *Trichoderma longibrachiatum* and *Trichoderma asperellum* reduced injuries caused by *alternaria alternata* and *Curvularia spicifera* in tomatoes after harvest. The study evaluated three species of antagonistic fungi in in vitro and in vivo assays. The results indicate potential for use in biological control strategies for post-harvest diseases of the crop.

The research analyzed *Trichoderma longibrachiatum*, *Trichoderma harzianum* and *Trichoderma asperellum*. The isolates came from the rhizosphere of tomato plants and belong to the collection of the Plant Protection and Biological Sciences Laboratory of the Regional Agricultural Research Center in Sidi Bouzid, Tunisia.

The pathogens *alternaria alternata* and *Curvularia spicifera* were obtained from tomato fruits of the Firenze cultivar with natural symptoms of black spot and rot.

Tests on fruit

In tests on fruit, *Trichoderma longibrachiatum* reduced the diameter of the lesions *alternaria alternata* at 53,60% compared to the infected control group.

Trichoderma asperellum reduced lesions from the same pathogen by 48,71%.

Against *Curvularia spicifera*, *Trichoderma longibrachiatum* it reduced injuries by 55,58%. *Trichoderma asperellum* achieved a reduction of 56,19%.

The fruits received standardized wounds five millimeters deep. Then, the researchers applied 20 microliters of culture filtrate from each species of *Trichoderma*, with a concentration of 10^7 spores per milliliter. After two hours, the fruits received 20 microliters of the pathogen suspension, also with 10^7 spores per milliliter. Incubation lasted seven days at 21 degrees Celsius, under humidity above 90%.

Inoculated fruits

The infected control group showed larger lesions. In fruits inoculated with *alternaria alternata*, the diameter reached 7,37 centimeters. Treatment with *Trichoderma longibrachiatum* reduced the value to 3,42

centimeters. *Trichoderma asperellum* resulted in 3,78 centimeters. Salicylic acid measured 3,97 centimeters.

In fruits inoculated with *Curvularia spicifera*, the infected control sample showed 8,15 centimeters of rot. *Trichoderma asperellum* had the smallest diameter, measuring 3,57 centimeters. *Trichoderma longibrachiatum* measured 3,62 centimeters. *Trichoderma harzianum* reached 3,88 centimeters. Salicylic acid resulted in 3,68 centimeters.

In vitro assays

In vitro assays also indicated antagonism. *Trichoderma longibrachiatum* reduced mycelial growth of *Curvularia spicifera* to 2,58 centimeters on the seventh day, with

51,7% inhibition. *alternaria alternata* growth decreased to 2,32 centimeters, with 51,8% inhibition. Infected controls reached 5,34 centimeters and 4,81 centimeters, respectively.

Analysis of the area under the disease progression curve confirmed the greater efficiency of *Trichoderma longibrachiatum*. The isolated specimen recorded 10,2 centimeters per day for *Curvularia spicifera* and 8,9 centimeters per day for *alternaria alternata*. The controls recorded 18,7 and 16,3 centimeters per day.

All three species produced catalase in an in vitro assay. None produced pectinase, protease, amylase, or beta-1,3-glucanase at detectable levels. *Trichoderma longibrachiatum* and *Trichoderma*

asperellum produced indole-3-acetic acid, hydrocyanic acid, and solubilized phosphate. *Trichoderma harzianum* produced hydrocyanic acid and solubilized phosphate. No species fixed atmospheric nitrogen.

Mycelial growth

Mycelial growth of the antagonists showed better performance at 30 degrees Celsius. At 19 degrees Celsius, growth was slower. At 45 degrees Celsius, all three isolates suffered strong inhibition. The study also observed greater growth in media with pH 7 and pH 9. pH 11 limited growth, mainly in the initial stages.

The culture filtrates also stimulated tomato seedlings. A one-to-ten dilution yielded the best results for *Trichoderma longibrachiatum* and *Trichoderma harzianum*. For *Trichoderma asperellum*, the undiluted filtrate generated the greatest growth. The researchers interpreted the response as dose-dependent.

The treatments altered fruit quality parameters. In general, the fruits treated with *Trichoderma* maintained greater firmness compared to the infected controls. They also showed changes in pH, electrical conductivity, sugar content, titratable acidity, and nitrate. The infected control showed the worst overall quality in the assays with *Curvularia spicifera*, with less firmness and lower electrical

conductivity.

Biochemical analyses

Biochemical analyses indicated a reduction in oxidative stress. In fruits inoculated with *Alternaria alternata*, *Trichoderma asperellum* showed the lowest malondialdehyde content, with 1,38 micromoles per gram. In fruits inoculated with *Curvularia spicifera*, *Trichoderma longibrachiatum* presented the lowest value, with 1,86 micromoles per gram. Malondialdehyde functions as an indicator of lipid peroxidation.

The study concluded with an indication of *Trichoderma longibrachiatum* and *Trichoderma asperellum* as promising

agents for the biological control of *alternaria alternata* and *Curvularia spicifera* in post-harvest tomatoes. The researchers highlighted, however, a limitation: the tests were conducted under laboratory conditions and may not fully reflect commercial storage environments.

Further information can be found at doi.org/10.3390/jof12060421

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ApheaBio and Bayer will co-develop bioinsecticides

Partnership targets sap-sucking insects in fruit trees; companies will use microbial metabolites in new solutions

10.06.2026 | 07:17 (UTC -3)

Cultivar Magazine, based on information from ApheaBio



ApheaBio announced a research partnership with Bayer to accelerate the development of bioinsecticides against

sucking insects. The agreement targets agricultural pests with a significant economic impact. The collaboration aims to expand the crop protection tools available to producers.

The partnership will utilize ApheaBio's research and development platform. The company works with bioactive metabolites extracted from selected microbial strains. According to the company, these compounds allow the development of biological solutions with handling characteristics and shelf life similar to those of non-living products.

Sucking insects pose a challenge to global agriculture. Regulatory restrictions and resistance issues with certain classes of insecticides have increased the demand

for control alternatives. AphaBio reports evaluating thousands of microbial strains and advancing the most promising candidates through stages focused on safety, efficacy, and commercial specifications.

Initial focus

The initial collaboration will focus on fruit trees. The scope includes pome fruits, stone fruits, citrus fruits, and grapes. The agreement also foresees potential expansion into vegetables and extensive crops such as cotton and soybeans.

The signing took place in Monheim, Germany. AphaBio will contribute with lead identification, characterization, and

development. Bayer will add global commercial reach and development and commercialization capabilities.

The companies intend to advance prototypes through field validation and initial regulatory interaction. Milestone discussions will follow criteria of effectiveness, safety, production capacity, and clarity of the regulatory path. Financial terms were not disclosed.

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Valtra opens dealership in Luís Eduardo Magalhães

The new unit will focus on high-power solutions for grains and cotton, in addition to serving the region's livestock sector

09.06.2026 | 15:08 (UTC -3)

Beatriz Voltani



Valtra inaugurates a dealership this Wednesday (June 10th) in the city of Luís Eduardo Magalhães, Bahia. The new unit

belongs to partner Nossa Valtra, strengthening the brand's presence in the promising western region of Bahia.

The Nossa group, which entered the business with Valtra in 2021, is now opening its third store in the region. In addition to the new and modern facility in Luís Eduardo Magalhães, the network already serves producers in Bahia with established units in the cities of Santa Maria da Vitória and Correntina.

The new dealership, like the others, offers Valtra's complete product portfolio, but with a strategic focus. Since the western region of Bahia stands out nationally for its strong grain and cotton production, the focus is on high-power machinery, such as the modern Q5 and S6 series tractors, the

renowned Momentum planter, as well as the line of sprayers and the DryBox distributor.

It is worth highlighting that the region also has great importance and tradition in the livestock sector, and to serve local breeders, the dealership offers Valtra's low and medium power tractors, recognized for their economy, robustness and versatility in handling animals and maintaining the property.

“The opening of this new store in Luís Eduardo Magalhães represents a strategic milestone for Valtra. Western Bahia is a key hub for Brazilian agribusiness, and with this expansion we will be even closer to producers, delivering our complete portfolio, which combines power,

intelligence and operational efficiency,” highlights Claudio Esteves, Commercial Director of Valtra.

At the new facility, rural producers in the region will be able to see firsthand the brand's latest innovations, such as the Momentum planter, which offers 18 planting rows or more, with recently launched versions of 30 and 40 rows. The planter features Weight Transfer technology, which distributes the central load of the chassis to the tips, providing homogeneous depth in seed placement and improved planting quality. The Precision Planting System, considered the best singulation technology on the market, promotes total population control and complete real-time monitoring.

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Rio Grande do Sul registers first cases of citrus greening in citrus plants

The diagnosis was confirmed in a home orchard in the municipality of Palmitinho, near the border with Santa Catarina

09.06.2026 | 14:00 (UTC -3)

Ministry of Agriculture, Cultivar Magazine edition



The Ministry of Agriculture (Mapa) has confirmed the first cases of citrus greening

(Huanglongbing – HLB) in citrus plants in Rio Grande do Sul. The plants with symptoms of the disease were identified in a home orchard located in the municipality of Palmitinho, in the Médio Alto Uruguai region, near the border with Santa Catarina. The confirmation was made after laboratory analysis in the Ministry's network.

The detection is the result of a surveillance program jointly executed by the Ministry of Agriculture, Livestock and Supply (Mapa), through the State Superintendence of Agriculture (SFA-RS), and the Secretariat of Agriculture (Seapi-RS), since 2004. Actions have been intensified in recent years due to the occurrence of the disease in Argentina, Uruguay, and Santa

Catarina.

Measures include eradication of the plants.

The teams from MAPA (Ministry of Agriculture, Livestock and Supply) and SEAPI-RS (State Secretariat for Agriculture, Livestock and Supply of Rio Grande do Sul) are already mobilized in the region to monitor areas near the site of the outbreak and adopt the necessary phytosanitary measures to prevent the spread of the disease. The actions follow the Action Plan established based on SDA/MAPA Ordinance No. 1.326/2025, which establishes the National Program for

the Control and Prevention of Greening.

According to the Ministry, phytosanitary surveillance activities will also be intensified throughout the region, with special attention to commercial orchards and the movement of seedlings.

As determined by the phytosanitary protocol, the eradication of infected plants will be carried out and rigorous control of the psyllid (*Diaphorina citri*), an insect that transmits the bacteria that causes citrus greening.

Disease affects quality and productivity.

Greening does not pose a risk to human health. Its impacts are related to citrus

production, causing fruit deformation, reduced quality, and decreased plant productivity.

The Official Service, comprised of MAPA (Ministry of Agriculture, Livestock and Supply) and SEAPI-RS (State Secretariat for Agriculture, Livestock and Fisheries of Rio Grande do Sul), reinforces the importance of using propagation material (seedlings) that complies with the Ministry's legislation regarding origin and sanitary aspects.

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FMC appoints Andre Godoy for soybean and corn operations in Brazil

Executive takes over management with a focus on portfolio, technical demand, and close relationships with producers and consultants

09.06.2026 | 10:26 (UTC -3)

Cultivar Magazine, based on information from Ingrid Ribeiro



FMC has announced Andre Godoy as the new manager of soybean and corn crops in Brazil. This change is part of the company's strategy to expand its technical expertise and accelerate the adoption of technologies in two crops that are central to the national agribusiness sector.

Godoy has 17 years of experience in the sector. Thirteen of those years were spent at FMC. The executive will now lead market strategies for soybeans and corn. His role will focus on gaining market share, positioning the current and future portfolio, and building relationships with technical influencers, researchers, consultants, and farmers.

According to Vinícius Batista, marketing director at FMC, the move accompanies a

new growth cycle for the company, supported by innovation, portfolio renewal, and closer ties to the agricultural sector. He states that soybeans and corn play a central role in the company's strategy in Brazil.

The new management will also be responsible for aligning FMC's pipeline of synthetic and biological solutions with the demands of Brazilian production systems. The company seeks integrated solutions that meet the practical needs of crops.

Another area of ??focus involves generating demand for the FMC Academy of Sciences. The company also intends to strengthen its relationships with consultants, researchers, cooperatives, distribution channels, and farmers.

As part of this strategy, FMC is preparing to launch the Top Class Program. The initiative will focus on technical connections with researchers and consultants. The program will bring together relationship-building and knowledge-sharing activities.

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Resistance of *Megalurothrips usitatus* to insecticides is increasing in China

Study points to higher risk in southern Hainan and warns about the use of acetamiprid and spinosyns

09.06.2026 | 08:03 (UTC -3)

Schubert Peter, Cultivar Magazine

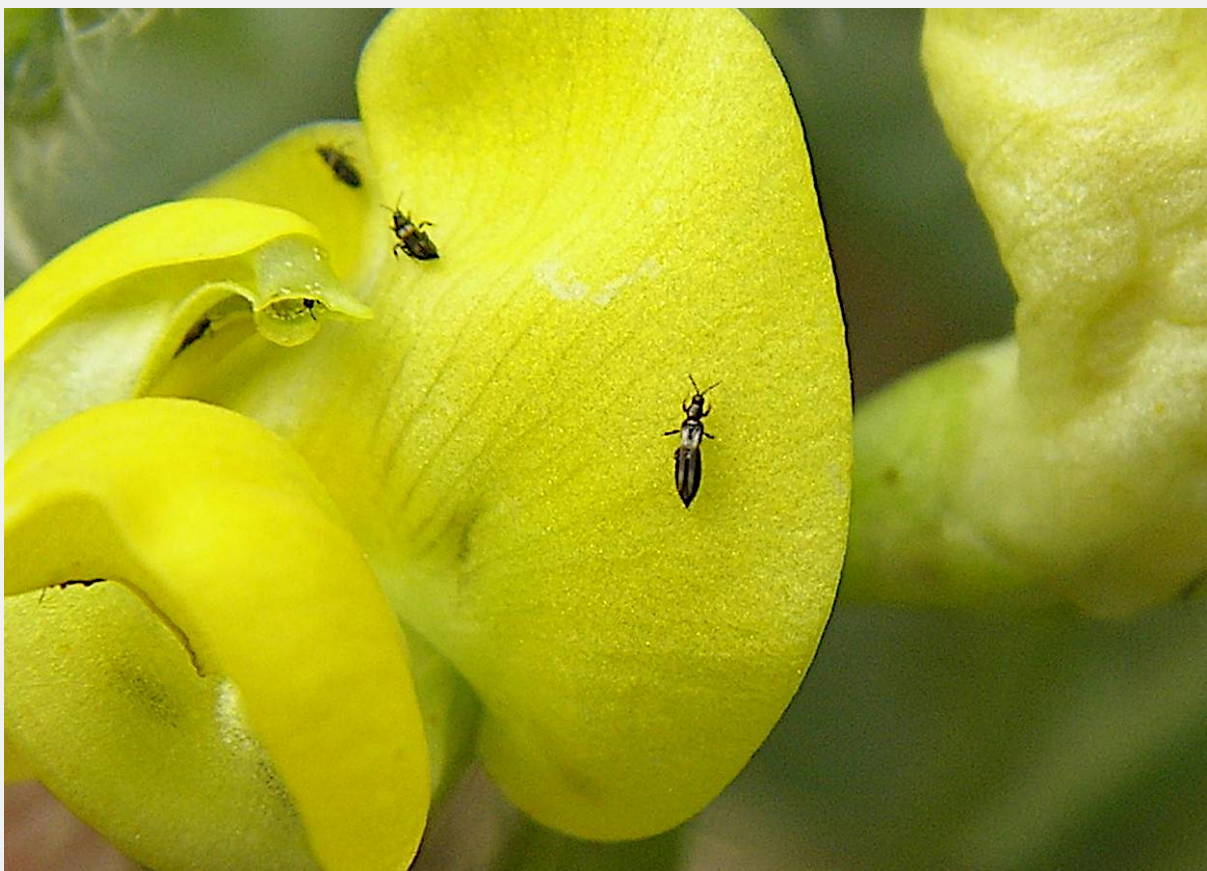


Photo: Ko Ko Maung, Bugwood

Populations of *Megalurothrips usitatus* collected in cowpea producing areas (*Unguiculata vine*) in Hainan, China, showed increased resistance to insecticides between 2023 and 2025. The biggest problem occurred with acetamiprid. By 2025, populations of Ledong, Sanya, and Lingshui had reached high resistance to the product. The study also recorded a rapid increase in resistance to spinosad and spinetoram, with phenotypic evidence of cross-resistance between these two spinosyns.

The research evaluated populations of *Megalurothrips usitatus* from five cowpea-producing regions: Haikou, Wuzhishan, Ledong, Lingshui, and Sanya. The scientists tested five insecticides used in

pest management: [acetamiprid](#), [emamectin benzoate](#), [chlorfenapyr](#), [spinetoram](#) and [spinosad](#). The bioassays used adult females collected in the field and the modified residual film-in-leaf tube method.

Greater resistance

The results indicated higher resistance pressure in southern Hainan. Ledong, Sanya, and Lingshui showed the highest median lethal concentration and resistance ratio values. Haikou and Wuzhishan maintained lower levels across various treatments. The study associates this pattern with local production conditions, intensive winter and spring cultivation,

frequent insecticide use, and an environment favorable to pest development.

Products tested

Acetamiprid presented the most severe picture. The susceptible laboratory strain registered a median lethal concentration of 6,16 milligrams per liter. In 2025, Ledong reached 1.838,63 milligrams per liter, with a resistance ratio of 298,48 times. Sanya reached 859,93 milligrams per liter, with 139,60 times. Lingshui reached 802,36 milligrams per liter, with 130,25 times. These three populations entered the high resistance category.

The study highlights an important limitation. Acetamiprid was the only neonicotinoid evaluated. Therefore, the data indicate high resistance to the tested compound, without direct extrapolation to the entire chemical group. Even so, the scientists point to strong selection pressure in the southern areas of the island.

Chlorfenapyr also showed increased resistance, although without reaching the high resistance category. The susceptible strain registered a median lethal concentration of 11,43 milligrams per liter. In Ledong, the value rose from 225,73 milligrams per liter in 2023 to 956,11 milligrams per liter in 2025. In Sanya, it increased from 285,77 to 736,30 milligrams per liter during the same period.

Resistance ratios reached 83,65 times in Ledong and 64,42 times in Sanya.

Emamectin benzoate maintained lower levels compared to acetamiprid, but also showed regional accumulation. The susceptible strain showed a median lethal concentration of 4,21 milligrams per liter. In 2025, Ledong reached 128,19 milligrams per liter, Sanya reached 115,56 milligrams per liter, and Lingshui reached 106,54 milligrams per liter. The three southern populations entered moderate resistance.

Spinosyns require careful management. Spinosad maintained lower absolute median lethal concentration values ??compared to acetamiprid and chlorfenapyr. However, the resistance rate

increased during monitoring. The susceptible strain showed 0,35 milligrams per liter. In 2025, Lingshui reached 12,97 milligrams per liter, with 37,06 times the resistance rate. Ledong reached 11,31 milligrams per liter, with 32,31 times the resistance rate.

Spinetoram showed the lowest baseline among the products tested, at 0,09 milligrams per liter in the susceptible strain. This low value increased resistance rates. In Ledong, the median lethal concentration rose to 9,97 milligrams per liter in 2025, with 110,78 times the resistance rate. In Lingshui, it reached 7,86 milligrams per liter, with 87,33 times the resistance rate.

The comparison between spinosad and spinetoram showed a significant positive correlation. The analysis used median lethal concentration values transformed into base-ten logarithms. The coefficient reached 0,8972, with p less than 0,0001. This result indicates a phenotypic association between the responses to the two products. The study treats this association as evidence of possible cross-resistance within the spinosyn class.

Scientific recommendation

Scientists recommend reducing reliance on acetamiprid in areas with high resistance. They also recommend avoiding

consecutive applications of spinosad and spinetoram. These two products should not be used as independent substitutes in rotation programs. Chlorfenapyr and emamectin benzoate can be included in rotations, but with limited frequency and local susceptibility monitoring.

The study also advocates for regional strategies. Management in Ledong, Sanya, and Lingshui requires greater restriction on the use of higher-risk products. Haikou and Wuzhishan still show lower levels in several cases, but also recorded increased resistance during the evaluated period. The work recommends integrating pest monitoring, correct application timing, rotation by mode of action, biological control, and other compatible integrated management practices.

Further information at
doi.org/10.3390/insects17060607

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Study links chromatin to precise repair of plant DNA

Discovery shows how YAF9A and YAF9B proteins act in repairing double-strand breaks

09.06.2026 | 07:23 (UTC -3)

Schubert Peter, Cultivar Magazine



Julie Law discovered that the YAF9B protein comes into play during DNA damage, helping to facilitate access to areas that need repair - Photo: Salk Institute

Scientists at the Salk Institute have identified the YAF9B protein as part of a specialized DNA repair system in plants. Their study shows a molecular response aimed at protecting meristematic tissues, responsible for the formation of roots, shoots, and leaves. The discovery helps explain how plants preserve genome stability under constant damage caused by sunlight, radiation, drought, and soil stress. The research used [Arabidopsis thaliana](#) as a model. Scientists identified two chromatin readers, YAF9A and YAF9B, as playing a role in repairing double-strand breaks in DNA. Only YAF9B was activated after DNA damage. Even so, YAF9A and YAF9B participated in the repair, including through homology-directed pathways,

known for their greater accuracy.

Functional difference

The study points to a functional difference between the two proteins. YAF9A acts broadly in the plant. YAF9B appears as a more specialized factor, concentrated in tissues rich in plant stem cells. These tissues give rise to new vegetative structures. Therefore, the activation of YAF9B in these locations may increase the chance of faithful repair in growth regions.

Plant DNA is packaged in chromatin, a structure formed by DNA associated with histones. This organization keeps the genome compact, but hinders the access of repair proteins to damaged points.

According to material from the Salk Institute, YAF9B helps open the chromatin and facilitates the recruitment of the repair machinery.

YAF9B regulation depends on the transcription factor SOG1. The study showed low YAF9B expression under normal conditions and strong induction after gamma radiation. The induction disappeared in the *sog1-1* mutant. Assays with promoter and reporter gene also indicated the need for a SOG1-linked cis-regulatory motif for expression in meristematic tissues after DNA damage.

Greater intensity

The YAF9B response was more intense in the presence of agents capable of causing double-strand breaks, such as gamma radiation and bleomycin. Expression showed little or no induction in response to ultraviolet C radiation, cisplatin, hydroxyurea, cold, salt, and heat. YAF9A maintained a similar expression pattern under the evaluated conditions.

Scientists also observed a direct effect of the proteins on repair. Mutants with simultaneous alterations in YAF9A and YAF9B showed more deformed or absent true leaves after exposure to 100 gray of gamma radiation. This assay measures accumulated damage in the apical meristem. Strains supplemented with functional versions of YAF9A or YAF9B reduced the observed defects.

In assays focused on homology-driven recombination, YAF9A and YAF9B did not fully compensate for each other. Simple *yaf9a* and *yaf9b* mutants showed a reduced repair rate in GUS reporters. The result indicates non-redundant roles in these high-fidelity pathways.

Molecular analysis

Molecular analysis revealed another difference. YAF9A associated with the chromatin remodeling complexes NuA4 and SWR1. YAF9B associated with the NuA4 complex. The study thus defines a version of NuA4 linked to DNA damage in plants. This connection represents the first link between NuA4 and double-strand break repair in plants, according to the

researchers.

The data also rule out an explanation based solely on gene regulation. Yaf9a and yaf9b mutants maintained a normal transcriptional response to DNA damage, but exhibited defects in repair assays. This supports a direct role for these proteins in the repair process, and not just an indirect effect on gene expression.

The YEATS domain of YAF9B played a crucial role. This domain recognizes marks on histones. Mutants with substitutions at key residues in the domain did not restore repair in specific assays. The result links the protein's chromatin-reading function to genomic stability.

This discovery has potential implications for gene editing. CRISPR-based

approaches in plants frequently trigger fast repair pathways, but these are prone to errors. Understanding natural high-fidelity repair mechanisms could guide future strategies for more precise gene insertion or replacement.

Further information at
doi.org/10.1073/pnas.2612171123

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Soil moisture affects the development of *Phthorimaea absoluta*

Study indicates greater emergence in soil with twenty percent moisture and total mortality in saturated soil

08.06.2026 | 15:10 (UTC -3)

Schubert Peter, Cultivar Magazine



Photo: Marja van der Straten, NVWA Plant Protection Service

Soil moisture influences pupation, survival, and emergence of Phthorimaea absoluta (formerly known as Tuta absoluta), a globally important pest in tomato crops. In laboratory trials, scientists observed greater biological success under moderately low moisture conditions. The best result occurred with twenty percent relative soil humidity. In this treatment, adult emergence reached eighty-three percent.

The study evaluated six humidity levels: zero, twenty, forty, sixty, eighty, and one hundred percent saturation. The researchers used one-day-old pupae, buried one centimeter deep. Each treatment was replicated five times, with twenty pupae per box. The team recorded

adult emergence, time to emergence, and morphological deformities.

Unimodal response

The results showed a unimodal response. Emergence decreased when the soil became too dry or too wet. In soil with forty percent moisture, emergence reached sixty-three percent. In soil with sixty percent, it fell to forty-seven percent. In dry soil, with zero percent moisture, it remained at eighteen percent. In soil with eighty percent moisture, it reached fifteen percent. In saturated soil, with one hundred percent moisture, no adults emerged.

The survival of the pupae followed a similar pattern. The treatment with twenty percent moisture maintained the highest survival rate throughout the observation period. The final value reached eighty percent. At forty percent moisture, the final survival reached seventy percent. At sixty percent, it reached fifty-three percent. At eighty percent, it dropped to twenty-two percent. In dry soil, it remained at twenty-four percent. In the treatment with one hundred percent moisture, all pupae died by the third day.

The scientists also assessed the larvae's preference for moisture. The trial offered four soil options, with twenty, forty, sixty, and eighty percent moisture. The larvae preferred the soil with twenty percent

moisture. This treatment accounted for 49,29 percent of pupations. The soil with forty percent moisture received twenty-five percent. The soil with sixty percent moisture received 17,14 percent. The soil with eighty percent moisture received 8,57 percent.

Pupation depth

The depth of pupation was also considered. Pupae concentrated in the surface layers of the soil, mainly between zero and one centimeter. In soil with eighty percent moisture, the concentration in the zero to half centimeter layer reached 71,7 percent. No pupae appeared in the deeper layers in this treatment.

The data indicate a vulnerability in the pupal stage of *Phthorimaea absoluta*. The pest uses the soil or the soil-plant interface during this stage of its life cycle. Since most pupae remain close to the surface, managing moisture in this area can be part of integrated pest management strategies.

Surface wetting

Researchers suggest the possibility of exploring short pulses of surface wetting during larval pupal stage entry. Saturation reduced survival and blocked emergence in the tests. This approach could decrease reliance on chemical applications, provided it undergoes field validation.

The work also has limitations. The experiments took place in a laboratory. The study used only one type of soil, classified as sandy loam, with 52,3 percent sand, 32 percent silt, and 15,7 percent clay. The average pH measured was 7,27. The results themselves indicate a need for testing with other soils, different climates, and growing conditions.

The research concludes that soil moisture acts as a crucial abiotic filter for *Phthorimaea absoluta* during pupation. Conditions between twenty and forty percent favored preference, survival, and emergence. Extreme conditions, such as drought or saturation, increased pupal mortality.

More information at

doi.org/10.3390/insects17060603

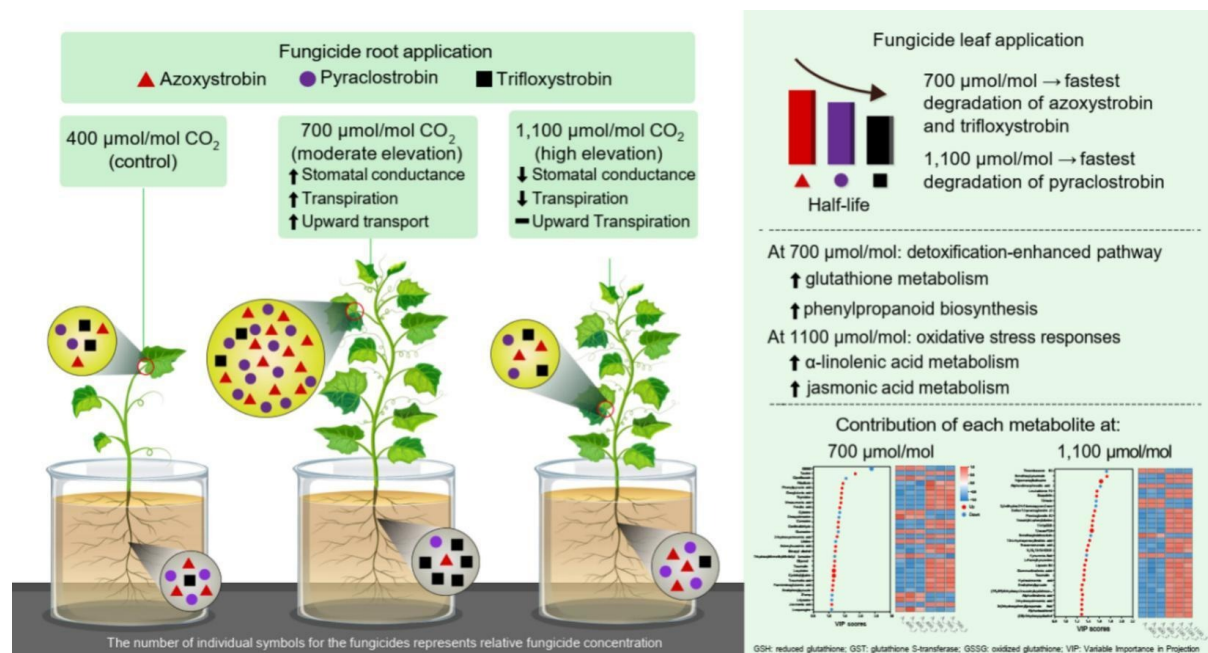
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Elevated carbon dioxide levels alter fungicide dynamics in cucumbers

Study indicates increased transport and degradation of strobilurins under moderate carbon dioxide concentrations

08.06.2026 | 14:23 (UTC -3)

Schubert Peter, Cultivar Magazine



doi.org/10.1016/j.pestbp.2026.107200

Moderately increasing carbon dioxide levels to 700 micromol per mol increased

acropetal transport and accelerated the degradation of strobilurin fungicides in cucumber seedlings. The effect involved increased stomatal conductance, increased transpiration, and activation of metabolic pathways linked to plant detoxification, according to the study.

The scientists evaluated azoxystrobin, pyraclostrobin and trifloxystrobin in plants cultivated under three carbon dioxide concentrations: 400, 700, and 1100 micromol per mole. The work combined physiological measurements, subcellular distribution analysis, degradation kinetics, enzymatic activity, and non-targeted metabolomics.

Main result

The main result indicates a non-linear response to carbon dioxide. A concentration of 700 micromol per mol favored seedling growth and the transport of more water-mobile compounds. Conversely, 1100 micromol per mol reduced stomatal conductance, induced signs of oxidative stress, and limited acropetal transport.

Azoxystrobin showed greater mobility to the leaves. At 14 days, under a concentration of 700 micromol per mol, the concentration reached 2,78 milligrams per kilogram in the leaves and 0,89 milligrams per kilogram in the stems. Translocation factors also increased compared to the ambient environment with 400 micromol per mol.

Pyraclostrobin showed greater root accumulation under ambient conditions. Even so, increasing the concentration to 700 micromol per mol elevated its presence in the leaves, with a residue of 0,187 milligrams per kilogram at 14 days. In the roots and stems, the levels decreased compared to the treatment with 400 micromol per mol.

Trifloxystrobin exhibited distinct behavior. The compound, being more lipophilic, remained concentrated in the roots. At 700 micromoles per mole, its root concentration reached 1,1 milligrams per kilogram at 14 days, but there was no significant increase in transport to the leaves.

Subcellular distribution

Subcellular distribution helped explain these differences. Azoxystrobin was found in greater proportion in the soluble fractions. At 700 micromol per mol, the proportion in the soluble fractions of roots and stems increased by 25 percent and 32 percent, respectively, after 14 days. This pattern favors movement through pathways associated with water flow.

Leaf degradation also progressed under elevated carbon dioxide. At 400 micromol per mol, the half-lives of azoxystrobin, pyraclostrobin, and trifloxystrobin reached 17,73 days, 15,68 days, and 9,94 days, respectively. At 700 micromol per mol, the half-lives of azoxystrobin and trifloxystrobin

decreased to 15,93 days and 3,51 days. Pyraclostrobin degraded most rapidly at 1100 micromol per mol, with a half-life of 9,83 days.

Enzymatic analysis identified glutathione S-transferase as a central component of the response. Among the enzymes evaluated, only this enzyme responded significantly to fungicide treatment. Its activity reached its highest absolute value at 700 micromol per mol. At 1100 micromol per mol, it remained elevated, but metabolism indicated restrictions related to redox balance.

Metabolomics identified 1056 metabolites in cucumber leaves. Of this total, 485 corresponded to primary metabolites and 571 to secondary metabolites. At 700

micromol per mol, there were alterations in pathways such as glutathione metabolism, ABC transporters, linolenic acid metabolism, and phenylpropanoid biosynthesis.

Integrated response

The data suggest an integrated plant response. At moderate carbon dioxide concentrations, cucumbers enhance the transport of more hydrophilic fungicides and activate detoxification mechanisms. At very high concentrations, the plant shifts part of its response toward controlling oxidative stress and cellular repair.

For protected cucumber production, the results indicate the need to pay attention to

the management of strobilurins in environments with carbon dioxide enrichment. Accelerated degradation can reduce final residues in harvested tissues. At the same time, it can shorten the effective period of protection against fungal diseases.

Further information at
doi.org/10.1016/j.pestbp.2026.107200

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John Deere updates 6R tractors for the 2027 model year

The series now features the e19 transmission, a revised cab, new hydraulic options, and connectivity

08.06.2026 | 13:47 (UTC -3)

Cultivar Magazine, based on information from Derik Morgan



John Deere announced the new generation of 6R tractors for the 2027 model year in the United States. The line received updates focused on comfort, operational control, and performance in field work, transportation, and use with a front loader. The company also reported improvements to the 6M Series, positioned as an intermediate specification option for rural properties, dairy farms, and ranches.

According to the company, the 6R MY27 aims to combine the strength of a larger tractor with the agility and efficiency for daily tasks. The line now offers four chassis sizes and 15 models. The configuration allows the producer to combine power, comfort, hydraulics, and technologies according to the needs of the

operation.

Main changes

Among the main changes is the e19 powershift transmission. The system aims to deliver smooth gear changes and performance in more demanding applications. John Deere also revised the cab and the CommandArm, with CommandX controls. The assembly increases interior space, improves visibility, and seeks to reduce fatigue on long journeys.

The company announced improvements to the suspension and steering. These features aim to enhance ride quality and tractor control in the field and on the road.

The proposal includes smoother driving and greater operator confidence when traveling and operating under load.

Hydraulic system

The high-capacity, closed-center hydraulic system is compatible with loaders and implements used in row crop applications. The 6R MY27 also introduces a new front loader. This equipment offers increased lifting capacity and technological features such as integrated weight sensing, position awareness, and optional camera visualization.

According to John Deere, these features help the operator move more material with fewer trips and reduce waste. The loader

has an integrated controller. This component facilitates the future inclusion of options such as loader suspension, lighting, hydraulic implement uncoupling, and expanded technology packages.

Selection of broadcasts

The 6R MY27 Series offers a selection of transmissions to suit different driving styles and workloads. Inside the cab, the manufacturer cites quiet operation, good visibility, and intuitive controls. The package is designed for long journeys in demanding conditions.

Anne Anderson, marketing manager for the John Deere 6 Series tractor line, stated in the company's press release that the 6R

MY27 handles tasks such as soil preparation, planting, baling, hauling, and loader work. According to her, the tractor offers performance and reliability to maintain productivity in different activities and conditions.

The 6R MY27 line also features full-frame construction. John Deere states that this structure offers stability and reliability under heavy loads in the field and in frequent use with a loader. Another feature cited by the company involves Intelligent Power Management. The system provides additional power when the load or power take-off demand increases. The increase reaches 40 horsepower, with a maximum power of 305 horsepower in the 6R 260 MY27 model.

The manufacturer also points to improvements in the powertrain. The goal involves smoother power delivery, faster operation, and greater fuel efficiency in field and transport applications. Integrated connectivity and precision agriculture technologies help organize tasks and support decisions throughout the day.

Technology package

The technology package includes over-the-air software updates and automation features. According to the company, these functions reduce manual input and keep the tractor up-to-date as operational needs evolve.

John Deere also announced updates to the 6M Series for the 2027 model year. This line complements the 6R tractors with an intermediate, configurable solution. The offering caters to diverse applications and allows adjusting the level of features and technology to the specific needs of the farm.

The updated 6M now features scalable technology, integrated connectivity, and precision agriculture capabilities. The e19 powershift transmission is also part of the lineup. Items found in larger tractors, such as the G5 CommandCenter monitor option and the CommandX lever, are available on the 6M. The configuration can vary according to the customer's preference.

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Adenosine receptor opens avenue for insect management

Study points to the role of AdoR in immunity, metabolism, sleep, pollination, and insecticidal action

08.06.2026 | 07:52 (UTC -3)

Schubert Peter, Cultivar Magazine

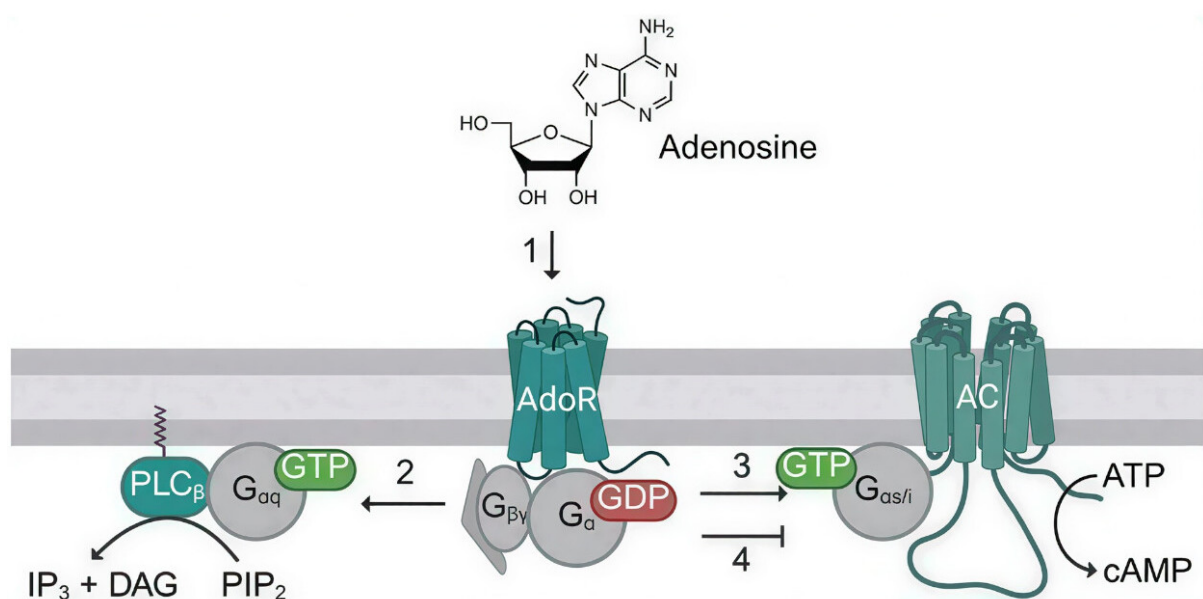


Image: doi.org/10.1093/aesa/saag020

Adenosine acts as a central metabolic signal in insects and controls processes related to immunity, metabolism, the

nervous system, development, and behavior. This study brings together recent evidence on the adenosine receptor in insects, called AdoR, and highlights its potential as a target for basic studies and applied management strategies.

The study, authored by Emily Vasko, Lindsay Newman, and Ryan Arvidson of the Department of Biochemistry at Case Western Reserve University, highlights an important difference between insects and vertebrates. Mammals possess four subtypes of adenosine receptors. Insects concentrate these functions in a single G protein-coupled receptor. This receptor integrates diverse physiological signals and can trigger cyclic AMP, calcium, and other cellular response pathways.

According to scientists, studies in [Drosophila melanogaster](#), bees, pest lepidopterans, grasshoppers, and parasitoid-host systems show the involvement of extracellular adenosine in broad responses. The metabolite coordinates metabolic reprogramming during infections, modulates sleep and neuronal resilience, influences intestinal stem cells, affects foraging performance in pollinators, and can be manipulated by pathogens.

Systemic sign

In immunity, adenosine functions as a systemic signal. In larvae of *Drosophila melanogaster*, parasitoid infection increases extracellular adenosine. This

increase triggers a metabolic change and directs energy reserves toward the proliferation and activity of immune cells. Researchers also report the role of adenosine deaminase-related factors, responsible for modulating extracellular levels of the metabolite.

The fine-tuned control of this system has physiological relevance. When adenosine is not adequately removed, chronic activation of the AdoR leads to uncontrolled mobilization of energy reserves, severe loss of mass, and death in *Drosophila melanogaster* individuals. Scientists describe adenosine as a link between the body's immune defenses and metabolism.

Pathogens also exploit this pathway. In lepidoptera, the bracovirus associated with *Snellenius manilae* reduces extracellular adenosine levels in *Spodoptera litura*. This reduction suppresses AdoR-mediated immune activation and favors the success of the parasitoid. In honeybees, infection with the deformed wing virus alters extracellular adenosine signaling and affects neurological functions of *Apis mellifera*.

Nervous system

The study highlights the relevance of AdoR in the nervous system. The receptor is expressed in various tissues, with a higher prevalence in the central nervous system in the species evaluated. In *Drosophila*

melanogaster, caffeine alters sleep and wakefulness by interacting with adenosine signaling and dopaminergic circuits.

Chronic alterations in AdoR expression in neurons and glial cells impair sleep architecture, locomotor activity, and longevity.

Adenosine signaling also plays a role in neuronal recovery under stress. In *Migratory locust*, extracellular adenosine contributes to recovery after anoxic coma. The mechanism involves temporary depression of neural activity and protection during reoxygenation. In *Drosophila melanogaster*, activation of AdoR regulates protective genes, such as Hsp70 and Mod(mdg4), in response to cytotoxic damage.

Larval growth

During development, altered adenosine levels impair larval growth and developmental progression. In adult tissues, AdoR regulates the proliferation of intestinal stem cells in the midgut of *Drosophila melanogaster*. The reduction of AdoR by RNA interference decreases this proliferation. The receptor's activity favors the expansion of the stem cell compartment and participates in epithelial renewal.

The study also links the adenosine pathway to pollinator ecology. In bees, exposure to the neonicotinoid imidacloprid reduces foraging performance and impairs wingbeat frequency. Dietary

supplementation with adenosine reverses some of these effects. Other cited studies indicate an impact of imidacloprid on the energy metabolism of hemolymph and fat bodies, reinforcing the link between adenosine, energy, and vulnerability to environmental stressors.

In the pharmacological field, researchers highlight adenosine agonists, antagonists, and analogs with specific effects on insects. The review cites compounds such as CPA, CHA, 2-chloradenosine, caffeine, DPCPX, 8-phenyltheophylline, IBMX, SCH58261, and ZM241385. These ligands produce distinct effects on cyclic AMP, calcium, sleep, neuromuscular transmission, development, and mortality, depending on the species, dose, and

experimental system.

Applied potential

The applied potential is highlighted in [Plutella xylostella](#), the diamondback moth.

The analog N6-(2-hydroxyethyl)-adenosine, or HEA, showed insecticidal activity against the species. A study cited in the paper linked the toxicity to the insect's adenosine receptor, called PxAdoR. This evidence positions AdoR as a viable pharmacological target for an agricultural pest.

Structural analysis indicates conservation of the typical core of G protein-coupled receptors. Insect receptors maintain an architecture with seven transmembrane

domains and conserved motifs, such as DRY and NPxxY. At the same time, they differ from human receptors by having larger C-terminal tails, disordered regions, areas rich in positive charges, and variation in extracellular loops. These differences may explain specific pharmacological profiles among insect orders.

Phylogenetic analysis

Researchers have compiled over 50 putative AdoR sequences from insects. Phylogenetic analysis positions insect receptors as a monophyletic group, separate from human A1, A2A, A2B, and A3 receptors. Within insects, the sequences tend to cluster in taxonomic

order. This pattern indicates evolutionary divergence following separation from vertebrate receptors.

Scientists conclude that AdoR combines structural conservation with insect-specific adaptations. This combination opens up avenues for studies of selectivity, ligand design, and risk assessment of beneficial species. For the researchers, further progress will depend on higher spatial and cellular resolution of AdoR expression, comparisons between insect orders, and experimental validation of structural models.

Further information can be found at doi.org/10.1093/aesa/saag020

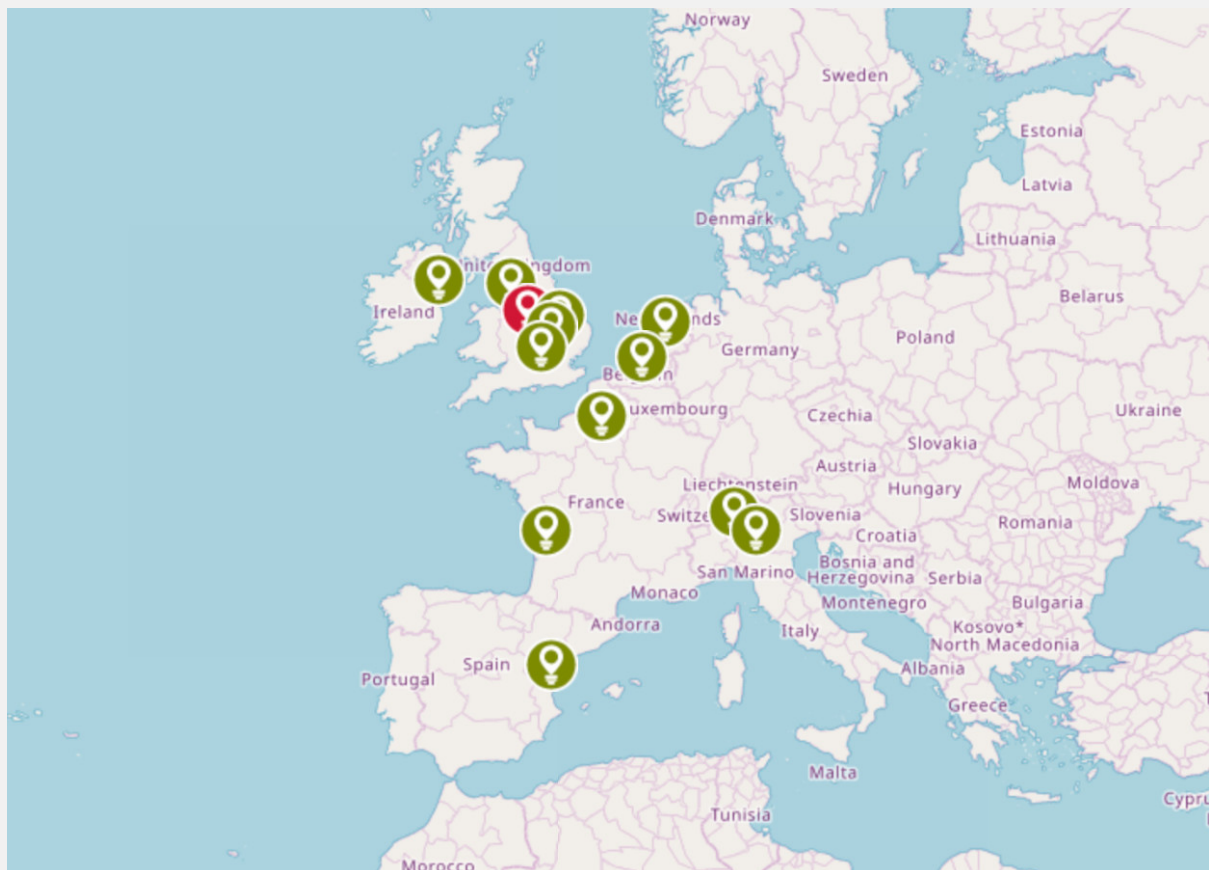
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European project aims at managing quarantine pests

PhytoPRISM will have a platform to support phytosanitary decisions in agricultural and forestry supply chains

08.06.2026 | 07:33 (UTC -3)

Cultivar Magazine



The University of Warwick leads PhytoPRISM, a Horizon Europe project focused on pest risk management in agri-food and forestry supply chains. The initiative has received a contribution from the European Union of almost six million euros. It is scheduled to begin on September 1, 2026, and end on August 31, 2030.

The project aims to deliver a data-driven platform to support a systemic approach to pest management. The system should integrate epidemiological modeling, economic analyses, and behavioral information. The focus involves national plant protection organizations.

The tool will allow users to simulate scenarios, assess trade-offs, and design

integrated strategies tailored to the local context. The project also includes ready-to-use tools, training, and public policy recommendations.

The initiative comes in response to the increasing number of pests. The University of Warwick reports losses of up to 40% of global agricultural production due to pests each year.

The platform will be co-developed with phytosanitary authorities, producers, foresters, and consultants. Six case studies will validate the system: Fall Armyworm, Citrus Black Spot, Pine Wood Nematode, Emerald Ash Borer, *Xylella fastidiosa*, and Fruit Fly. The results could cover more than 60 related European quarantine pests.

Further information at
doi.org/10.3030/101287943

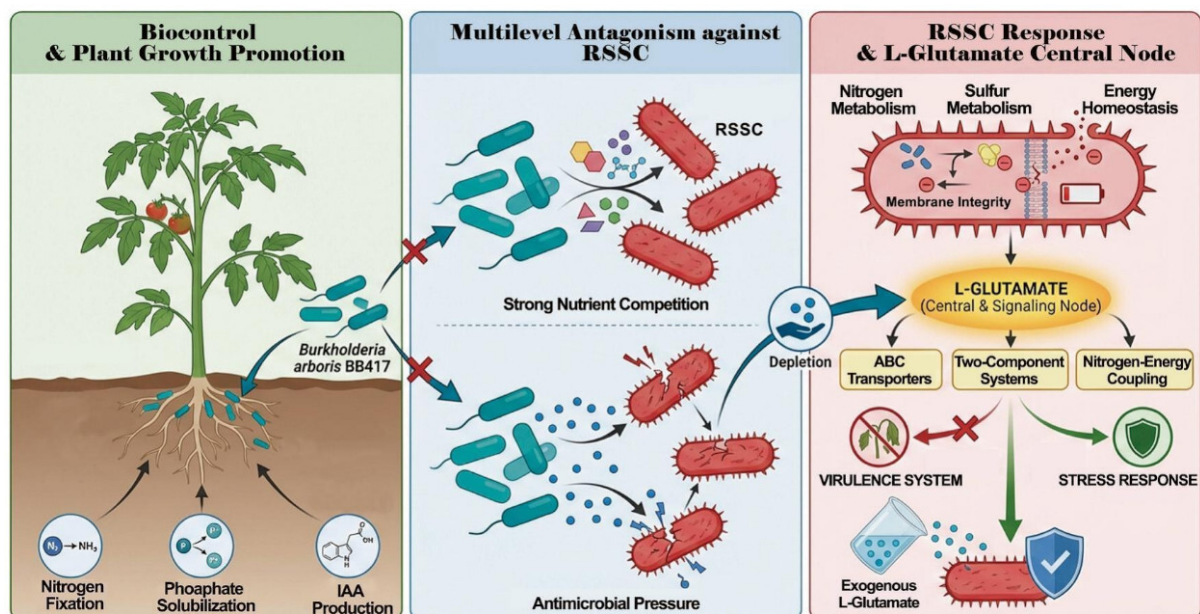
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Burkholderia arboris bacteria reduces bacterial wilt in tomato plants

Bacteria colonize the rhizosphere, alter nitrogen pathways, and limit pathogen advancement

06.06.2026 | 07:46 (UTC -3)

Schubert Peter, Cultivar Magazine



doi.org/10.1016/j.pestbp.2026.107188

A lineage of *Burkholderia arboris* reduced the progression of bacterial wilt in tomato

plants and showed comparable efficiency to a chemical treatment during ten days of evaluation in a greenhouse. The study identified the BB417 strain as a biocontrol agent against the species complex Ralstonia solanacearum (RSSC).

Researchers also described mechanisms linked to competition for nutrients, interference with virulence signals, and metabolic reprogramming of the pathogen.

BB417 inhibited 16 RSSC strains in antagonism assays. These strains represented eight sequence variants and came from four host plants. The inhibition halos ranged from 1,50 centimeters to 2,45 centimeters. Suppression was most intense against RSSC isolates originating from tomato plants.

Greenhouse

In a greenhouse, tomato seedlings received pre-treatment with a BB417 suspension five days before inoculation with RSSC. Eight days after inoculation, the incidence of the disease reached 51,11%. The disease index reached 48,87. The control efficiency was 50,80%. This value was close to that obtained with 20% copper thiodiazole, used in the study as a chemical treatment, which had 50,10% efficiency.

After ten days, the plants in the positive control group reached total mortality. Treatments with BB417 and copper thiodiazole further reduced the progression of the disease. Efficiency was 39,40% for

BB417 and 46,70% for the chemical treatment. Researchers observed a continuous increase in the disease index during the period, without stabilization until the tenth day.

BB417 Lineage

The BB417 strain originated from the rhizosphere of pine trees in Meizhou, Guangdong province, China. Identification involved morphological, physiological, biochemical, and genomic characteristics. The bacterium presented rod-shaped cells and a Gram-negative reaction. Nucleotide mean identity analysis indicated 99,51% similarity with *Burkholderia arboris* PN1. Digital DNA-DNA hybridization showed 93,2% similarity with *Burkholderia arboris*

LMG24066.

BB417 colonized the tomato rhizosphere but did not appear on roots, stems, or leaves during the assay. The maximum population reached $2,3 \times 10^7$ colony-forming units per gram of soil on the fifteenth day. After that, the population showed gradual stabilization. The researchers interpreted this pattern as non-endophytic colonization.

Plant growth

The bacterium also promoted the growth of tomato plants. After 15 days of treatment, the plants showed an increase of 14,53% in height, 14,73% in root length, 8,77% in fresh biomass, 35,46% in root biomass,

and 5,71% in stem diameter. The strain exhibited nitrogen fixation, phosphate solubilization, siderophore production, and indole-3-acetic acid synthesis. It also secreted protease. It did not show amylase, α -1,3-glucanase, or cellulase activity.

The BB417 genome comprised three circular chromosomes, with 8.291.816 base pairs and 66,88% GC content. Annotation identified 7.361 genes. Anti-SMASH analysis indicated 19 gene clusters for the biosynthesis of secondary metabolites. Among them were clusters related to pyrrolnitrin, piochelin, ornibactin, and occidiofungin A. Ten clusters remained uncharacterized.

RNA-seq analysis showed a broad alteration in RSSC gene expression under BB417 pressure. Researchers identified 825 differentially expressed genes, with 358 genes activated and 467 repressed. Genes linked to motility, such as *fliC* and *cheY*, showed increased expression. Scientists interpreted this response as a possible escape strategy in the face of antagonistic pressure.

Gene repression

At the same time, genes linked to virulence, substance transport, carbon metabolism, and enzymes associated with infection were repressed. Among them were *epsB*, *gsiB*, *yrbE*, *gnnB*, *malE*, and *cbhA*. The result indicates less investment

by the pathogen in virulence systems and physiological maintenance.

Metabolomics by liquid chromatography coupled with mass spectrometry identified 532 differentially accumulated metabolites. Of this total, 346 increased and 186 decreased in RSSCs exposed to BB417. The enriched pathways included purine metabolism, aminoacyl-transfer RNA biosynthesis, ABC transporters, and secondary metabolite biosynthesis.

L-glutamate emerged as a central point of interaction between BB417 and RSSC.

The integration between transcriptome and metabolome indicated interference in ABC transporters, two-component systems, and nitrogen metabolism. The reduction of L-glutamate coincided with the repression of

ammonia assimilation genes, nitrate reduction, and virulence regulation.

External supplementation

Trials with external supplementation confirmed the role of L-glutamate. The addition of 2,5 millimolars and 5 millimolars reduced the bacteriostatic halo by 54,2% and 73,1%, respectively. With 10 millimolars and 15 millimolars, the reduction reached 82,6% and 84,3%. With 20 millimolars, the reduction reached 92,7%. Supplementation did not impair the growth of BB417, according to the study controls.

The researchers concluded that BB417 exerts pressure on the pathogen through nutritional competition and antimicrobial activity. RSSC responds with increased motility, reduced virulence expression, and metabolic rearrangement. The competition for L-glutamate appears to be the central element of the interaction between the biocontrol agent and the pathogen.

Further information at
doi.org/10.1016/j.pestbp.2026.107188

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