10.may.2025 N º 29

Cultivar Semanal ®

Pests controlled by sexual biochemistry

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How mating biology could redefine pest control

Research reveals central role of neuropeptides in insect reproductive behavior

09.05.2025 | 03:43 (UTC -3)

Cultivar Magazine

Migratory locust was one of the insects evaluated - Photo: ChriKo

Insect sexual behavior, though seemingly instinctive, depends on a sophisticated

network of biochemical signals. A new study details how neuropeptides—small chains of amino acids secreted by the nervous system—precisely regulate each phase of mating, from attraction to post-mating actions.

The survey, which gathered data from multiple economically relevant species, reveals the action of 18 different neuropeptides and highlights their potential as targets for ecologically responsible pest control technologies.

The study reinforces a disturbing premise: insect mating is less random and more regulated than previously thought. Every pheromone released, every wingbeat, every touch during courtship can be initiated, modulated or interrupted by

neuropeptides. Manipulating these molecules could therefore offer a viable alternative to conventional pesticides.

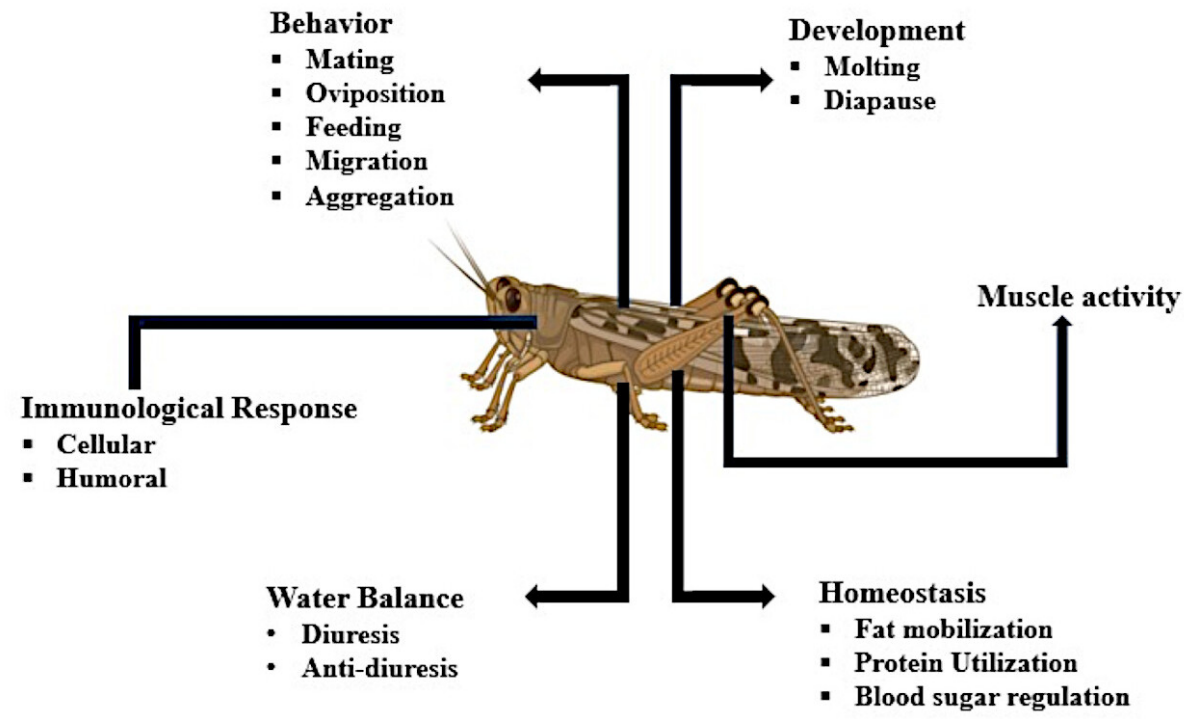
The invisible choreography of mating

Neuropeptides do not act alone. They function as biochemical conductors, orchestrating cascading reactions by binding to G-protein-coupled receptors (GPCRs).

This binding triggers cellular signaling pathways that modulate everything from sensitivity to pheromones to the duration of copulation. In some cases, a single neuropeptide can influence multiple stages of the reproductive process. This is the

case of natalisin (NTL), which increases the sexual receptivity of females, intensifies courtship behavior in males and, subsequently, stimulates egg laying.

Other compounds, such as PBAN (pheromone biosynthesis-activating neuropeptide), act in a more specific way. PBAN regulates the production of sexual pheromones in moths, and is essential for mate attraction. When silenced by techniques such as RNAi or CRISPR, sexual attraction disappears — and so does reproduction.



From the song of crickets to the light of wasps

Seemingly simple behaviors, such as the song of a cricket or the aerial dance of a dragonfly, are activated by molecules such as proctolin and TRPs (tachykinins).

These not only control muscles, but also sexual appetite. Decreasing the expression of these compounds in laboratory tests reduced or completely eliminated courtship behavior in different species.

The study also describes substances that act after copulation. For example, sex peptide (SP), transferred by the semen of male Drosophila melanogaster, alters the behavior of the female: she stops accepting new partners and begins the oviposition process.

Other peptides, such as DH44 and insulin-like peptides (ILPs), regulate sperm retention and the use of energy reserves after mating.

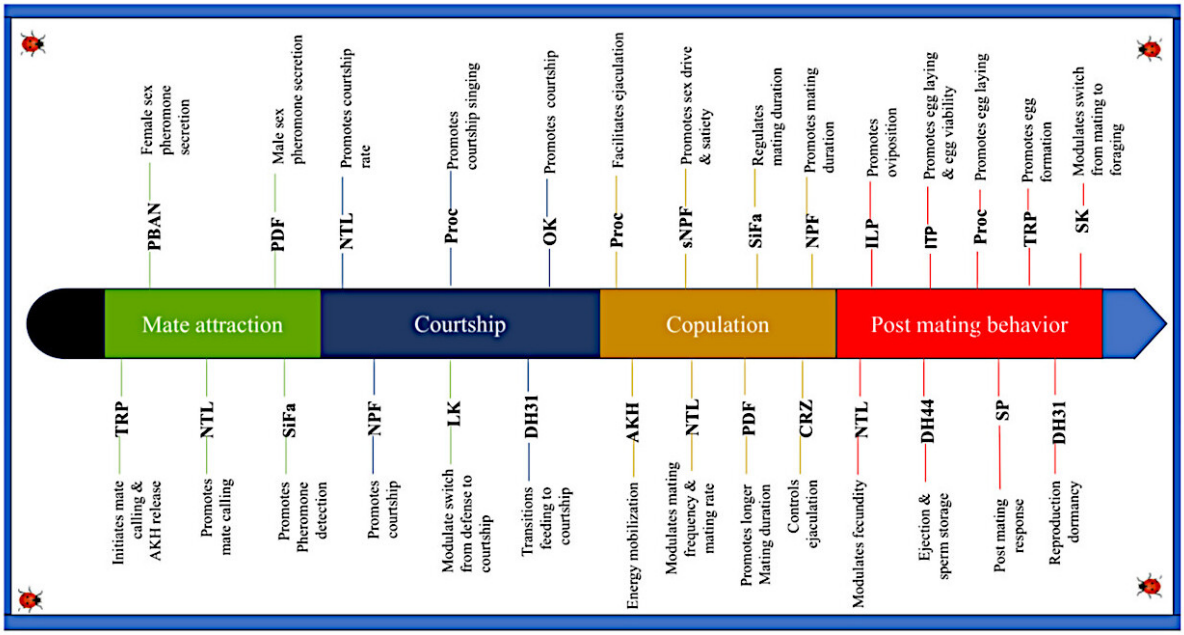
Implications for agriculture

The discovery that these neuropeptides are conserved across different insect orders—including Diptera, Lepidoptera, Coleoptera, and Hemiptera—suggests strategic value.

By identifying and inhibiting specific neuropeptides, it would be possible to suppress the reproduction of agricultural pests without impacting other life forms.

Tools based on RNAi, genetic engineering or GPCR receptor disruptors are already under development and promise to replace synthetic pesticides with reduced environmental impact.

In addition to direct control, knowledge of neuropeptidergic mechanisms can help predict population outbreaks. Environmental signals such as temperature, photoperiod, and food availability affect the release of these substances. Monitoring these variables can anticipate peaks in reproduction and allow for more precise interventions.



Future frontiers

Despite the progress, gaps persist. Many economically important insects, such as bedbugs and whiteflies, remain poorly studied in this regard.

Scientists emphasize the need to invest in functional genomics and bioinformatics to identify neuropeptides and their receptors in new species. There is also the technical challenge of developing selective compounds that interfere only with the desired targets, without side effects.

More information can be found at
doi.org/10.3390/insects16050506

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CNH presents strategic plan and goals until 2030

Company aims to lead agricultural markets, expand margins in agriculture and construction and double sales of precision technology

08.05.2025 | 14:08 (UTC -3)

Cultivar Magazine

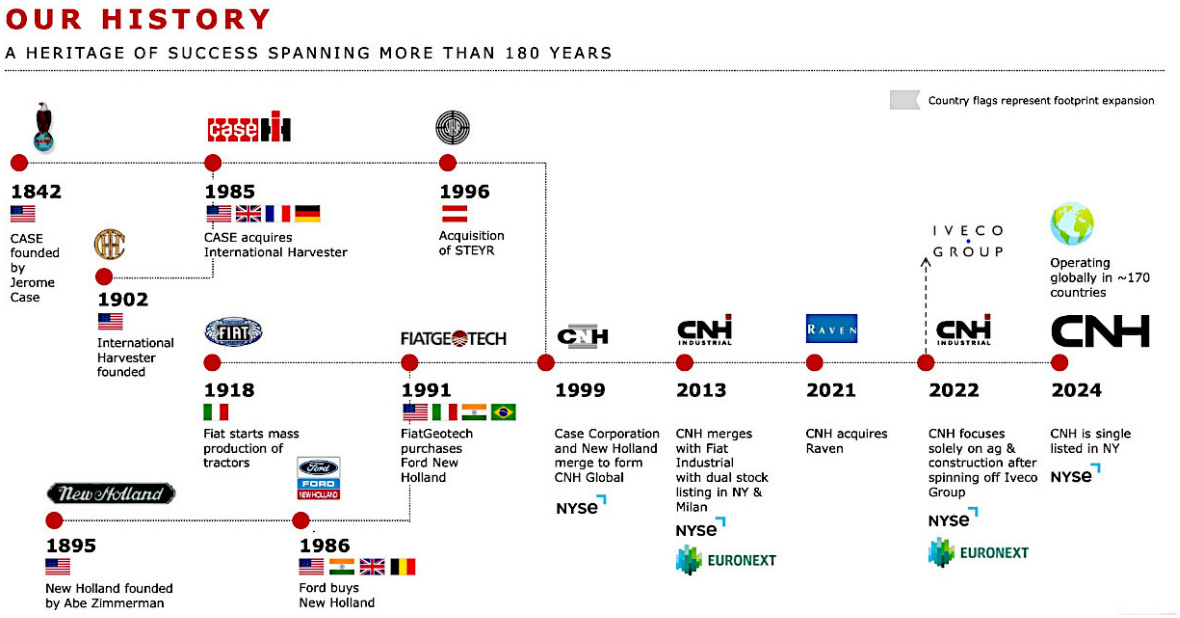
CNH presented its new Strategic Business Plan this Thursday (8/5) during Investor

Day 2025, in New York. The company set goals until 2030, focusing on sustainable growth, expanding operating margins and greater returns to shareholders.

The strategy is based on four pillars: progress in the integration between machines and technology, expansion of adjusted EBIT margins, growth in the construction area and distribution of almost all industrial cash flow to shareholders.

In the agricultural sector, CNH intends to consolidate its position as leader or vice-leader in the main global markets. The company will renew its entire line of tractors, from 20 to over 700 horsepower, and expand the range of harvesters with lower total operating costs.

Precision technology will gain more space in the company's machines. By 2030, 90% of these solutions will be developed internally. Among the resources are agronomic sensors, advanced automation, satellite connectivity and integration via the FieldOps digital platform. The goal is to double the share of precision technology in the agricultural segment's net sales.



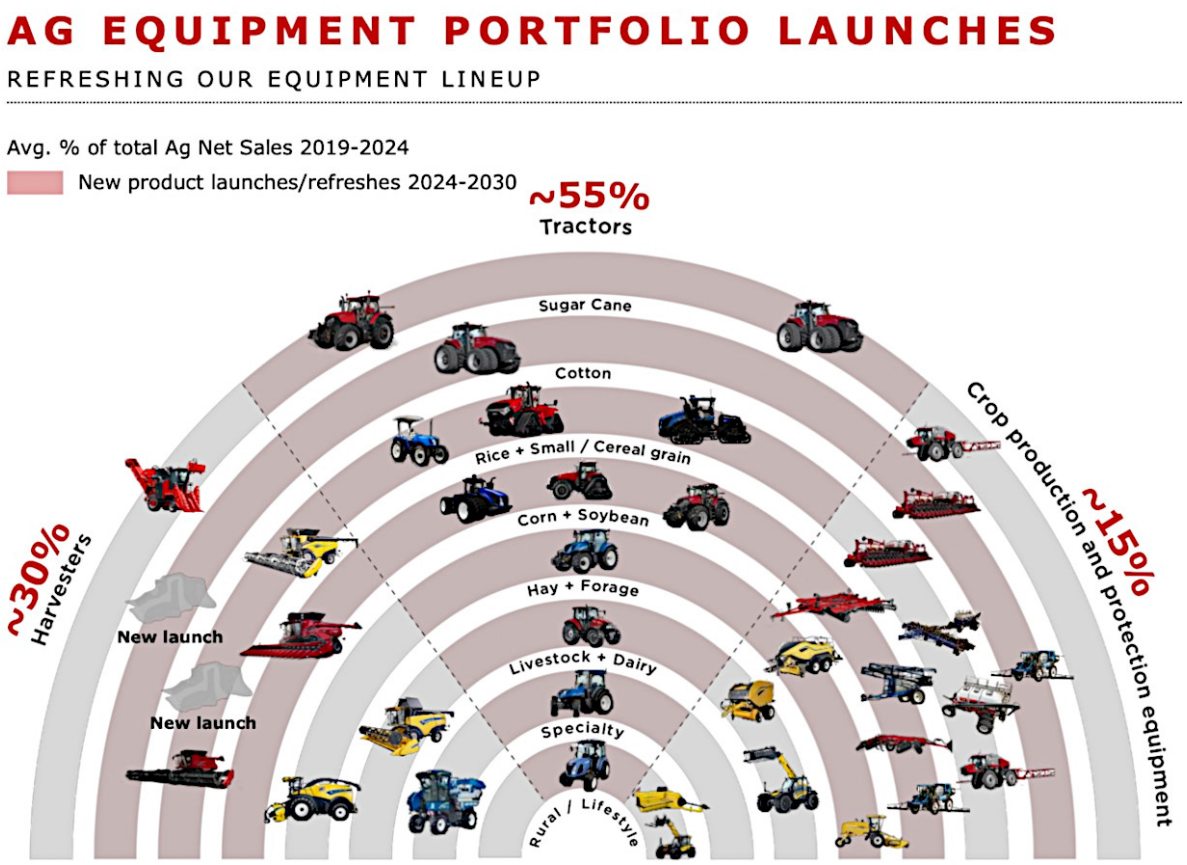
CNH will also invest in a new relationship model with its dealer network. The focus

will be on strengthening the Case IH and New Holland brands as global brands and Steyr as a regional brand in Europe. The company plans to invest part of the annual margin to boost dealerships focused on growth and improve customer service.

In construction, the goal is to achieve an adjusted EBIT margin of 7% to 8% by 2030. The strategy includes launches, digitalization, after-sales growth and industrial efficiency gains. CNH wants to strengthen brands such as CASE, New Holland Construction and Eurocomach, maintaining its position among the top five in North and South America.

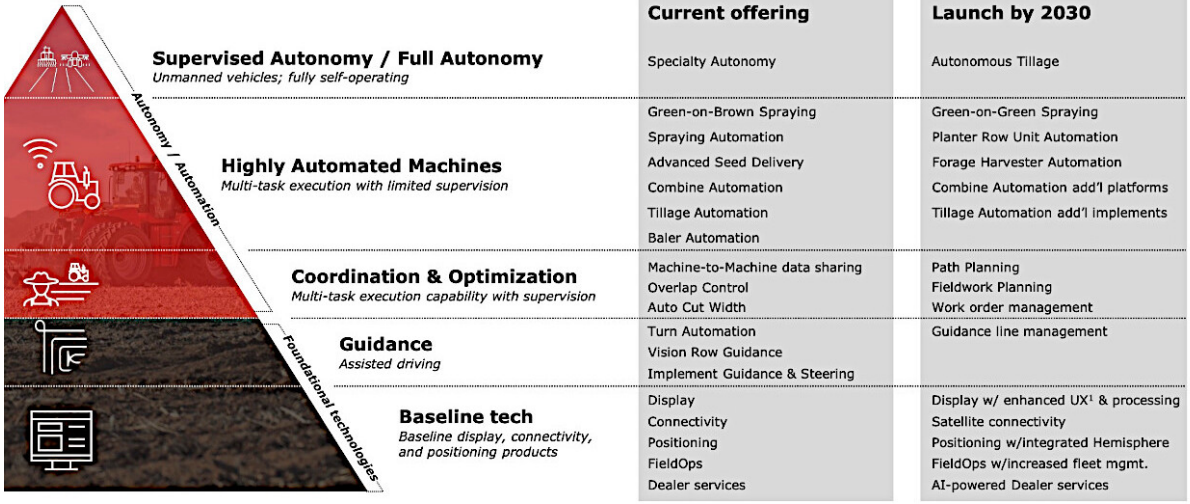
The plan also foresees increasing returns to shareholders. The company expects to increase industrial cash generation by 25% and return almost all free cash flow

through dividends and share buybacks, after paying off debts and making strategic acquisitions.



PRECISION TECH EVOLUTION

EVOLVING OUR PRECISION TECH SOLUTIONS TO MEET FARMER NEEDS



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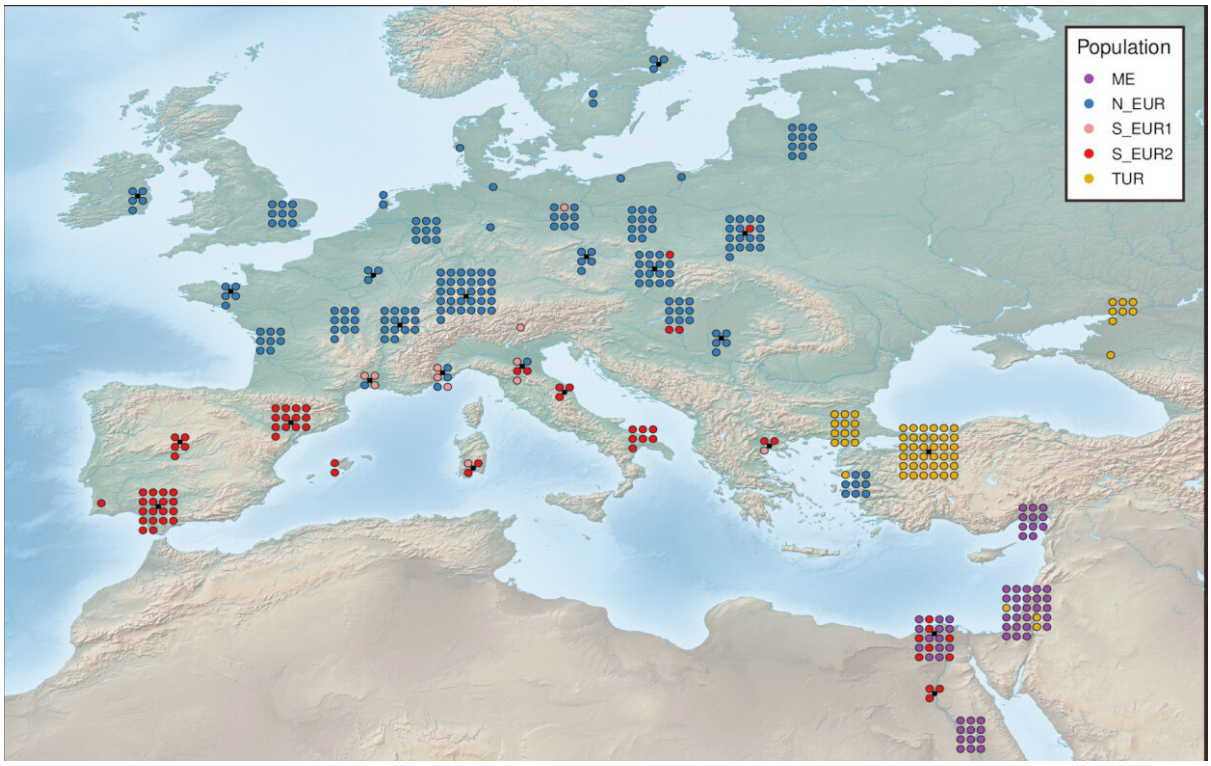
Scientists reveal pathways of powdery mildew in European wheat

First-of-its-kind DNA survey shows how wind shapes fungal epidemics and challenges resistance programs on the continent

09.05.2025 | 09:37 (UTC -3)

Cultivar Magazine



European scientists have mapped the genome of hundreds of samples of the fungus *blumeria graminis* f.sp. *tritici* (Bgt), revealing how it spreads, evolves and circumvents the resistance mechanisms adopted in the fields.

A total of 415 Bgt isolates collected between 2022 and 2023 in 22 countries were analyzed. The results show a divided picture. Northern Europe is home to a single, large, homogeneous fungal population. In the south, small, genetically distinct local populations dominate. This difference has an explanation: the wind.

By comparing genetic data with climate and geographic patterns, researchers confirmed that wind is the main vector for the pathogen's dispersion. Air masses

facilitate genetic connection in the north, where the fungi travel great distances. In the south, mountain ranges and the sea hinder the migration of spores, creating isolated populations.

The study also overturns long-standing hypotheses. Contrary to what was previously thought, the fungus does not follow a north-south progression following the vegetation (the so-called “green wave”). Instead, data suggest a predominant west-to-east movement over decades — a trajectory that coincides with the region’s prevailing winds.

Another highlight is reproduction. Contrary to the idea that Bgt reproduces mainly clonally, genomic data reveal widespread sexual reproduction. This recombination

increases the pathogen's evolutionary potential. And with it, its ability to escape genetic and chemical control.

Scientists have identified genetic regions that have undergone strong recent selection, including genes that confer resistance to fungicides. A case in point is the AvrPm17 gene, which interacts with the Pm17 resistance protein, introduced into European wheat in the early 2000s. Variants of AvrPm17 capable of evading recognition by the plant were already circulating before the adoption of Pm17. A new mutant, which emerged more recently, has completely escaped resistance, calling into question the gene's effectiveness.

Functional tests confirmed that the mutation detected in the H allele of AvrPm17 completely prevents the activation of the plant's defense. This new variant is already spreading across parts of northern Europe and Türkiye.

Another experiment revealed that even sources of resistance not yet commercially adopted may already be compromised. Transgenic lines containing the Pm3e gene, never before used in the field, were infected by European isolates in the laboratory. Three strains, from Switzerland, Germany and Sweden, completely overcame resistance.

These findings show that genomic surveillance can anticipate future failures. The early presence of virulent variants

explains why resistance genes are short-lived after introduction. If the diversity of the pathogen is known before widespread adoption, breeding programs can avoid investing in solutions that are doomed to failure.

The team suggests that new strategies should consider regional population structure. In northern Europe, where populations are unique and interconnected, decisions about resistance should be coordinated across countries. In the south, where populations are isolated, local strategies may be more effective.

More information can be found at

doi.org/10.1371/journal.pbio.3003097

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Neutral climate in the Pacific could change rainfall patterns in Brazil

NOAA indicates ENSO-neutral will remain until the end of 2025; uncertainty increases challenge for Brazilian agricultural sector

08.05.2025 | 15:03 (UTC -3)

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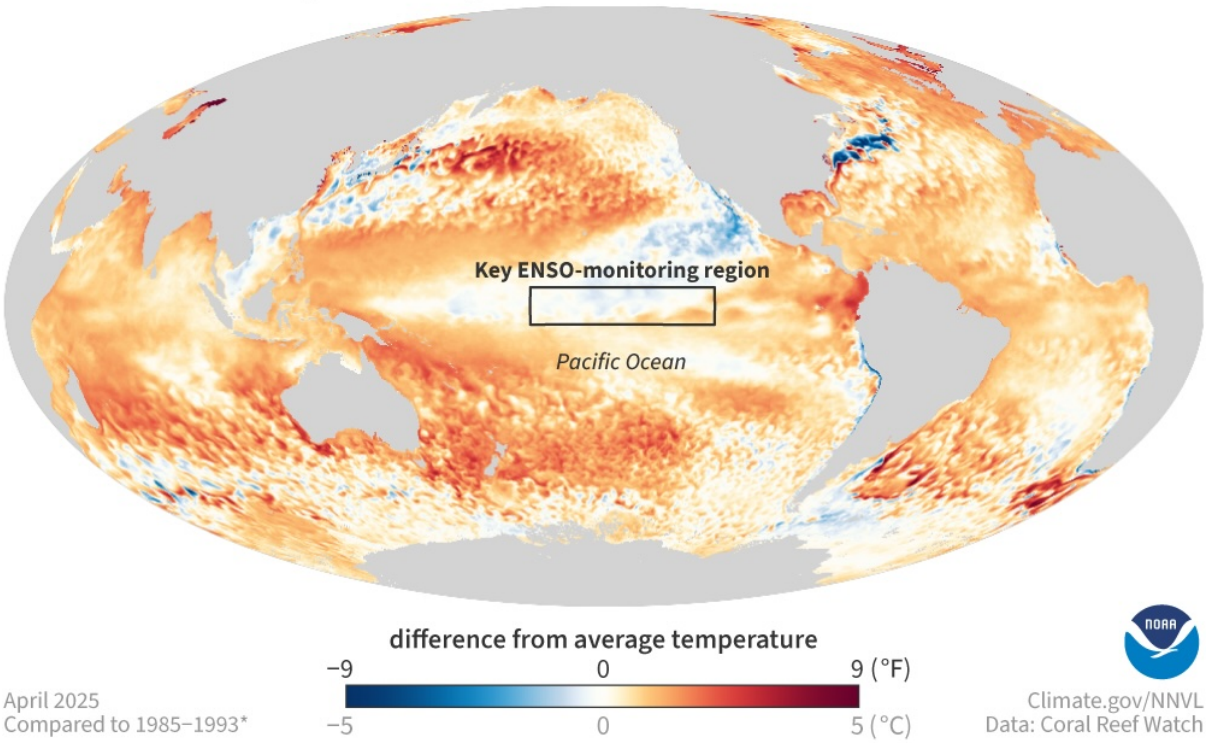

The central Pacific Ocean has entered a neutral phase and is expected to remain so until the end of 2025. The information comes from NOAA (the US National Oceanic and Atmospheric Administration), which indicates a 74% chance of the current scenario remaining. La Niña, although a close possibility, is still not the most likely scenario. El Niño, on the other hand, has only a 15% chance of returning.

The neutral condition occurs when the waters of the Niño-3.4 region vary less than 0,5 °C in relation to the historical average. In April, the temperature was 0,16 °C below normal. The subsurface layer and atmospheric circulation also remain close to the average pattern, although with residual signs of La Niña.

This period of neutrality reduces climate predictability. In Brazil, this means a greater influence of other short-term phenomena, such as the Madden-Julian Oscillation. The consequence may be an increase in rainfall variability, making agricultural planning difficult, especially in the summer harvest.

For producers, the current situation requires extra attention to short-term forecasts. Irregular rainfall patterns can affect the planting of crops such as soybeans and corn, as well as delay harvests in the Central-West and Matopiba regions. Spring is a critical time for climate forecasts, and models should only become more accurate in the second half of the year.

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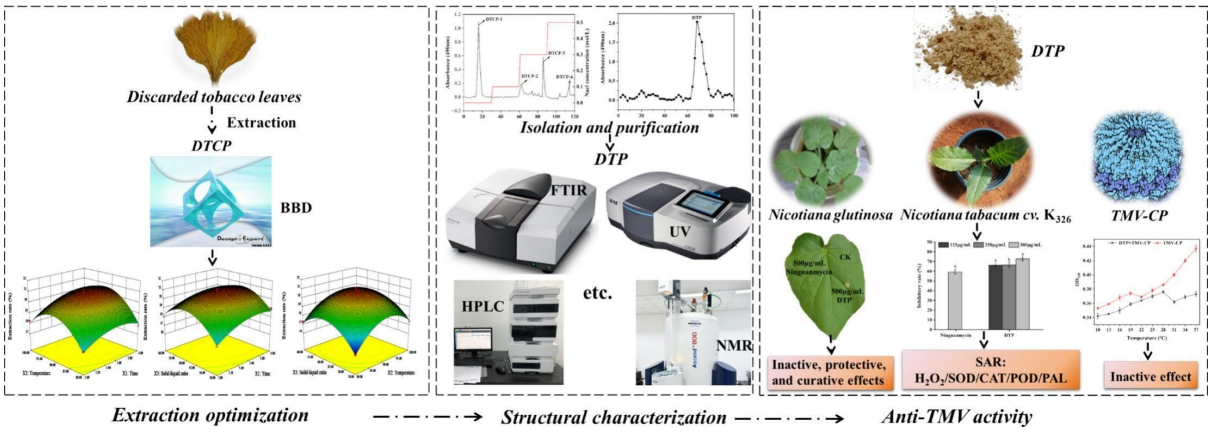
Tobacco leaf polysaccharide shows strong action against TMV

Researchers extract natural substance from tobacco industry waste with potential to replace synthetic pesticides

08.05.2025 | 14:51 (UTC -3)

Cultivar Magazine



A substance extracted from discarded tobacco leaves has shown effects against tobacco mosaic virus (TMV), one of the

most destructive viruses for agricultural crops. Researchers from Kunming University of Science and Technology and Yunnan Tobacco Company have isolated a polysaccharide with a defined structure and antiviral properties that outperform commercial pesticides.

The discovery turns an environmental problem into an agronomic solution. An estimated 25 percent of tobacco leaves produced in China are discarded, resulting in more than 2 million tons of waste annually. This waste, often burned or piled up, contributes to pollution.

By reusing this material, scientists demonstrated that the leaves have a high polysaccharide content — up to 20% of the composition —, a little-explored potential in

plant protection.

The purified polysaccharide, called DTP, has a molecular mass of 3061 Da and a chain composed mainly of galactose, glucose, galacturonic acid and glucuronic acid. The extraction was optimized using hot water and alcoholic precipitation, reaching a yield of 21,11% under 3,5 hours of extraction at 90 °C, with a solid-liquid ratio of 1:45.

In efficacy tests, DTP demonstrated protective and inactivating action against TMV with inhibition rates higher than 76%. This activity surpassed that of the chemical agent ningnanmycin, a reference in the Chinese market. In addition, DTP directly interfered with the self-aggregation of the virus's coating proteins, preventing the

assembly of the viral structure. When applied to the leaves, it fragmented the viral particles and limited their multiplication.

The compound also activated plant defense mechanisms. It increased the production of antioxidant enzymes such as superoxide dismutase (1,83 times), catalase (2,73), peroxidase (3,69) and phenylalanine ammonia-lyase (4,84). These increases indicate activation of acquired systemic resistance, with accumulation of hydrogen peroxide and hypersensitivity response — an effective barrier against the spread of the virus in plant tissues.

The action of DTP was especially relevant in the first seven days after application,

with a gradual reduction in viral activity and normalization of oxidative stress levels by the 13th day. The prolonged effect suggests that the polysaccharide may function as a long-lasting resistance inducer, in addition to presenting low toxicity and being biodegradable.

From a structural point of view, DTP revealed a mixed configuration of ?- and ?-glycosidic bonds, with branches that favor its interaction with pathogens and plant cells. This complexity contributes to its ability to block infection and stimulate immune responses in the plant.

More information can be found at

doi.org/10.1016/j.pestbp.2025.106443

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STF rules that Rio Grande do Sul's law on pesticides is constitutional

Court rules that only requires federal registration for agricultural pesticides to be valid

08.05.2025 | 14:32 (UTC -3)

Dias Toffoli, rapporteur of ADI 6955

The Brazilian Supreme Federal Court (STF) confirmed the validity of Law 15.671/2021 of Rio Grande do Sul, which allows the sale of imported pesticides even without authorization for use in the country of origin. By majority, the ministers understood that the requirement is not necessary, as long as the products are registered with a federal agency and state registry. The decision was made in the trial of Direct Action of Unconstitutionality (ADI) 6955.

The lawsuit was filed by PT and PSOL. The parties claimed that the new rule weakens health and environmental protection. They also criticized the urgent processing of the bill and cited the risk of using substances banned in other countries.

For the rapporteur, Minister Dias Toffoli, there was no socio-environmental setback. According to him, the new law merely harmonizes state legislation with federal standards, which already regulate the use of pesticides. The judge emphasized that the products continue to be subject to federal registration and state control.

The rapporteur's vote was supported by ministers Alexandre de Moraes, Gilmar Mendes, Nunes Marques, André Mendonça, Luiz Fux and Luís Roberto Barroso. Cármen Lúcia, Flávio Dino, Cristiano Zanin and Edson Fachin voted against. They warned of possible negative impacts on the health of the population and the environment.

The decision maintains the current criteria and is of interest mainly to the agribusiness sectors. The Federation of Rice Growers Associations of RS (Federarroz) and chemical industry entities defended the law as a competitiveness measure.

Find out more by clicking on: "Parties contest the sale of imported pesticides in RS".

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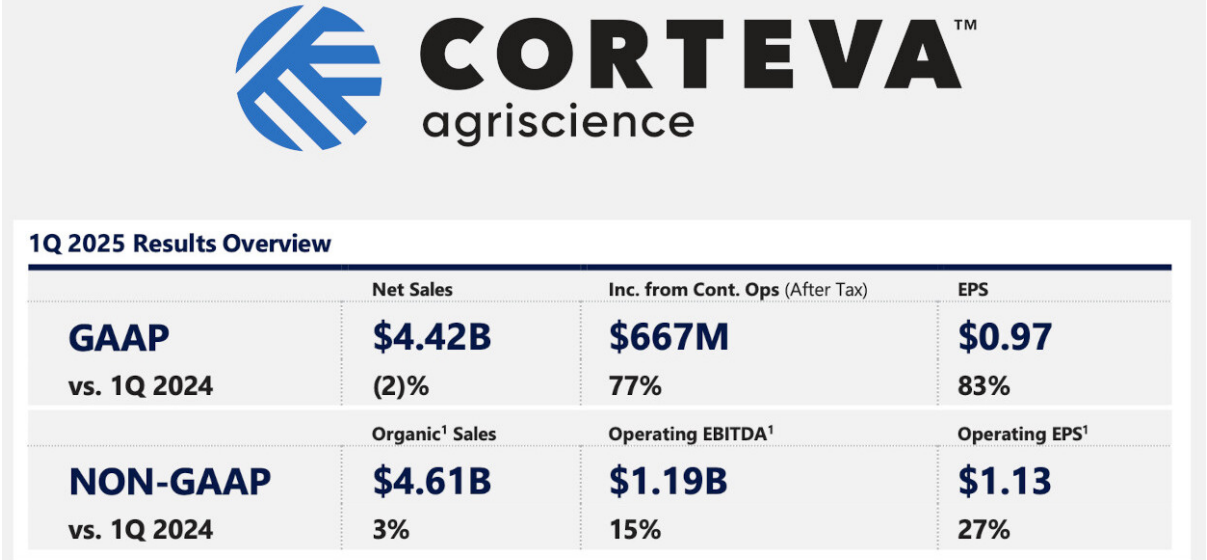
Corteva releases first quarter 2025 results

In the seed segment, revenue fell 2% to US$ 2,71 billion

07.05.2025 | 18:28 (UTC -3)

Cultivar Magazine



Corteva ended the first quarter of 2025 with net income of US$667 million, up 77% compared to the same period in 2024. Net revenue totaled US$4,42 billion, down 2%.

However, organic sales increased 3%, driven by technology and biologicals.

The positive performance allowed the company to reaffirm its targets for the year. Revenue projections remain between US$17,2 billion and US$17,6 billion. Adjusted earnings per share are expected to reach US$2,70 to US$2,95, representing double-digit growth. Corteva also intends to repurchase US$1 billion in shares.

In the seeds division, revenue fell 2% to US$2,71 billion. Volume grew 2% in North America, but fell in Latin America, where corn planted area shrank in Argentina. The appreciation of the dollar negatively impacted results in several regions.

In crop protection, sales fell 2%, but demand for new products and biologicals led to a 5% increase in volume. The division's operating margin rose 425 basis points, supported by cost cuts and productivity gains.

According to CEO Chuck Magro, the focus on operational discipline ensured margin gains and cost reduction. He highlighted the strength of the technology portfolio and the company's preparation for a still uncertain market environment.

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Quicke equipment makes heavy-duty field cleaning easier

QS hydraulic broom hits the market with a 394 L bucket and a width of 1,52 m

07.05.2025 | 16:38 (UTC -3)

Cultivar Magazine

During Agrishow 2025, Quicke highlighted its commitment to robust and versatile

solutions with the launch of the QS60 and QS72 line of hydraulic brooms. Compatible with all brands and models of skid steer loaders, the new equipment was designed to meet the different demands of civil construction and agriculture, with high performance, durability and easy maintenance.

Designed for heavy-duty services, QS brooms stand out for their hydraulic motor with relief valve, which guarantees maximum performance and extends the equipment's useful life. The model also draws attention for its high-quality bristles, available in polypropylene and mixed (poly + wire) versions, which offer efficiency in cleaning asphalt residues, parking lots, streets, poultry houses and agricultural terraces.

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The line also features a series of attributes focused on productivity: simplified maintenance, widely available spare parts and a structure designed to ensure high operational availability.

With a working width of 1,52 meters and a bucket volume of 394 liters, the models launched by Quicke combine robustness with high hydraulic performance, operating with a flow between 57 and 95 LPM and pressure of up to 241 bar.

Also check out the test drive that Cultivar Máquinas carried out with another Quicke product, the **V Series Front Loader**

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Citrosuco obtains US$25 million 'green' loan

Investment financed by Rabobank will be used to strengthen innovation and efficiency in the company

07.05.2025 | 15:05 (UTC -3)

Citrosuco, edition of Cultivar Magazine

Citrosuco announced it has secured a $25 million “green” loan from Rabobank. The

aim is to strengthen the company’s ESG (environmental, social and governance) commitments.

Among the indicators to be developed by 2030 are the expansion of water resilience capacity in periods of drought; increased development rates of the sustainable value chain for fruit certification; and the strengthening of actions aimed at Diversity, Equity and Inclusion.

Camila Anaici (pictured, left), Citrosuco’s Global Financial Manager, explains that the loan will be used in a five-year investment cycle, “ensuring Citrosuco’s leading role in transforming the value chain and generating a positive impact.”

For Orlando Nastri (pictured, right), Head of ESG at Citrosuco, the initiative

reinforces the company's commitment to practices that enhance sustainability. The same applies to Mário Ferreira (pictured, center), Director of Corporate Clients at Rabobank Brazil, who celebrates the operation by highlighting the company's progress in recent years and the positive long-term impacts.

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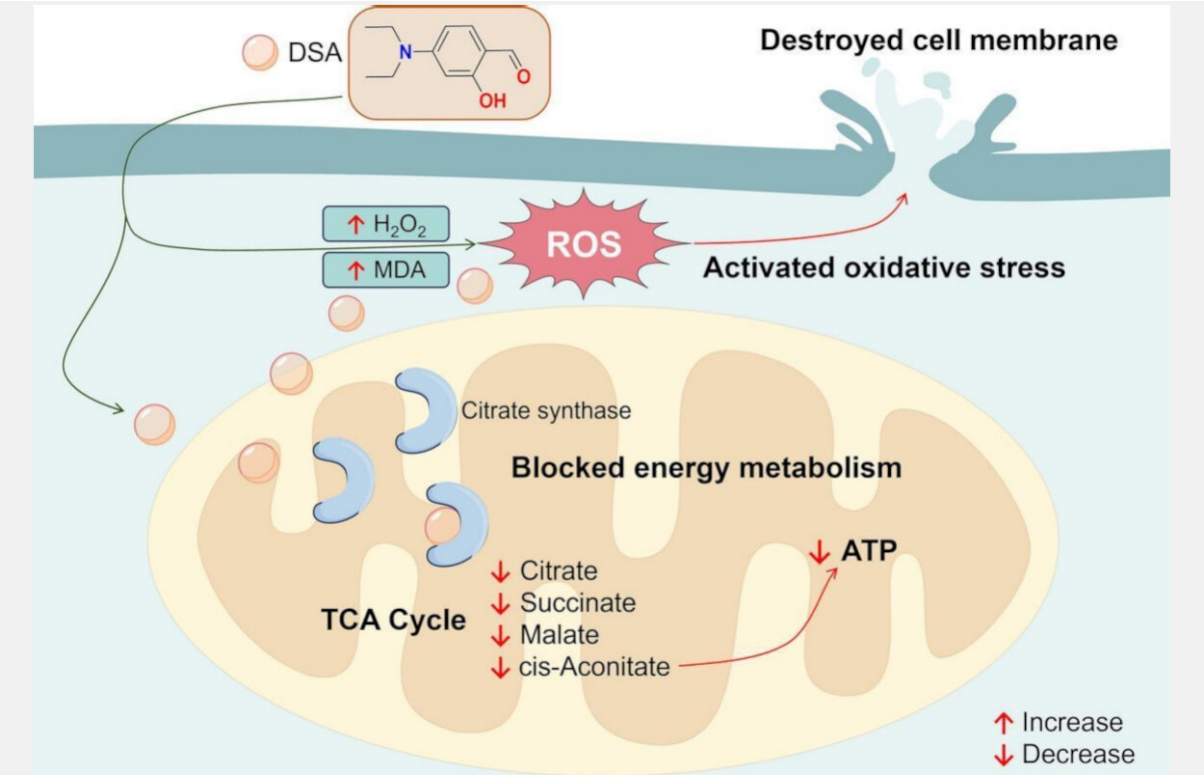
Natural biopesticide attacks the fungus Rhizoctonia solani

Study reveals that compound derived from Streptomyces inhibits the growth of Rhizoctonia solani

07.05.2025 | 14:58 (UTC -3)

Cultivar Magazine



The compound 4-(diethylamino)salicylade (DSA), isolated from the bacterium *Streptomyces* sp. KN37, demonstrated strong action against the fungus Rhizoctonia solani, a pathogen that affects more than 260 plant species and causes severe damage to crops such as rice, soybeans, cotton and cucumber.

The research demonstrated that DSA has an inhibition index (EC50) of 26,9 ?g/mL against the fungus, a value that indicates high efficacy. In laboratory tests, the compound drastically reduced mycelial growth, inhibited sclerotia germination and destroyed the cellular structure of the fungus.

DSA also outperformed carbendazim, a widely used synthetic fungicide. In a trial

with cucumber seedlings infected with *R.solani*, the natural compound guaranteed 58% control of the disease known as damping-off. Carbendazim, by comparison, showed 42% efficacy.

In addition to its agronomic efficacy, the study reveals details of DSA's mode of action. The substance acts in two main ways: by damaging the fungal cell membrane through the accumulation of reactive oxygen species (ROS) and by inhibiting the fungus' energy metabolism. To do this, the compound competitively binds to the enzyme citrate synthase, which is essential in the Krebs cycle. This interaction prevents the production of ATP, an energy vital for the fungus' survival.

Morphological analyses by optical, scanning and transmission electron microscopy revealed profound alterations in the structure of the treated mycelia. The cells presented damaged membranes, disorganized organelles and swollen mitochondria — typical signs of metabolic collapse. These observations were corroborated by transcriptomic and metabolomic analyses.

At the molecular level, DSA affected genes linked to oxidative processes, lipid metabolism and membrane integrity. The accumulation of hydrogen peroxide and malondialdehyde in the treated cells indicated intense oxidative stress. In response, the fungus activated antioxidant enzymes such as SOD, CAT and POD, but without success in neutralizing the toxic

effect.

Molecular simulation analysis confirmed the hypothesis that DSA occupies the same site as the oxaloacetate molecule in the citrate synthase enzyme. With greater binding affinity, the compound blocks the enzyme function, preventing the initiation of the energy production cycle.

More information can be found at
doi.org/10.1016/j.pestbp.2025.106444

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Study indicates production costs of 2nd corn crop in MS

Together, fertilizers and seeds represent almost 70% of crop costs

07.05.2025 | 14:54 (UTC -3)

Joélen Cavinatto

Photo: Wesley Santos

The Mato Grosso do Sul Soybean Producers Association (Aprosoja/MS)

released the production cost of the 2nd corn crop for 2024/2025. According to the survey, which considered all direct and indirect expenses of the activity, including fixed and variable costs, to produce one hectare of corn in a single cropping system, the farmer spent R$4.474,70, which corresponds to 89,49 bags per hectare. The calculations were made based on the estimated average productivity of 81 bags per hectare, and the average price of R$50,00 per 60-kilo bag.

The items with the greatest weight in crop costs were fertilizers, which correspond to 41,8% of the total, equivalent to 24,20 bags/ha, followed by seeds, responsible for 27,3% or 15,80 bags/ha, and insecticides, which represent 9,8%,

equivalent to 5,7 bags/ha, contributing significantly to the final cost composition.

In addition to inputs, the survey indicated administrative expenses, technical assistance, storage, transportation, interest and depreciation of machinery as components of the operational cost of the crop. The total cost also included the remuneration of the invested capital.

In areas with crop rotation, where corn is used to offset the costs of the soybean harvest, the cost per hectare drops to R$3.278,83 or 65,58 bags. However, fertilizers and seeds remain the main cost expenses, together representing 70% of the total, equivalent to 40 bags/ha.

“With each harvest, we see increasingly tighter profit margins, and this requires

farmers to have very efficient planning, management and decision-making skills. With our study, we have proven what most farmers know: producing corn in rotation with soybeans is more economically advantageous. In this model, the profit is 15,42 bags, while in the single system, the cost in bags per hectare exceeds the average productivity estimate," explains economist Mateus Fernandes from Aprosoja/MS.

The values ??disclosed are a state average, and to formulate individual costs, the peculiarities of each property must be considered.

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BRS 54 Lumiar grape cultivar reduces production costs in the Semi-Arid region

Developed by Embrapa, it requires less labor, offers high yields and does not require the payment of royalties.

07.05.2025 | 08:57 (UTC -3)

Photo: João Dimas Garcia Maia

Embrapa has launched BRS 54 Lumiar, a new seedless white grape cultivar validated for the Semiarid region. Developed in the “Uvas do Brasil” program, the variety reduces labor costs in handling bunches by up to 50%. It is a response to the scarcity of national seedless white grape varieties adapted to the climate of the Northeast.

Lumiar has large, crunchy berries with a high sugar content, balanced acidity and no astringency. Average productivity is between 20 and 22 tons per hectare per harvest. As it does not require the payment of royalties per kilo sold, the producer only bears the cost of the seedlings.

With less thinning requirements, the cultivar makes management easier and helps to contain one of the main costs in the sector, which can represent up to 35% of production in traditional varieties. The savings reach both small producers and large companies.

Lumiar will be distributed by licensed nurseries. Reservations for planting in 2025 have already begun. The Petromudas nursery in Petrolina (PE) is leading the supply. Interested producers can also access Embrapa's notices in Santa Catarina.

The new variety was tested by 12 companies in four municipalities in the São Francisco Valley. According to producer and consultant Newton Matsumoto, the

grape combines productivity, flavor and commercial appearance.

Inspired by the moonlight of the Northeast, the name Lumiar refers to the greenish color of the berries. The cultivar was born from crosses that began in 2010, at Embrapa's Tropical Viticulture Station in Jales (SP).

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Attacks on corn by Spodoptera frugiperda require management

By Luisa Laila Sousa da Silva, from the Santa Isabel II Farm

06.05.2025 | 16:23 (UTC -3)

Damage caused by S. frugiperda in corn occurs in both the vegetative and reproductive phases of the plant.

Spodoptera frugiperda, popularly known as the fall armyworm, is a lepidopteran insect that, in its larval stage, is considered the

main cause of damage to various crops, especially corn.

Originating in North America, the fall armyworm has easily adapted to the tropical climate, a factor that favors its proliferation. As it is a polyphagous insect, it has the capacity to cause damage to a wide range of crops. There are approximately 150 species susceptible to attack by *S. frugiperda*, with emphasis on corn (*zea mays* L.). Among the most harmful pests to the species, the insect stands out for feeding on the plant in all its stages of development, which can cause high losses, depending on the cultivar and also the environment.

Several plant species can act as hosts for *S. frugiperda*, among them, soybeans (

Glycinemax) - which is the most abundant legume in Brazilian agribusiness, and can play a fundamental role in the proliferation of insects when control is not carried out correctly. Corn is often grown in succession to soybeans, thus facilitating the spread of the fall armyworm in its more susceptible host. Considering that the damage caused to corn can reach approximately 39% of production, it is extremely important to control the pest in host plants.

Life cycle and characteristics

Spodoptera frugiperda It is linked to the order Lepidoptera, which includes butterflies and moths. Its life cycle consists of four phases: egg, larva (which has different characteristics at the beginning and end of the phase), pupa and adult.

The eggs of *S. frugiperda* They are laid on corn leaves, preferably at night. A female can lay between 150 and 350 eggs and has up to 13 clutches during her life cycle.

In terms of color, immediately after laying they are light green, after 12 hours they turn orange, and darken even more as they approach hatching.

Incubation lasts a maximum of four days, however, it can be reduced to half that time in high temperature environments, as high temperatures are a factor capable of accelerating the maturation of eggs.

The larvae immediately feed on the shells of newly hatched eggs and then attack the plant. This phase lasts between 14 and 23 days and consists of six or seven larval instars. The color of the larva also varies, from light green in the first instars to brown as the pupal stage approaches.

It is in the larval stage that the visual identification of *S. frugiperda* It becomes

easier, since it has its own apparent characteristics. The corn earworm has an inverted “Y” on its forehead and black dots arranged in a square shape at the end of its abdomen. The larvae have three pairs of legs in the thorax region and five pairs of false legs on the abdomen.

After all larval stages have passed, the pupal stage occurs, which lasts between six and 55 days, under the influence of temperature. The pupa is reddish-brown in color and, at this stage, can be found among the corn husks, on the leaves, but mainly on the soil.

Adults are moths that emerge at different times, depending on the length of the pupal phase. Females are grayish-brown in color and males are dark gray. These

insects are highly mobile, measure approximately four centimeters, and this phase lasts an average of 12 days.

Attack symptoms

There are reports of the presence of fall armyworm in almost all cultivated areas in Brazil, however, its damage has been reduced with the use of treated and/or genetically modified seeds, with the implementation of integrated pest management (IPM), chemical and biological control.

The damage caused by *S. frugiperda* in corn, they occur both in the vegetative and reproductive phases of the plant. Initially, the caterpillars scrape the leaves, leaving them transparent. The leaves are mainly responsible for photosynthesis. Compromising the leaf area can lead to a decrease in productivity or even the death of the plant.

When it reaches a higher stage of development, the caterpillar begins to feed on the corn plant cartridge, which is located between the stem and the ear, and serves as a support base for the ear.

In the reproductive phase, damage can occur in the leaf area, such as where the ear is inserted into the plant, which can prevent the grains from filling completely or cause the ear to fall. On the ear, the attack initially occurs at the tip where the stigmas are located, which are the corn's “hairs” responsible for carrying the pollen grain to the plant's ovule.

Control in focus

We hear a lot about the most common pest control methods in agriculture.

Integrated pest management (IPM), with its most powerful tools, which puts into practice a set of actions - such as cultural control, mechanical control, chemical control, use of seeds of resistant varieties and/or cultivars - is often cited as a combatant against pest attacks. *S. frugiperda* in corn. In this context, with the increased search for efficient, highly durable products that cause less damage to the environment, biological products also emerged, which were added as tools within integrated management.

In view of the importance of *S. frugiperda* As it causes damage to various crops, it is essential to adapt control measures to each plant species, but also to the needs of the producer, since the investment may be expensive and inappropriate for certain

situations.

Per* **Luisa Laila Sousa da Silva, *from the Santa Isabel II Farm*

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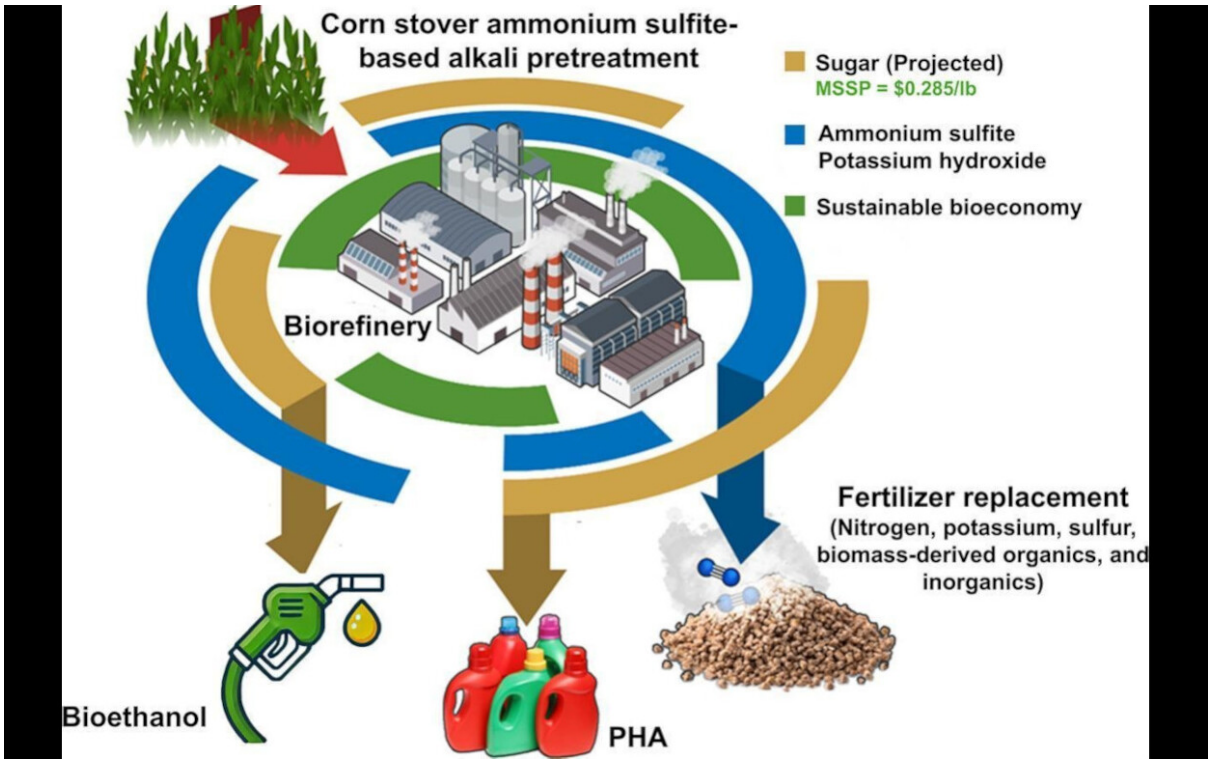
New method turns corn straw into sugar and fertilizer at a lower cost

Researchers develop alkaline pretreatment without chemical recovery that increases yield

06.05.2025 | 16:12 (UTC -3)



A new process for transforming agricultural waste into fermentable sugars and fertilizer

could reduce costs and increase sustainability in bioenergy production. Scientists from universities and laboratories in the United States have tested a pretreatment of corn stover using a combination of potassium hydroxide (KOH) and ammonium sulfite (AS), without the need for subsequent chemical recovery.

The method achieved yields of over 95% in sugar production and demonstrated the agronomic effectiveness of the residual liquor as a fertilizer rich in potassium, nitrogen and sulfur.

The research showed that treatment with 40% KOH and 15% AS at 80°C for two hours removed almost 79% of the lignin and more than 82% of the acetylated

groups from the biomass. The treated straw showed high enzymatic digestibility, with a total sugar yield of more than 87,5% in 120 hours of hydrolysis. The process also eliminated the need for effluent treatment, since the residual liquor can be used directly in the soil.

The liquid residue contains organic and inorganic compounds, including sulfonated lignin, which facilitates enzymatic hydrolysis by reducing non-productive enzyme adsorption.

The remaining chemically modified lignin has potential for agricultural use, acting as a soil conditioner and slow releaser of nutrients. Greenhouse trials with corn have shown that the liquor effectively replaces commercial potassium and sulfur

fertilizers, maintaining or increasing plant biomass.

The estimated minimum cost of selling the sugar produced was US$0,285 per pound, a value considered competitive compared to conventional processes that require chemical recovery. The economic analysis took into account the reuse of the liquor as fertilizer, reducing operating costs and environmental impacts. The residual liquor, because it contains phenols and lignin derivatives, can also be used in the polymer, food and pharmaceutical industries.

The combined use of KOH and AS creates an alkaline environment that favors the breaking of bonds between lignin and carbohydrates, in addition to promoting

low-temperature sulfonation reactions. Unlike acid treatments that degrade hemicelluloses, the method preserves xylan, generating more xylose. The retention of sugars and the efficiency of enzymatic hydrolysis make the process ideal for biorefineries that aim to produce ethanol, organic acids or bioplastics.

The fermentation of the sugars obtained was validated with the genetically modified bacterium Pseudomonas putida. The yield of polyhydroxyalkanoate (PHA), a biopolymer of industrial interest, reached 0,072 grams per gram of glucose consumed — efficiency equivalent to that obtained with commercial glucose. This indicates that the sugars obtained are viable as raw material for fermentation processes on an industrial scale.

The mass balance of the operation with 100 kg of corn straw showed the production of 50,9 kg of fermentable sugars and 15,8 kg of lignin in the residual liquor. The process fully utilizes the biomass components, without generating toxic waste or requiring complex purification steps.

Based on the results obtained, the study proposes the implementation of the process in integrated biorefineries, focused on the production of biofuels and biofertilizers.

More information can be found at
doi.org/10.1016/j.biortech.2025.132402

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Adama announces new Business Director for Cerrado Leste

Rogério de Castro takes on the role with a focus on team management and strengthening partnerships

06.05.2025 | 16:04 (UTC -3)

Cláudia Santos, Cultivar Magazine edition

Adama has appointed Rogério Ferraz de Castro (pictured) as Business Director for

the Cerrado Leste region. He took office on May 1. The executive now reports directly to Romeu Stanguerlin, EVP Brazil, and is primarily responsible for leading Adama’s commercial strategy in the region, which includes the states of Maranhão, Piauí, Tocantins, western Bahia, Goiás and northern Minas Gerais, managing the team and strengthening partnerships with local producers and distributors.

The move is in line with the company's strategy of valuing internal development and recognizing talent. With 15 years of experience in the agribusiness sector, Castro has worked at Adama for 11 years, and previously held the position of regional manager in Franca (SP).

He holds a degree in Agronomy from the Centro Superior de Ensino e Pesquisa de Machado (MG) and an MBA in Marketing Management from Universidade Vale do Rio Verde (MG). "I am taking on this new challenge with the commitment to contribute to strengthening Adama's presence in the Cerrado Leste region. We will remain focused on offering solutions that meet the needs of producers and building solid partnerships that drive sustainable growth in the sector," he says.

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Caterpillar infestation challenges control in corn and cotton crops

Expert warns of insecticide failures and increased costs in combating Spodoptera frugiperda in regions of GO, MT and MS

06.05.2025 | 10:39 (UTC -3)

Cultivar Magazine, based on information from Fernanda Campos

The scenario of caterpillar infestations in crops corn e cotton was described as

“chaotic” by researcher Germison Tomquelski. He refers to those in Goiás, Mato Grosso and Mato Grosso do Sul. Linked to the consultancy Desafios Agro, based in Chapadão do Sul, the researcher points out increasing flaws in the efficiency of insecticides, including molecules considered premium.

According to Tomquelski, chemical control, which previously guaranteed more than 80% effectiveness, now requires additional applications and the use of mixtures with biological products. Spodoptera frugiperda leads the concerns. The extra cost of insecticides on corn can reach 10%, just to control caterpillars, without considering other pests such as leafhoppers, aphids and stink bugs.

In the Chapadão region, crop management requires 80 to 100 bags per hectare, compared to an average productivity of between 130 and 160 bags/ha. “Even with a good harvest, investment increased and so did the risk. This cost with caterpillars exceeds the planned amount,” he says.

The researcher recommends rapid action on crops, focusing on small caterpillars and the combined use of chemicals and biologicals. Baculoviruses, according to him, act as protectors of chemicals and help maintain the effectiveness of management.

In cotton, the pressure of *spodoptera* has also intensified. Weather conditions favorable to the pest can compromise productivity, despite the increase in area in recent years. Producers who planned two

applications now make up to eight.

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2025 coffee harvest expected to break record in year of low biennial yields, says Conab

Production is expected to grow by 2,7% and reach 55,7 million bags, driven by a strong recovery in conilon

06.05.2025 | 10:13 (UTC -3)

Cultivar Magazine

Even with the negative biennial, the Brazilian coffee harvest in 2025 is expected to reach the highest volume ever recorded in years of low productivity. The estimate is 55,7 million processed bags, an increase of 2,7% compared to 2024, according to the 2nd survey released by Conab.

Conilon is driving growth. Production is expected to reach 18,7 million bags, representing a 28,3% increase in productivity. Espírito Santo is responsible for 13,1 million bags, benefiting from regular rainfall in the north of the state. In Bahia, production is expected to grow by 28,2%, reaching 2,5 million bags, surpassing Rondônia, which projects 2,28 million.

Arabica coffee, which is more sensitive to biennials, is expected to fall by 6,6%, with an estimated harvest of 37 million bags. In Minas Gerais, the largest producer of the variety, the projected drop is 7,4%, totaling 25,65 million bags. The reduction is attributed to long dry periods in 2024 and the slower vegetative recovery of crops.

In São Paulo, adverse weather conditions and biennial harvesting caused a 3,8% drop in productivity. However, the 5,3% increase in the cultivated area should ensure a slight increase of 1,3% in production, reaching 5,5 million bags.

The total area dedicated to coffee growing increased by 0,8%, reaching 2,25 million hectares. While the area in production fell by 1,4%, the area in formation increased by 12,3%, which reinforces the trend of

renewing coffee plantations in years of low biennial yields.

TABELA 1 – COMPARATIVO DE ÁREA EM PRODUÇÃO, PRODUTIVIDADE E PRODUÇÃO DE CAFÉ TOTAL (ARÁBICA E CONILON) NO BRASIL

Região/UF	ÁREA EM PRODUÇÃO (ha)			PRODUTIVIDADE (scs/ha)			PRODUÇÃO (mil sacas beneficiadas)		
	Safra 2024 (a)	Safra 2025 (b)	VAR. % (b/a)	Safra 2024 (c)	Safra 2025 (d)	VAR. % (d/c)	Safra 2024 (e)	Safra 2025 (f)	VAR. % (f/e)
NORTE	**40.333,6**	**42.412,2**	**5,2**	**52,4**	**54,4**	**3,8**	**2.112,5**	**2.306,6**	**9,2**
RO	39.805,0	41.622,0	4,6	52,6	54,8	4,2	2.093,7	2.280,9	8,9
AM	528,6	790,2	49,5	35,6	32,5	(8,6)	18,8	25,7	36,7
NORDESTE	101.375,0	102.435,0	1,0	30,3	35,9	18,7	3.067,4	3.679,5	20,0
BA	101.375,0	102.435,0	1,0	30,3	35,9	18,7	3.067,4	3.679,5	20,0
Cerrado	5.200,0	6.000,0	15,4	43,0	41,0	(4,7)	223,6	246,0	10,0
Planalto	51.845,0	50.245,0	(3,1)	17,2	18,6	7,8	893,2	933,5	4,5
Atlântico	44.330,0	46.190,0	4,2	44,0	54,1	23,0	1.950,6	2.500,0	28,2
CENTRO-OESTE	**17.578,0**	**17.341,0**	**(1,3)**	**29,8**	**27,4**	**(8,0)**	**524,0**	**475,4**	**(9,3)**
MT	11.606,0	11.825,0	1,9	23,1	22,4	(3,0)	268,4	265,3	(1,2)
GO	5.972,0	5.516,0	(7,6)	42,8	38,1	(11,0)	255,6	210,1	(17,8)
SUDESTE	**1.692.539,0**	**1.663.152,0**	**(1,7)**	**28,2**	**29,1**	**3,1**	**47.753,3**	**48.381,1**	**1,3**
MG	1.103.544,0	1.075.565,0	(2,5)	25,5	24,3	(4,7)	28.097,2	26.094,0	(7,1)
Sul e Centro-Oeste	547.083,0	517.832,0	(5,3)	24,7	23,9	(3,1)	13.489,7	12.373,6	(8,3)
Triângulo, Alto Paranaiba e Noroeste	195.258,0	197.645,0	1,2	27,4	26,4	(3,9)	5.356,8	5.210,2	(2,7)
Zona da Mata, Rio Doce e Central	332.667,0	330.988,0	(0,5)	25,1	23,0	(8,4)	8.355,0	7.615,1	(8,9)
Norte, Jequitinhonha e Mucuri	28.536,0	29.100,0	2,0	31,4	30,8	(2,0)	895,7	895,1	(0,1)
ES	391.351,0	379.822,0	(2,9)	35,4	43,1	21,8	13.865,0	16.389,0	18,2
RJ	11.503,0	11.740,0	2,1	30,1	32,5	8,0	346,5	382,0	10,2
SP	186.141,0	196.025,0	5,3	29,2	28,1	(3,8)	5.444,6	5.516,1	1,3
SUL	**25.281,0**	**25.488,0**	**0,8**	**26,7**	**27,9**	**4,6**	**675,3**	**711,9**	**5,4**
PR	25.281,0	25.488,0	0,8	26,7	27,9	4,6	675,3	711,9	5,4
OUTROS (*)	**4.067,0**	**4.604,0**	**13,2**	**20,3**	**26,2**	**28,8**	**82,6**	**120,4**	**45,8**
NORTE/NORDESTE	**141.708,6**	**144.847,2**	**2,2**	**36,6**	**41,3**	**13,1**	**5.179,9**	**5.986,1**	**15,6**
CENTRO-SUL	**1.735.398,0**	**1.705.981,0**	**(1,7)**	**28,2**	**29,1**	**3,0**	**48.952,6**	**49.568,4**	**1,3**
BRASIL	**1.881.173,6**	**1.855.432,2**	**(1,4)**	**28,8**	**30,0**	**4,1**	**54.215,1**	**55.674,9**	**2,7**

LEGENDA: (*) ACRE, PARÁ, CEARÁ, PERNAMBUCO, MATO GROSSO DO SUL E DISTRITO FEDERAL

ESTIMATIVA EM MAIO/2025.

Comparison of production area, productivity and total coffee production (arabica and conilon) in Brazil

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Mite Tetranychus urticae attacks coffee plants in Espírito Santo

Unprecedented presence of the pest in coffee plantations interplanted with papaya trees raises alert about risks of intercropping

06.05.2025 | 08:27 (UTC -3)

Cultivar Magazine

Mites in different stages of development on the back of young coffee leaves - photo: Raphael Castilho/USP

In northern Espírito Santo, coffee producers face an unusual problem. The two-spotted spider mite, Tetranychus urticae, a pest known for attacking papaya trees, has also started to cause damage to coffee plants (*Coffea canephora*) grown in consortium with papaya.

This association, common in the initial phase of the crop, ceased to be just a shading and income diversification strategy. It became a bridge for the infestation of a pest that, until then, had not caused direct damage to the coffee.

The attack was recorded in areas of Boa Esperança, in the north of Espírito Santo. Young coffee seedlings presented deformed, necrotic leaves that were falling

off prematurely. Dense web-like tissues, produced by the mite, covered the underside of the leaves.

The researchers estimated that up to 30% of the plants in one of the fields were infested. Although the economic damage was not measured, the impacts could be serious because they occur during a sensitive period of plant development.

T. urticae It is a polyphagous pest, already reported in hundreds of plant species. In Brazil, it is one of the main phytosanitary problems in papaya crops. Its control requires care, as the excessive use of acaricides tends to eliminate natural enemies, which further favors its proliferation.

Until this study, there were only sparse historical records of the mite in coffee outside of Brazil — such as in Hawaii, back in the 19th century. In general, the pest attacks are concentrated on older, already formed leaves, where the tissue is easier to pierce.

In Espírito Santo, however, the behavior was different: the mite began colonizing directly on young leaves, causing malformations, which suggests recent and worrying adaptation to the host plant.

Intercropping aims to shade coffee plants during their growth - photo: Raphael Castilho/USP

The authors point to the physical proximity between infested papaya trees and developing coffee trees as a decisive factor. In typical intercropping, the papaya tree is planted first and partially covers the coffee tree. This provides shade — beneficial for the plant's initial growth — but also shelters the mites, which prefer

areas with less ultraviolet radiation. Migration of adults or eggs can occur easily, especially when contaminated papaya leaves are placed on coffee seedlings.

Furthermore, studies indicate that the adaptation of *T. urticae* to new hosts can occur rapidly, especially when different crops are grown in close proximity. This evolutionary process, which is not yet fully understood, poses a risk to other plant species involved in intercropping systems.

The practice of intercropping coffee and papaya aims to reduce costs, optimize land use and anticipate revenues. However, the presence of the mite in an unusual plant requires a review of integrated management measures. The

introduction of pests into new hosts usually generates more complex and costly control cycles.

This is not the first case where co-cropping with papaya has resulted in unexpected damage. Significant infestation of *Tetranychus bastosi* in cowpea intercropped with papaya, in Petrolina (PE). In isolation, the bean rarely suffers attacks of this magnitude.

More information can be found at

doi.org/10.24349/v72j-1ago

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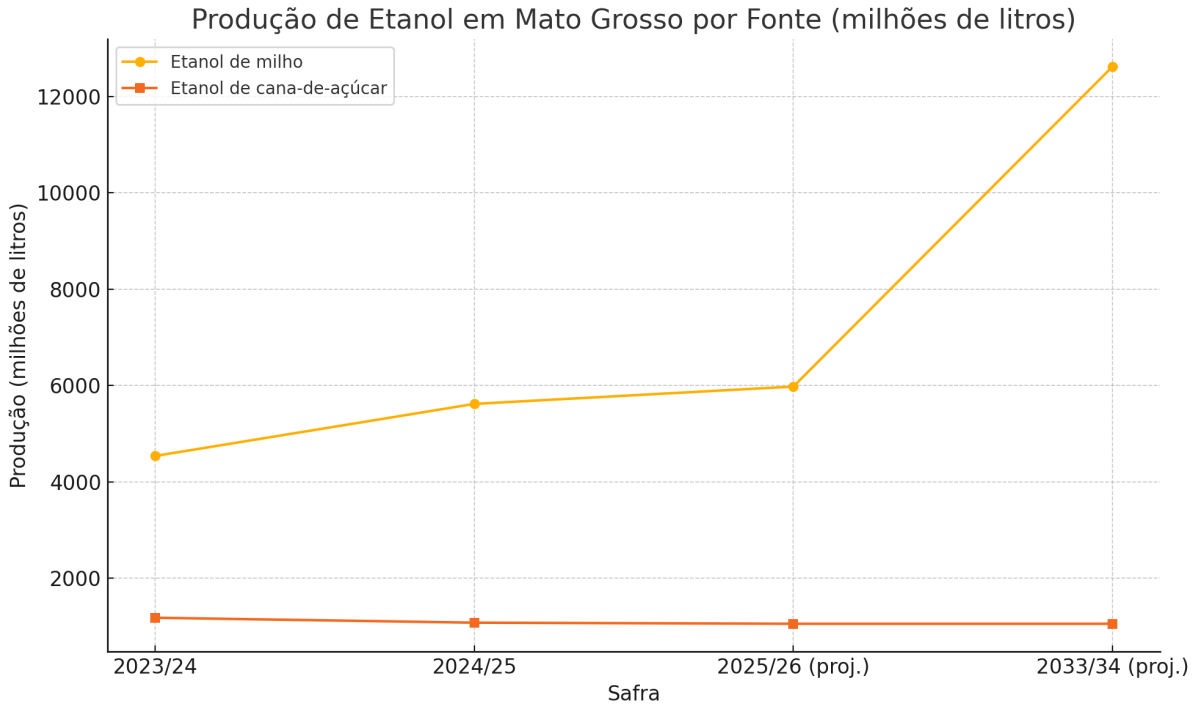
Mato Grosso consolidates leadership in corn-based ethanol production

State grows 17% in the 2024/25 harvest, accounts for 68% of the country's corn ethanol and projects new expansion with the entry of plants

06.05.2025 | 07:52 (UTC -3)

Cultivar Magazine



Mato Grosso has established itself as the second largest national ethanol producer, behind only São Paulo. The state reached 6,70 billion liters in the 2024/25 harvest, with growth of 17% compared to the previous cycle. The increase exceeds the national average of 3,65% and guarantees the state the largest percentage increase among the five main producers in the country.

The data was released by the Federation of Industries of Mato Grosso (Fiemt) and the Union of Bioenergy Industries (Bioind-MT). The superintendent of the Famato System, Cleiton Gauer, presented the Panorama of the 2024/25 Harvest, prepared by the Mato Grosso Institute of Agricultural Economics (Imea).

Corn ethanol drove growth. Production reached 5,62 billion liters, an increase of 23,77%. Grain milling increased from 10,11 to 12,50 million tons. Mato Grosso accounted for 68% of the national production of cereal ethanol.

Co-products also grew. DDG/DDGS production increased by 28,28%, totaling 2,72 million tons. Corn oil increased by almost 30%, reaching 257,5 thousand tons.

Sugarcane ethanol declined. Production fell 8,63%, closing at 1,08 billion liters. Milling decreased 2,37%. Sugar production, however, grew 6,21%, reaching 571,1 thousand tons.

For the 2025/26 harvest, the projection is for a new increase. Total production

should grow by 5%, totaling 7,03 billion liters. Corn ethanol should reach 5,98 billion, driven by two new plants and an estimated crushing of 13,3 million tons. Sugarcane ethanol should fall by 2,10%.

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Cover crops increase soybean productivity

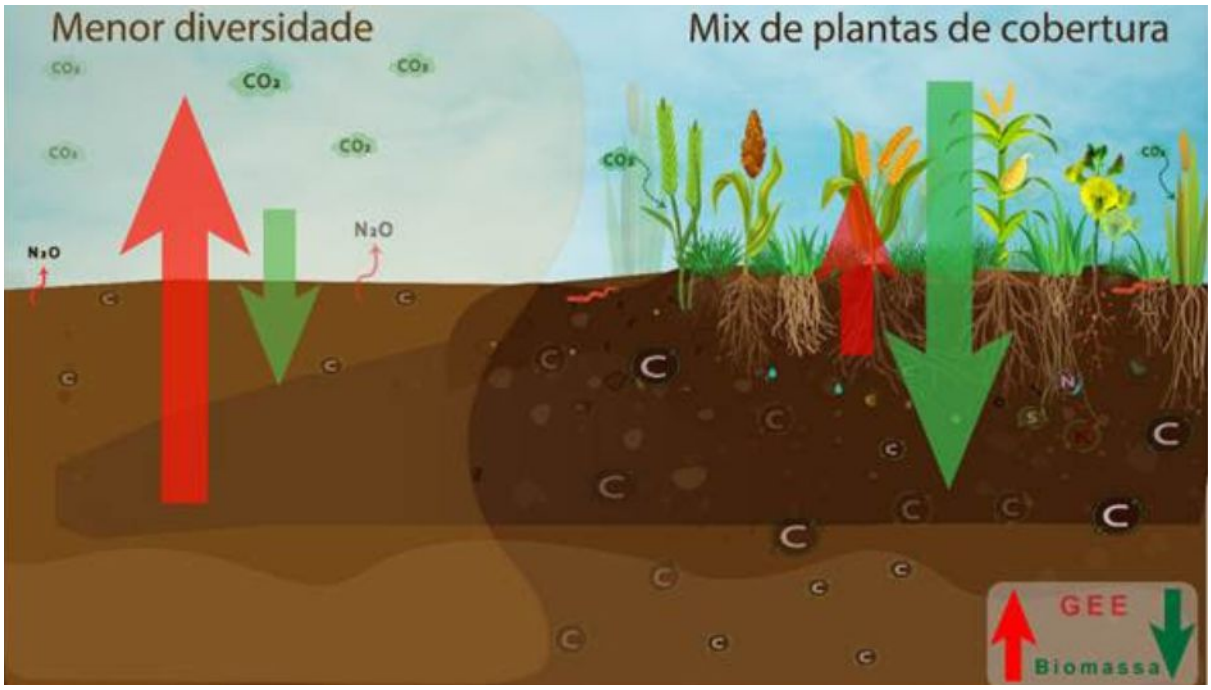
Study in the Cerrado shows an increase in soil carbon and an improvement in crop health and stability

05.05.2025 | 16:06 (UTC -3)

Angela Trabbold, Cultivar Magazine edition

Research conducted in soybean cultivation areas in Rio Verde (GO) and Rondonópolis (MT) shows that the use of cover crops, such as brachiaria, crotalaria and millet, significantly improves soil health, carbon sequestration and agricultural productivity in the Cerrado. The study is led by PhD student Victória Santos Souza, from Esalq/USP, with support from the Center for Research and

Innovation in Greenhouse Gases (RCGI).



The experiments indicate that more diverse systems, with consortia between grasses and legumes, increased carbon stocks by up to 19%, increased soil health by 13% and soybean productivity by 11%, compared to conventional systems such as soybean-corn or soybean-fallow. The high biomass production of the species used also promotes benefits such as

greater water retention and reduced impact from climate extremes.

The research reinforces the importance of sustainable agricultural practices in the Cerrado, which is responsible for almost half of the country's soybean area and also leads in greenhouse gas emissions. The work seeks to contribute data for calculating the carbon balance in agriculture and offer viable alternatives to mitigate the effects of climate change.

Access the Practical Guide to Cover Plants prepared by Esalq-USP:
doi.org/10.11606/9786587391618

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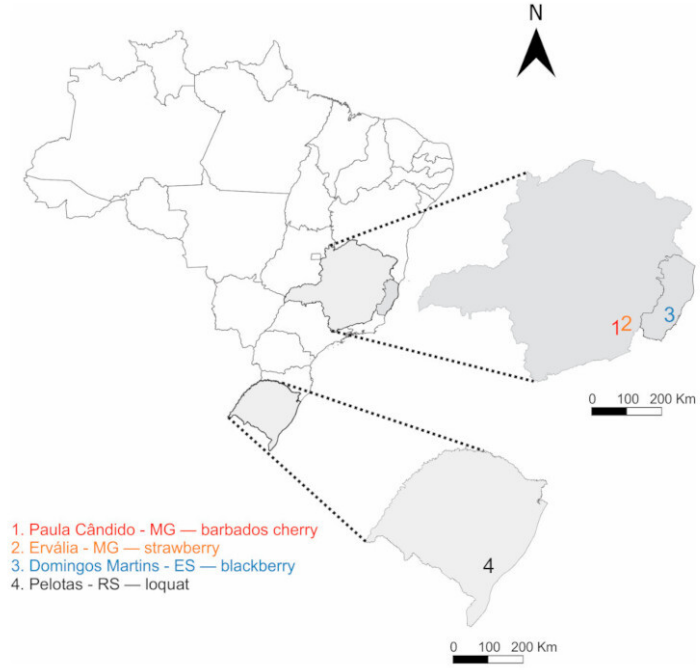
Resistant Drosophila suzukii threatens production in Minas Gerais

Study identifies resistance to the insecticide imidacloprid in a population in the Zona da Mata region of Minas Gerais

05.05.2025 | 07:22 (UTC -3)

Cultivar Magazine



A lineage of Drosophila suzukii presents high resistance to the insecticide imidacloprid in the municipality of Paula Cândido, in Minas Gerais. The conclusion is based on a study by researchers from the Federal University of Viçosa (UFV).

d.suzukii It is capable of infesting strawberries, grapes, figs, peaches, plums, among other fruits. It differs from other drosophila in that it lays its eggs on fruits that are still intact, which causes direct losses to the crop.

There are few studies on insecticide resistance in this species in the Neotropical region. The UFV research, led by Felipe Andreazza and Eugenio Oliveira, fills this gap by evaluating populations of the fly collected in three states in

southeastern Brazil and exposed to four active ingredients: deltamethrin, permethrin, spinetoram and imidacloprid.

Among the samples analyzed, only the Paula Cândido population demonstrated significant resistance. Even when exposed to a dose ten times higher than the average lethal concentration of imidacloprid, mortality was below 54%. This result contrasts with the other populations tested, including one from Ervália, just 24 km away, which showed complete susceptibility.

The observed resistance is associated with the presence of detoxification enzymes, especially those of the cytochrome P450 family. When resistant individuals were previously treated with piperonyl butoxide,

an inhibitor of this enzyme, mortality increased, which confirms the role of these metabolic mechanisms in the phenomenon.

The researchers' hypothesis is that the intensive and frequent use of neonicotinoids in the region, mainly in coffee and guava cultivation, is putting pressure on the selection of resistant individuals. In crops such as guava, imidacloprid-based insecticides are applied biweekly, and there are records of the survival of *d.suzukii* in decaying coffee fruits, which can act as a temporary shelter for the pest outside the main harvest.

The study recommends rotating active ingredients with different modes of action, continuous monitoring of resistance and

rational use of insecticides. The adoption of practices such as biological control, use of attractive traps and cultural management should gain prominence to reduce dependence on chemicals and maintain the effectiveness of existing products.

The resistance identified in Paula Cândido remains even after eight generations of the pest created in the laboratory without exposure to the insecticide, which suggests that the trait is well established in that population. The spread of individuals with this genetic profile could compromise control in other fruit-producing regions.

More information can be found at
doi.org/10.3390/insects16050494

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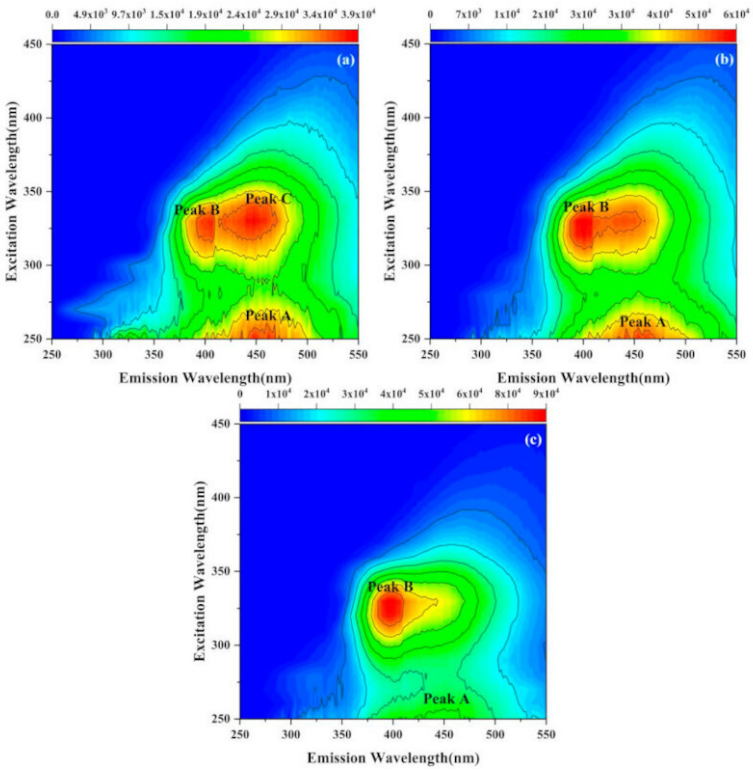
Prolonged cultivation reduces imidacloprid retention in citrus soil

Chinese research shows that soils in old orchards accumulate more organic matter, but lose efficiency in fixing insecticides

04.05.2025 | 16:35 (UTC -3)

Cultivar Magazine



Three-dimensional fluorescence spectra of dissolved organic matter in different planting years: (a) 50 years; (b) 30 years; (c) 10 years

Increasing crop age in citrus groves may compromise the soil’s ability to retain the insecticide imidacloprid (imidacloprid, CAS 38261-41-3, IRAC 4A), according to a study conducted by scientists at Jiangxi Agricultural University, who analyzed soils that had been under continuous cultivation for 10, 30 and 50 years in red soil regions in southern China. The researchers used advanced spectroscopic techniques to understand the interactions between the insecticide and dissolved organic matter (DOM) in the soil.

Over the years, the soil in these orchards has accumulated more organic matter. The content has increased by almost 58% over the course of five decades. This accumulation is a reflection of the decomposition of plant residues and the

action of microorganisms stimulated by fertilization.

However, the older the orchard, the lower the affinity between the soil and imidacloprid. This is due to the increasing complexity of the organic molecules, which become larger and more aromatic, making it difficult to adsorb the pesticide.

The research found that imidacloprid interacts preferentially with fractions of dissolved organic matter similar to fulvic acids. These compounds have a high capacity for electronic exchange and carboxylic groups that favor binding with the insecticide. As soils age, these fractions decrease proportionally. Humic acids, more abundant in old orchards, demonstrated lower binding efficiency.

Another important factor is soil pH. According to scientists, with the constant application of nitrogen fertilizers, the soil became more acidic over time. The pH dropped from 4,83 in younger orchards to 4,08 in 50-year-old orchards. This acidification contributes to the chemical transformation of organic matter, making it less likely to form complexes with the insecticide.

Even with more dissolved organic matter present, older soils retained less imidacloprid. This phenomenon, described by the authors as a “quantity–quality paradox,” shows that greater availability of organic matter does not translate into greater adsorption capacity. The adsorption coefficient normalized by organic carbon (Koc) decreased as the soil

aged.

Fluorescent analyses also revealed structural changes in organic matter. In older soils, new fractions associated with microbial byproducts emerged. These fractions behaved differently during binding with the pesticide.

Furthermore, tests showed that the most reactive functional groups, such as hydroxyls and amines, become less available after decades of cultivation, reducing the formation of stable complexes.

The order of interaction between dissolved organic matter and the insecticide was also observed. First, imidacloprid binds to fulvic fractions. Then, to humic fractions. Finally, to protein fractions. This sequence

reinforces the idea that soils richer in humic fractions — typical of old orchards — have lower retention efficiency.

More information can be found at

mdpi.com/2077-0472/15/9/997#

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*The **Cultivar Semanal** magazine is a technical and scientific publication focused on agriculture in Brazil.*
It was designed to be read on mobile phones.
It is published on Saturdays.

Grupo Cultivar de Publicações Ltda.

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