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N° 80

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**Phytophagous
bugs on
the rise**

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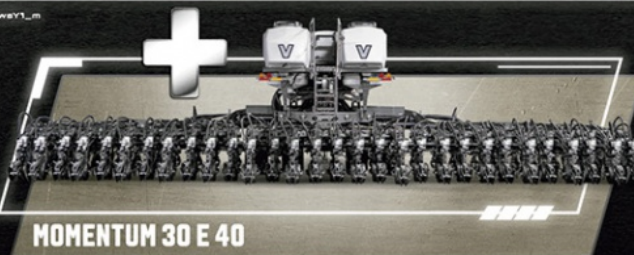
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Bed bugs are increasing their impact on crops worldwide

International scientific review warns of the spread of bed bugs and the risk of resistance to pesticides

22.05.2026 | 09:36 (UTC -3)

Schubert Peter, Cultivar Magazine



Photo: Susan Ellis, Bugwood

Phytophagous stink bugs and related species of the superfamily Pentatomoidea have expanded their impact on agricultural crops in various regions of the world. This expansion stems from rising temperatures, the continuous supply of host plants in diversified agricultural systems, the overuse of insecticides, and the international trade of plant products, according to a scientific review. The study compiles information on pests affecting soybeans, corn, cotton, rice, wheat, fruits, vegetables, and other crops.

Researchers state that managing these species requires a change in strategy. Chemical control still occupies a central position in many systems. However, reliance on broad-spectrum insecticides has increased environmental risks,

reduced natural enemies, and favored the selection of resistant populations. The review points to biological control with egg parasitoids as one of the tools with the greatest potential for expansion. It also cites semiochemicals, botanical insecticides, RNAi, CRISPR, modified biological agents, and monitoring and forecasting technologies as future components of management.

Pentatomids and related groups damage plants through direct feeding. Adults and nymphs insert their stylets into plant tissues and extract fluids. The injury causes loss of turgor, deformation, seed and fruit abortion, and delayed maturation. The damage affects the quality and appearance of grains, fruits, and

seedlings. In some cases, feeding favors the transmission of viruses, phytoplasmas, bacteria, and fungi.

South America

In South America, the review highlights the importance of the green bridge in intensive systems. Brazil and Argentina maintain large areas of soybeans. The succession with corn and wheat, in addition to the proximity to cotton and other crops, provides food for stink bugs for much of the year. This scenario favors polyphagous species and makes field management difficult.

In Brazil

In Brazil, *Euschistus heros* has assumed a central role in the soybean agroecosystem. The species occurs in soybeans, cotton, corn, and wheat. The article reports a reduction of up to 25% in cotton fiber and up to 30% in soybean productivity. It also records the participation of *Euschistus heros* in up to 60% of insecticides used in soybean cultivation. *Diceraeus melacanthus* causes damage to corn seedlings, with necrosis, yellowing, leaf deformation, and tillering. In rice, *Tibraca limbativentris* emerges as a significant pest, causing a 17% to 44% reduction in seed productivity.



Photo: Jovenil Jose da Silva, Embrapa

The review notes the advancement of alternatives in Brazil. The mass release of the egg parasitoid, *telenomus podisi* against *Euschistus heros* can reach up to 90% egg parasitism in the field. The parasitoid has been commercially available in the country since 2019. The text also

points to the use of entomopathogenic fungi and conservative biological control through weed management and landscape shaping.

North America

In North America, *Halyomorpha halys* occupies a prominent position. The invasive species has high mobility and more than 175 host plants have been reported on the continent. The insect damages fruits, vegetables, and extensive crops such as soybeans. The review also cites *Bagrada hilaris*, *Murgantia histrionica* and *Nezara viridula* as invasive species with economic importance.

North American management combines sampling, action levels, chemical control, trap plants, removal of weed hosts, alteration of planting dates, and biological control. The review cites egg parasitoids of the genera *Ooencyrtus*, *Telenomus* and *Trisolcus* in addition to tachinid flies *Trichopoda pennipes* and *Euthera tentatrix*. The work also mentions predators such as *Podisus maculiventris*, *Orius insidiosus* and *Solenopsis invicta*.

Europe

In Europe, *Halyomorpha halys* appears as the most serious species among stink bugs. The article records damage in orchards, olive groves, vineyards, soybeans, corn, tomatoes, peppers,

beans, cherries, hazelnuts, kiwis, and other crops. The review reports estimated losses of €600 million in 2019 in northern Italy. It also cites measures under study or in use, such as localized spraying, sulfur, diatomaceous earth, kaolin, exclusion nets, multimodal traps, real-time monitoring platforms, and remote sensing.

Classical biological control appears as a long-term alternative against *Halyomorpha halys* in Europe. The review cites regulated introductions of *Trissolcus japonicus* in Italy from 2020 and releases of *Trissolcus mitsukurii* in France since 2022. It also records adventitious populations of *Trissolcus mitsukurii* in Italy and *Trissolcus japonicus* in Switzerland.

Other species are a concern for European agriculture. *Nezara viridula* expands its distribution northward, in association with favorable climatic conditions. *Pentatoma rufipes* emerges as a pest of fruit trees in northern Europe. *Palomena prasina* also causes damage to orchards and hazelnut groves. In cruciferous plants, species of the genus *Eurydema* can cause significant losses, depending on the population density and phenological stage of the plants.

Asia

In Asia, the situation varies depending on the region and culture. In Japan, *Eysarcoris aeneus*, *Eysarcoris lewisi*, *Eysarcoris ventralis* and *Niphe elongata*

cause stained rice. *Plautia stali*, *Glaucias subpunctatus* and *Halyomorpha halys* occur in fruit trees. *Nezara viridula*, *Nezara antennata* and *Piezodorus hybneri* cause damage to soybeans, vegetables, and other crops.

In Korea, *Halyomorpha halys* and *Plautia stali* gained economic importance in legumes and fruit crops. The work also mentions *Dolycoris baccarum*, *Piezodorus hybneri*, *Carbula putoni*, *Chinavia hilaris*, *Nezara antennata*, *Eysarcoris aeneus* and *Scotinophara lurida* such as species associated with damage to soybeans, fruits, and rice.

In China, *Thesaratoma papillosa* causes losses in lychee and longan crops. The study reports losses of 70% to 90% in

these crops. *Halyomorpha halys* attacks apples, apricots, cherries, beans, kiwis, peaches, pears, soybeans, and beets. The review also records an average parasitism rate of 87% to 91% of *Thesaratoma papillosa* by *Anastatus fulloi* in Chinese programs.

Oceania

In Oceania, the review highlights *Nezara viridula*, *Musgraveia sulsiventris* and *Dictyotus caenosus* among the most important species. *Nezara viridula* occurs in vegetables, legumes, and other crops. *Musgraveia sulsiventris* and *Dictyotus caenosus* originate from Australia and are part of a group of pests that impact local agricultural systems. Management

involves insecticides, agronomic adjustments, and biological control, requiring continuous review in light of the risks of resistance and changes in cultivation practices.

Scientists argue that pest management needs to integrate agricultural, biological, chemical, and physical methods.

Coordinated application depends on knowledge of the pest's life cycle, its biological characteristics, and its interaction with the environment. The review also reinforces the need for precise monitoring and population forecasting, using traps, image analysis, and other technologies.

Scientists Antônio R. Panizzi, JE
McPherson, C. Scott Bundy, Jesus F.

Esquivel, Alberto Pozzebon, Alberto Mele, Davide Scaccini, Dmitrii L. Musolin, Natalia N. Karpun, Vladimir V. Neimorovets, M. Javahery, Hideharu Numata, Yoshinori Shintani, Un Taek Lim, Lian-Sheng Zang, Yong-Ming participated in the study. Chen, Robert K. Mensah, Melina M. Miles, Gimme H. Walter, Louis EN Jackai, Beatrice N. Dingha, and Adeney F. Bueno.

Further information can be found at doi.org/10.1127/entomologia/3800

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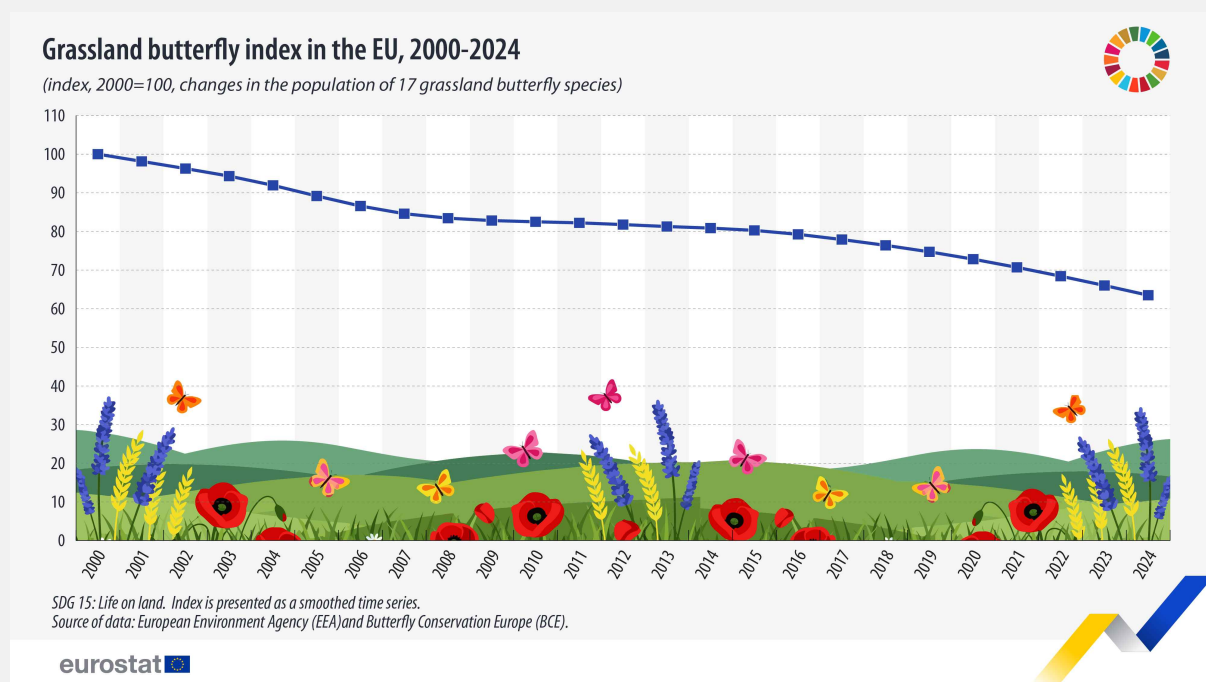
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Bird and butterfly populations are declining in the European Union

Eurostat indicates a 15,1% drop in common birds and a 36,5% drop in grassland butterflies since 2000

22.05.2026 | 08:16 (UTC -3)

Cultivar Magazine, based on information from Eurostat.



The population of birds and butterflies will decline in the European Union in 2024,

according to data released by the official statistics office of the European Union (Eurostat) this Friday, May 22nd. The survey is part of the monitoring of Sustainable Development Goal 15, focused on terrestrial life and biodiversity conservation.

Populations of common bird species have fallen by 15,1% compared to 2000. The decline was most pronounced among birds common in agricultural areas, where the drop reached 32,1%. Common forest species have begun a slow recovery since 2010, according to Eurostat.

The grassland butterfly index also showed a decline. The indicator tracks the abundance of 17 species. The estimate shows a 36,5% reduction compared to

2000.

Eurostat uses the Common Bird Index and the Grassland Butterfly Index to monitor biodiversity in the European Union. The data forms part of the bloc's regular assessment of progress towards the Sustainable Development Goals.

More information at

ec.europa.eu/eurostat/web/sdi/database/life-on-land

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Agricultural Market - May 22, 2026

Markets are operating cautiously amid weather and demand

22.05.2026 | 07:47 (UTC -3)

Vlamir Brandalitze - @brandalitzeconsulting



The agricultural market entered the second half of May with attention divided between the weather in the United States, the crisis

involving Iran, and China's trade movements. In Chicago, soybeans and corn are trading sideways. In Brazil, producers are slowing down sales, while costs, restricted credit, and uncertainties about the weather are limiting decisions for the next harvest.

In the US, soybean planting is progressing within the appropriate window. The planted area has already exceeded 75%, compared to 68% at the same time last year and an average of 60%. In Illinois, planting has reached approximately 80%, compared to an average close to 70%. The weather remains rainy and without significant problems. The main risk cited by the market involves the possibility of El Niño at the end of June, in July, and at the beginning of August, an important period

for determining yields.

In Chicago, soybeans are holding support near \$11,50 per bushel and resistance between \$12,10 and \$12,20. Most positions remain below \$12. Oil above \$100 per barrel is helping to limit steeper declines.

In Brazil, new data from Abiove indicates record crushing in 2026. The organization projects processing of 62,5 million tons of soybeans. Estimated production reaches 48,1 million tons of soybean meal and 12,6 million tons of soybean oil. Projected exports total 114,1 million tons of soybeans, 24,8 million tons of soybean meal, and 1,6 million tons of soybean oil. The total volume of the soybean complex would reach 140,5 million tons.

The marketing of the current soybean crop has reached approximately 63,5%. During the same period last year, it exceeded 66%. The average is 67%. For the new crop, sales are close to 16%, below the 21% recorded last year and the average of 22%. In Mato Grosso, advance sales are approaching 19% to 20%, predominantly through barter transactions. Producers are seeking inputs and credit through this method due to the scarcity of funds.

Corn situation

In the corn market, Chicago is also trading sideways. The contract has support near US\$4,60 per bushel. 2027 positions are above US\$5. US planting has already surpassed 80%, compared to 78% last

year and an average of 75%. Iowa, the largest producer, has reached 92% of the planted area, compared to 85% in the same period last year. The ideal planting window closed in most regions on May 20th, but the technical window remains open until the end of the month.

In Brazil, producers are not seeing a reaction at the market. The B3 stock exchange shows improvement in futures positions, with 2027 contracts between R\$74,50 and R\$75,50 per sack. The port indicates purchases between R\$66 and R\$67 for August and September, but sellers are asking for higher prices.

Business remains sporadic.

The second corn crop (safrinha) received rain in parts of Paraná, Mato Grosso do

Sul, São Paulo, Goiás, and Minas Gerais. There are still doubts about the size of the production. Projections range from 98 million to 108 million tons. The final number should fall in the middle of this range. The harvest is expected to be lower than the 113,3 million tons harvested in the previous cycle. There were problems in Goiás, Minas Gerais, eastern Mato Grosso, Mato Grosso do Sul, and Paraná. There was also frost in central Paraná.

For the 2026/27 summer corn crop, input negotiations remain slow. Producers are showing discouragement regarding seeds, fertilizers, and pesticides. Urea is a significant cost factor. Over-the-counter prices, between R\$ 48 and R\$ 60 at the best positions, are squeezing margins.

Producers calculate that high productivity is necessary to make a profit. The scenario indicates a further reduction in planted area for the first crop, with soybean planting expanding.

Wheat situation

In the wheat market, Chicago advanced in recent days and then stabilized. Short-term support is near \$6,50 per bushel. The 2027 contracts are trading in the \$7 range. The international market shows supportive fundamentals, with crop problems in major exporting countries.

The U.S. crop is of poor quality. Only 27% of the main crops are in good or excellent condition. Russia, Ukraine, and

Kazakhstan are also facing problems after a prolonged winter and uneven germination. Global supply may fall below 800 million tons, compared to consumption of approximately 840 million tons.

In Brazil, producers remain discouraged. The wheat acreage is expected to decrease. Conab estimates 2,2 million hectares, compared to 2,5 million last year. Other estimates point to 2,3 million hectares. Based on field observations, the area may not even reach 2 million hectares. Producers are assessing high costs and prices between R\$ 1.300 and R\$ 1.370 per ton. This value does not cover costs, according to the assessment presented. To make a profit, many producers would need to exceed 5 tons

per hectare.

Rice situation

Regarding rice, the week was calm. Conab released 13 public tender notices for Pepero, with a total volume of 333,7 tons. Premiums start at R\$ 10,18 and reach R\$ 11,37 for the Western Border region. The offers include 48,8 tons for Santa Catarina and 284,9 tons for Rio Grande do Sul.

The rice harvest is coming to an end. Production is heading towards 11 million tons, down from 12,8 million tons last year. Demand is expected to reach 11 million tons or more. Exports accumulated since January are approaching 900 tons. The market, however, is still showing little

reaction. Buyers are avoiding stockpiling due to the cost of money. Producers are seeking liquidity and export alternatives.

Bean situation

In the bean market, the price remains firm. Premium carioca beans, grade 9, are approaching R\$ 500 per sack. There were indications of deals at this price, with a payment term. Commercial carioca beans, grade 8 to 8,5, are trading above R\$ 400, between R\$ 400 and R\$ 435. Limited supply is supporting prices.

Black beans also saw an increase in prices. Indications range from R\$ 250 to R\$ 290 per sack. Some sellers report deals close to R\$ 300 with payment terms, while buyers indicate R\$ 260 to R\$ 270.

The second crop was impacted by frosts, which reduced the potential supply.

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Study shows how insects react to darkness while flying

Experiment demonstrates controlled flight in dipterans and rapid collision in bees

21.05.2026 | 15:29 (UTC -3)

Schubert Peter, Cultivar Magazine



Photo: Paul Langlois - USDA

Fruit flies and mosquitoes maintain controlled flight after a sudden drop in light. Honeybees, under similar conditions, interrupt their flight and collide in about 100 milliseconds. The result comes from a study with [Drosophila melanogaster](#), *Culex pipiens* and *Apis mellifera*.

The research evaluated flight in continuous low light and after sudden darkening mid-flight. Flies and mosquitoes performed a defined maneuver. After a visual-motor delay of approximately 45 milliseconds, they increased their wingbeat frequency, pitch angle, reduced speed, and changed flight direction. The sequence occurred within a 250-millisecond observation window.

The bees exhibited the opposite behavior. In the sudden darkening trial, researchers recorded collisions in all 217 events evaluated. The change in trajectory occurred, on average, 98 ± 39 milliseconds after the loss of light. The individuals tilted their bodies downwards and struck the bottom or wall of the container.

Sensory factors

The study links this difference to two sensory factors. Flies and mosquitoes have greater sensitivity to light.

Furthermore, dipterans possess halteres, gyroscopic organs used to measure body posture without relying solely on vision.

Bees do not have these structures.

In tests under continuous darkness, flies and mosquitoes were also able to take off and fly. The frequency of takeoff decreased in relation to light. Flies took off 15 times less. Mosquitoes took off six times less. Even so, the trajectories indicated stable flight up to the filmed volume, located 10 cm from the walls of the chamber.

The response to the sudden loss of light involved rapid kinematic adjustments. Flies and mosquitoes raised their bodies by about 10 degrees and reduced their forward horizontal speed. In flies, 74% of events reached a complete stop in this velocity component, with a mean braking time of 85 ± 14 milliseconds. In mosquitoes, 49% of events reached this stop, with a mean time of 96 ± 35

milliseconds.

Vertical dynamics showed a different pattern. Mosquitoes stopped vertically in 70% of the events. Flies did so in 56% of the events. In both cases, the average vertical stop time was close to 70 milliseconds.

Partial drop in brightness

The researchers simulated a partial drop in brightness. In this case, the light decreased tenfold, from 34 to 3,4 lux. The scenario aimed to mimic a transition from a lit area to a shaded area. Flies and mosquitoes showed a response similar to that observed in complete darkness,

especially at the beginning of the maneuver.

The partial response maintained the sequence of increased wing frequency, pitch elevation, braking, and change of direction. However, the final result of the orientation differed. In complete darkness, the insects finished the maneuver with an almost random direction. In partial darkness, there was a preference for the initial flight direction.

In flies, leg extension was a significant part of the response. In 74 out of 76 responses to step-darkness, the insects extended their legs. The average time was 52 ± 15 milliseconds. The study suggests a relationship with increased moment of inertia and aerodynamic drag, as well as a

possible pre-landing or pre-impact function. Mosquitoes kept their legs extended under all conditions.

Removing awns, structures present on the antennae, did not prevent flight in the dark. In flies, ablation reduced response rates to darkness. In mosquitoes, there was no significant change in the evaluated criteria. The result indicates a possible difference in the role of antennae in flight control mechanisms between the two species.

More information at
doi.org/10.1242/jeb.251675

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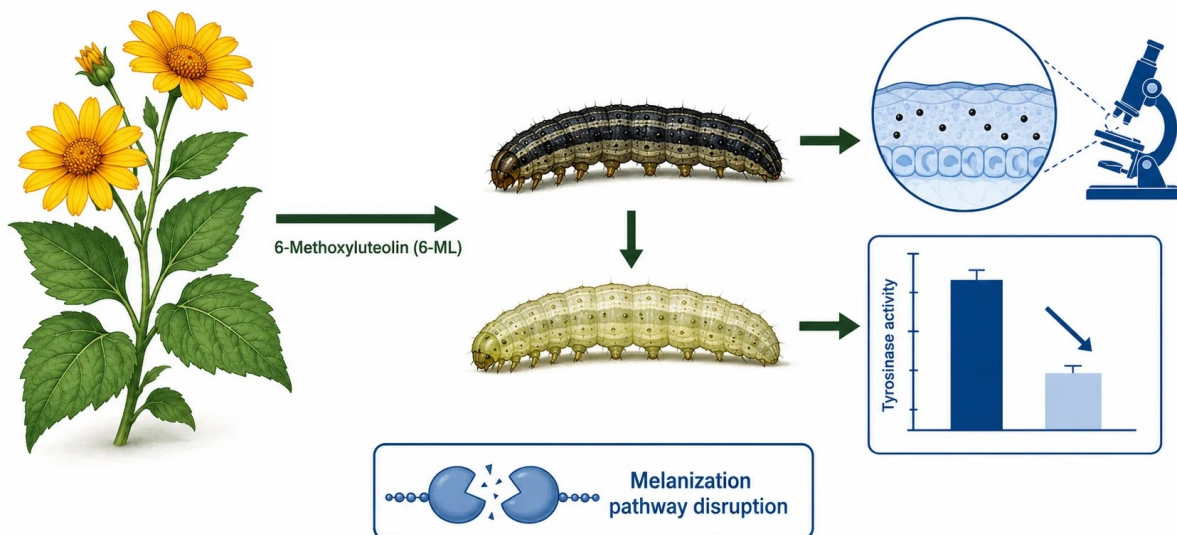
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Flavonoid from *Tithonia diversifolia* affects the cuticle of *Spodoptera litura*

Study indicates action of 6-methoxyluteolin on tyrosinase, melanin and epidermal integrity in larvae

22.05.2026 | 09:20 (UTC -3)

Schubert Peter, Cultivar Magazine



doi.org/10.3390/insects17060535

The 6-methoxyluteolin, a flavonoid isolated from the plant *tithonia diversifolia*, reduced

tyrosinase activity, decreased melanin content, and caused structural changes in the cuticle of larvae of *Spodoptera litura*. The result, obtained by Chinese researchers, indicates the compound's potential as a base for botanical insecticides that act on melanization in lepidopteran pests.

Scientists evaluated larvae between the third and sixth instar stages. The study used concentrations of 1,625 to 100 micrograms per milliliter of 6-methoxyluteolin. The larvae received an artificial diet treated with the compound for three days, starting from the second instar. Afterwards, they were fed a diet without the compound.

The research targeted the melanization pathway. This route is involved in cuticle sclerotization, wound healing, and immune defense in insects. Tyrosinase catalyzes steps related to the oxidation of tyrosine-derived substrates. This process leads to the deposition of melanin in the integument.

Tyrosinase activity

Tyrosinase activity changed in all instars evaluated. In the third instar, the control group showed the highest activity, close to 125 units per milligram of protein. The lowest activity occurred at a concentration of 100 micrograms per milliliter. In the fourth instar, the baseline activity of the control group was lower than in the third

instar. A concentration of 1,625 micrograms per milliliter significantly reduced activity. In the fifth and sixth instars, the authors recorded differences between treatments, with variation dependent on concentration.

The melanin content in the skin also decreased after treatment. The effect was most pronounced in the third instar. At this stage, the content dropped from approximately 2,2 micrograms per milligram of tissue in 3,125 micrograms per milliliter to approximately 0,4 micrograms per milligram in 100 micrograms per milliliter. The reduction was more than fivefold. In the fifth instar, the control group showed the highest content, close to 6,2 micrograms per milligram, and there were

significant reductions at 6,25 and 25 micrograms per milliliter.

Macroscopic images

Macroscopic images reinforced the biochemical data. Control larvae showed dark pigmentation and defined dorsal stripes. Treated larvae showed progressive body lightening. The visual effect appeared from 3,125 micrograms per milliliter. At concentrations of 25 to 50 micrograms per milliliter, the tegument assumed a paler coloration compared to the control.

Histological analysis

Histological analysis revealed loss of melanin granules and disorganization of the cuticle. The authors prepared sections of fourth- and fifth-instar larvae, embedded in paraffin and stained with hematoxylin and eosin. In the fourth instar, the control showed a continuous cuticle and dense deposition of melanin granules on the outer surface. At 12,5 micrograms per milliliter, the structure became looser and with a lower density of granules. At 100 micrograms per milliliter, the cuticular layer became thinner and more disorganized.

In the fifth instar, the control maintained a well-defined pigmented layer. At 6,25 micrograms per milliliter, there was loosening of the cuticle and a reduction in melanin deposition. At 25 micrograms per milliliter, the authors observed structural

fragmentation and irregular distribution of granules.

Thickness measurement confirmed the effect in the fourth instar. The cuticle of the control group measured $4,70 \pm 0,13$ micrometers. All treatments with 6-methoxyluteolin showed reduced thickness. The greatest reduction occurred at 12,5 micrograms per milliliter, with a thickness of $2,53 \pm 0,13$ micrometers. This value represents a 46% decrease compared to the control group.

More information at

doi.org/10.3390/insects17060535

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Selenium stimulates soybean sprout growth, research indicates

A study suggests a dose of 5,0 to 7,5 micromol/L of selenite to enhance growth, provide antioxidants, and mobilize reserves

21.05.2026 | 15:02 (UTC -3)

Cultivar Magazine



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Moderate concentrations of sodium selenite stimulated the growth of soybean sprouts and increased the antioxidant capacity of the plants. The best performance occurred with 5,0 and 7,5 micromol/L of Na_2SeO_3 , after 72 hours of dark cultivation. At these doses, the sprouts showed greater hypocotyl elongation, greater biomass accumulation, and better mobilization of cotyledon reserves. This information comes from a study by Chinese researchers.

The study evaluated the Bayan cultivar under five selenite concentrations: 0, 2,5, 5,0, 7,5, and 10 micromol/L. Germinated seeds were kept in culture boxes at 30°C in the dark. The solutions were changed every 24 hours. At the end of the period, researchers measured length, fresh mass,

selenium content, and physiological indicators in the radicle, hypocotyl, and cotyledon.

The concentration of 7,5 micromol/L generated the greatest growth gains. The radicle grew 26,0% compared to the control. The fresh mass of the radicle increased by 40,7%. The hypocotyl showed a 19,0% increase in length and fresh mass. The dose of 5,0 micromol/L also promoted relevant gains, with a 19,6% increase in radicle length and a 10,2% increase in hypocotyl length.

Distinct accumulation

Selenium accumulated differently in the tissues. The highest concentration

occurred in the radicle, followed by the hypocotyl. The cotyledon showed the lowest values. This pattern indicates absorption by the radicle and limited translocation during germination in the dark.

Moderate doses also activated the antioxidant system. At 5,0 and 7,5 micromol/L, there was an increase in the activities of superoxide dismutase, peroxidase, and ascorbate peroxidase. These enzymes act in the removal of reactive oxygen species. The treatment also elevated reduced glutathione, ascorbic acid, and free proline in different tissues.

This response reduced oxidative stress. Superoxide anion and hydrogen peroxide

concentrations decreased in moderate treatments. Malondialdehyde, an indicator of lipid peroxidation, also decreased. At a dose of 7,5 micromol/L, MDA decreased by 20,9% in the radicle, 22,7% in the hypocotyl, and 31,8% in the cotyledon.

Mobilization of reserves

The study also showed an effect on the mobilization of reserves. Selenite increased the activity of amylases and proteases in the cotyledons. α -amylase increased by 106,4% at 7,5 micromol/L. Alpha + berta-amylase activity rose by 64,8% at the same dose. Protease increased by approximately 50% at 5,0 and 7,5 micromol/L.

This process favored the conversion of reserves into soluble sugars, soluble proteins, and free amino acids, the researchers point out. In the hypocotyl, the content of soluble sugars increased by 36,8% with 5,0 micromol/L and by 65,4% with 7,5 micromol/L. Free amino acids increased 4,50 times with 5,0 micromol/L and 4,43 times with 7,5 micromol/L. These compounds supported elongation and mass gain.

The 10 micromol/L dose had the opposite effect. The treatment suppressed antioxidant activity, elevated reactive oxygen species, and increased MDA. Growth lost the stimulus observed at moderate doses. The authors relate this effect to excess selenium, which can disrupt redox balance and impair the

mobilization of reserves.

The results indicate potential for biofortification of soybean sprouts with selenium. According to the researchers, the application of selenite between 5,0 and 7,5 micromol/L strengthened antioxidant defense, reduced oxidative damage, and favored the transport of reserves to the hypocotyl. The work points to a physiological basis for protocols for the production of sprouts enriched with selenium.

Further information can be found at doi.org/10.17221/72/2026-PSE

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John Deere maintains annual forecast after \$1,77 billion profit

Global revenue grew 5% in the second quarter, while large-scale agriculture saw a drop in sales

21.05.2026 | 13:50 (UTC -3)

Cultivar Magazine, based on information from Jen Hartmann



Deere & Company reported net income of \$1,773 billion in the second fiscal quarter

of 2026, ended May 3. This result was 2% lower than the \$1,804 billion recorded in the same period of 2025. Diluted earnings per share reached \$6,55, compared to \$6,64 a year earlier. The company maintained its projection of net income attributable to Deere & Company between \$4,5 billion and \$5,0 billion for fiscal year 2026.

Global net sales and revenues totaled US\$13,369 billion in the quarter. This represents a 5% increase over the US\$12,763 billion of the same period of the previous year. Net sales reached US\$11,778 billion, compared to US\$11,171 billion in 2025.

In the first six months of the fiscal year, net income attributable to Deere & Company

totaled US\$2,429 billion. In the same period of the previous year, the company had recorded US\$2,673 billion. Diluted earnings per share for the semester were US\$8,97, compared to US\$9,82. Net sales and revenues reached US\$22,981 billion, an increase of 8%.

Performance by segment

Performance by segment showed differences between areas of operation. In Precision Agriculture and Production, net sales fell 14% in the second quarter to US\$4,503 billion. Operating profit declined 39% to US\$706 million. The operating margin dropped from 22,0% to 15,7%. The company attributed the decline to lower

shipment volumes and higher production costs. Currency conversion had a partial positive effect.

In Small-Scale Agriculture and Lawns, net sales grew 16% to US\$3,485 billion.

Operating profit increased 25% to US\$719 million. The operating margin rose from 19,2% to 20,6%. The company cited higher shipment volumes, a positive exchange rate effect, and price realization as factors in the result.

The Construction and Forestry segment saw a 29% increase in net sales, to US\$3,790 billion. Operating profit grew 48%, to US\$561 million. The operating margin rose from 12,9% to 14,8%. Deere reported higher shipment volumes and favorable price realization. Higher production costs offset some of this

growth.

The Financial Services area reported a net profit of US\$190 million in the quarter. This result exceeded the US\$161 million projected for 2025 by 18%. According to the company, favorable financing spreads and positive adjustments in the valuation of derivatives supported the increase. A smaller average portfolio reduced some of the gain.

Deere also reported recovering \$272 million related to IEEPA tariff refund requests accepted by U.S. Customs and Border Protection. This recovery followed a U.S. Supreme Court decision on February 20, 2026, regarding tariffs imposed under the International Emergency Economic Powers Act.

Agricultural market in 2026

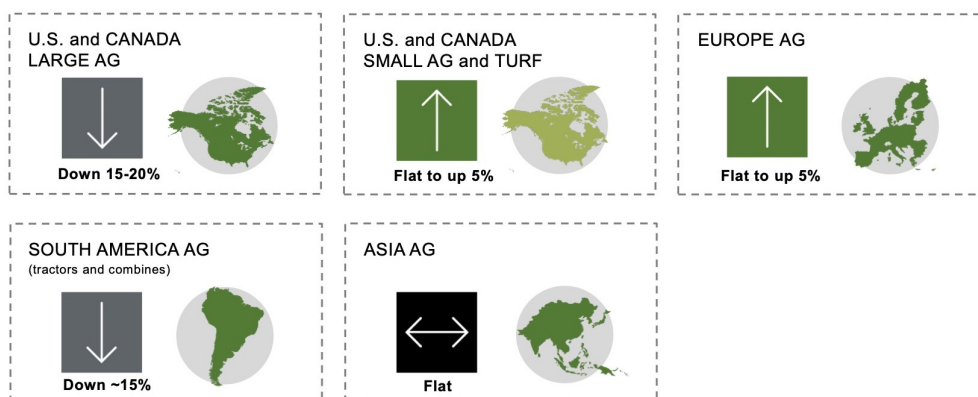
For the agricultural market in 2026, the company projects a 15% to 20% decline in the large agricultural machinery segment in the United States and Canada. For small agricultural and lawn equipment in these markets, the expectation indicates stability or growth of up to 5%. In Europe, the projection also points to stability or growth of up to 5%. In South America, the tractor and combine harvester market is expected to decline by about 15%. In Asia, the company projects stability.

In Deere's own segment breakdown for 2026, Production and Precision Agriculture is expected to see a 5% to 10% drop in net

sales. Small-scale Agriculture and Lawns is projected to grow by approximately 15%. Construction and Forestry is expected to advance by about 20%. For Financial Services, the company estimates net income of approximately US\$860 million.

Ag and Turf

Industry Outlook (in units) – FY 2026



Source: Deere & Company forecast as of 21 May 2026

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Conab estimates coffee harvest at 66,7 million bags

High biennial cycle of Arabica coffee, new growing areas, and favorable climate raise projections for the 2026 harvest

21.05.2026 | 10:27 (UTC -3)

Cultivar Magazine



The National Supply Company (Conab) estimates the Brazilian coffee harvest for 2026 at 66,7 million processed bags. This

volume represents an 18% increase over the harvest of the previous cycle. The projection is included in the second crop survey, released in May, influenced by the positive biennial cycle in most producing regions.

The increase is also related to the entry of new areas into production, greater use of technologies and inputs, and more favorable weather conditions. Compared to the 2024 harvest, also a high-yield biennial year, the current estimate indicates growth of 23,1%. In 2024, the country produced 54,2 million bags.

The total area cultivated with Arabica and Robusta coffee reaches 2,34 million hectares. This number exceeds the area of the previous harvest by 3,9%, with an increase of 86,9 hectares. Of this total,

1,94 million hectares are in production, a 4,4% increase. Another 401,7 hectares remain in the formation stage, a 1,3% growth.

Arabica coffee accounts for the largest share of the production expansion. Conab estimates production at 45,8 million bags, a 28% increase over the previous harvest. The increase is due to the positive biennial cycle, the growth in the area under production, and favorable weather.

The total area cultivated with Arabica coffee reaches 1,9 million hectares, a 3,2% increase. Of this total, 1,55 million hectares are currently dedicated to production, and 345,9 hectares remain under development. This species occupies 81% of the national coffee-growing area.

Minas Gerais leads in Arabica coffee cultivation area. The state has 1,42 million hectares, equivalent to 75% of the total national area occupied by this species. São Paulo follows, with 204,1 hectares, or 10,8% of the area cultivated with Arabica in the country.

For Robusta coffee, Conab projects production of 20,9 million bags, a 0,8% increase over the previous harvest. This result is related to the growth in planted area and favorable weather conditions up to the time of the survey.

The total area planted with conilon coffee reaches 444 hectares, an increase of 6,9%. Of this total, 388,2 hectares are in production and 55,8 hectares are still being developed. Espírito Santo concentrates the largest national area of

??this species, with 306,2 hectares, or 70% of the total. Bahia, with 55,6 hectares, and Rondônia, with 50,5 hectares, follow.

The national average productivity is expected to reach 34,4 sacks per hectare, a 13% increase. For Arabica coffee, the estimate reaches 29,5 sacks per hectare, a 22,6% increase compared to the previous harvest. For Robusta coffee, the projected productivity reaches 53,9 sacks per hectare, a 3,5% decrease. Conab attributes the reduction to the overloading of crops in the previous season, especially in the older areas of Espírito Santo.

Minas Gerais is expected to harvest 33,4 million sacks. Production exceeds the volume of the previous harvest by 29,8%. The survey attributes this performance to the positive biennial cycle, better rainfall

distribution in the months prior to flowering, and favorable weather until March, which is reflected in grain formation.

In Espírito Santo, the estimated production reaches 18 million bags, a 3% increase.

Arabica accounts for 4,4 million bags, with an estimated productivity of 34,6 bags per hectare and a growth of 27,9%. Robusta is expected to total 13,6 million bags, a 4,2% decrease, after a strong performance in the previous harvest. Even so, the estimated productivity for this variety in the state is the second highest in Conab's historical series.

São Paulo is expected to produce 5,9 million bags of Arabica coffee. The forecast indicates a 24,6% increase, driven by the positive biennial cycle and the recovery of areas affected in the previous

cycle.

In Bahia, total production is expected to reach 4,7 million bags, a 5,9% increase. This volume includes 1,2 million bags of Arabica and 3,5 million bags of Robusta. Conab attributes the growth to consistent weather, increased investment in inputs, and the entry of new areas into production.

Rondônia is expected to harvest 2,8 million bags of conilon coffee, an increase of 19,4%. This growth is due to the renewal of genetic material with more productive clonal plants and favorable weather conditions since the beginning of the cycle.

In Rio de Janeiro, the estimated production totals 423,9 bags of Arabica coffee, a slight increase of 0,4%. Conab reports that the high production load in the previous

harvest limited growth this year.

Paraná is expected to produce 713,9 bags of coffee, a volume 4,6% lower than the previous harvest. The state predominantly cultivates Arabica coffee. The reduction is related to low rainfall, high temperatures during the cycle, especially during flowering and grain filling, as well as the negative biennial cycle.

In Mato Grosso, production is expected to reach 301,4 bags, an increase of 8,1%. This result stems from the expansion of the area under production, investments in crops, and the expansion of clonal coffee plantations.

Goiás is expected to harvest 284,8 sacks of coffee, a 32,2% increase. Conab attributes the growth to a 9,8% increase in

the area under production, the positive biennial cycle, and regular rainfall. The projected productivity reaches 46,5 sacks per hectare, a 20,4% increase over the previous harvest.

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 2025 (a)	Safra 2026 (b)	VAR. % (b/a)	Safra 2025 (c)	Safra 2026 (d)	VAR. % (d/c)	Safra 2025 (e)	Safra 2026 (f)	VAR. % (f/e)
NORTE	41.747,5	44.847,5	7,4	56,4	62,8	11,3	2.355,4	2.817,0	19,6
RO	40.762,0	43.155,0	5,9	56,9	64,2	12,8	2.320,2	2.770,1	19,4
AM	985,5	1.692,5	71,7	35,7	27,7	(22,4)	35,2	46,9	33,2
NORDESTE	103.245,0	103.550,0	0,3	43,0	45,4	5,6	4.434,5	4.698,2	5,9
BA	103.245,0	103.550,0	0,3	43,0	45,4	5,6	4.434,5	4.698,2	5,9
Cerrado	6.000,0	6.500,0	8,3	44,2	40,0	(9,4)	265,0	260,0	(1,9)
Planalto	50.245,0	48.850,0	(2,8)	17,5	19,2	9,7	879,5	938,2	6,7
Atlântico	47.000,0	48.200,0	2,6	70,0	72,6	3,7	3.290,0	3.500,0	6,4
CENTRO-OESTE	17.404,0	18.063,0	3,8	28,4	32,5	14,3	494,2	586,2	18,6
MT	11.825,0	11.940,0	1,0	23,6	25,2	7,1	278,7	301,4	8,1
GO	5.579,0	6.123,0	9,8	38,6	46,5	20,4	215,5	284,8	32,2
SUDESTE	1.666.030,0	1.743.631,0	4,7	29,0	33,1	14,1	48.365,3	57.735,9	19,4
MG	1.077.804,0	1.133.576,0	5,2	23,9	29,5	23,4	25.755,1	33.432,7	29,8
Sul e Centro-Oeste	521.815,0	542.410,0	3,9	23,1	28,1	21,6	12.061,3	15.240,0	26,4
Triângulo, Alto Paranaíba e Noroeste	195.941,0	219.461,0	12,0	24,4	34,8	43,1	4.771,6	7.646,2	60,2
Zona da Mata, Rio Doce e Central	330.450,0	341.171,0	3,2	24,3	27,8	14,3	8.040,0	9.488,6	18,0
Norte, Jequitinhonha e Mucuri	29.598,0	30.534,0	3,2	29,8	34,6	16,2	882,2	1.057,9	19,9
ES	379.822,0	396.987,0	4,5	45,9	45,3	(1,4)	17.448,0	17.974,0	3,0
RJ	12.379,0	12.482,0	0,8	34,1	34,0	(0,4)	422,3	423,9	0,4
SP	196.025,0	200.586,0	2,3	24,2	29,4	21,8	4.739,9	5.905,3	24,6
SUL	25.404,0	25.172,0	(0,9)	29,5	28,4	(3,8)	748,6	713,9	(4,6)
PR	25.404,0	25.172,0	(0,9)	29,5	28,4	(3,8)	748,6	713,9	(4,6)
OUTROS (*)	4.863,0	5.035,0	3,5	28,2	29,8	5,4	137,3	149,9	9,2
NORTE/NORDESTE	144.992,5	148.397,5	2,3	46,8	50,6	8,1	6.789,9	7.515,2	10,7
CENTRO-SUL	1.708.838,0	1.786.866,0	4,6	29,0	33,0	13,8	49.608,1	59.036,0	19,0
BRASIL	1.858.693,5	1.940.298,5	4,4	30,4	34,4	13,0	56.535,3	66.701,1	18,0

Legenda: (*) Acre, Pará, Ceará, Pernambuco, Mato Grosso do Sul e Distrito Federal
Estimativa em maio/2026.

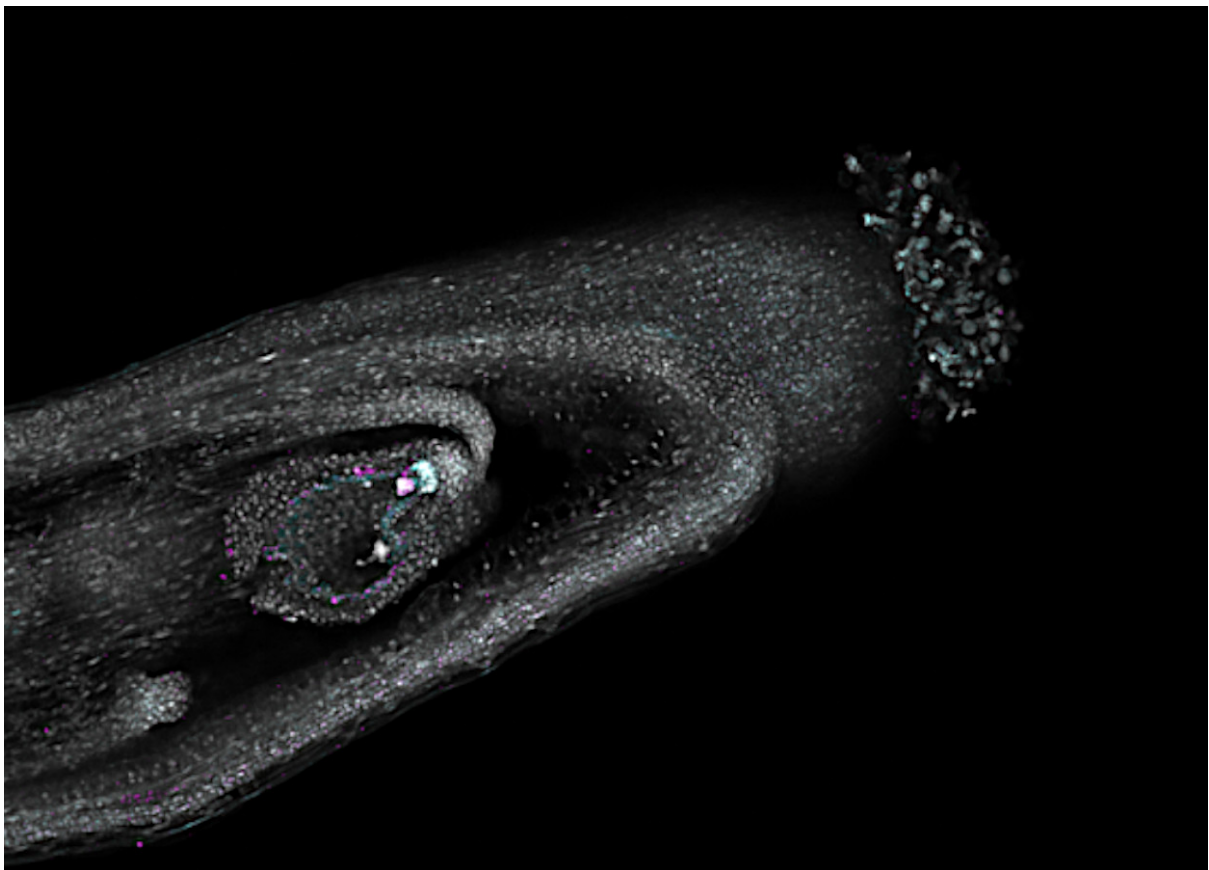
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Atlas shows gene activity in seed development

Study in *Arabidopsis* maps embryonic nuclei, endosperm, and integument in three phases after pollination

21.05.2026 | 08:59 (UTC -3)

Schubert Peter, Cultivar Magazine



Development of a seed of *Arabidopsis thaliana* in silica - Photo: Caroline Martin - Whitehead Institute

Researchers in Mary Gehring's lab at the Whitehead Institute, affiliated with the Massachusetts Institute of Technology, have created a transcriptional atlas of the early development of seeds of [Arabidopsis thaliana](#). The study mapped gene activity in different cell and nuclear types at 3, 5, and 7 days after pollination. The study points to mechanisms associated with the coordination between the embryo, endosperm, and maternal integument.

The atlas contains 54.210 seed nucleus profiles. Of this total, 24.024 correspond to seeds 3 days after pollination, 16.039 to seeds 5 days after pollination, and 14.147 to seeds 7 days after pollination. The base includes approximately 10,5% embryo, 23,4% endosperm, 64,3% seed coat, in

addition to unfertilized ovule and funiculus.

Seed development

The team used single-nucleus RNA sequencing to track a dynamic phase of seed development. At 3 days, the embryo appears in the globular stage and the endosperm still maintains coenocytic organization. At 5 days, the endosperm begins cellularization in the micropylar region. At 7 days, cellularization is complete and the embryo undergoes rapid expansion.

The study expands the resolution of previous atlases of *Arabidopsis*. According to the press release, previous databases did not distinguish many cell types due to

technological limitations. The new set allows for the localization of genes active in tissues linked to seed growth, nutrient storage, and communication between compartments.

Scientists have identified the main cell or nuclear types of the seed. The work also refined transcriptional states in the endosperm and mapped selection signals in specific genes for cell types. Among the results, the analysis showed compartmentalization of genes associated with the activation of transcription factors responsive to brassinosteroids.

Brassinosteroids regulate growth processes in plants. In the study, genes linked to the biosynthesis of these hormones showed concentrated

expression in the micropylar region of the seed coat. The data also showed nearby cells in the endosperm with genes associated with the hormonal response. This location suggests local coordination between hormonal production and response during seed development.

Previous studies

The work relates this information to previous studies on seed size. The dissemination material reports that the interruption of brassinosteroid production had already reduced seed size, but the location of production within the developing seed remained undefined.

The atlas also detailed the chalazal region of the seed coat, a point linked to the entry of maternal resources into the seed.

Researchers identified subtypes in the placentochalazal region with complementary functions. One group showed markers associated with callose synthesis. Another showed genes linked to phosphate transport and phosphatase activity.

In the endosperm, the team described greater tissue specialization. The study found abundant expression of genes encoding secreted short peptides, especially in the chalazal and micropylar endosperms. These regions are located at important seed interfaces: the chalazal region is involved in the entry of maternal

resources, while the micropylar region is close to the embryo.

Founding population

The analysis also proposed the existence of a founder population in the chalazal endosperm. This population may contribute to establishing a region at the interface between maternal tissues and tissues derived from fertilization. According to the publication, the quantity and timing of resource supply by the mother plant influence oil, starch, and protein reserves in the seed.

Further information at

doi.org/10.1038/s41477-026-02295-8

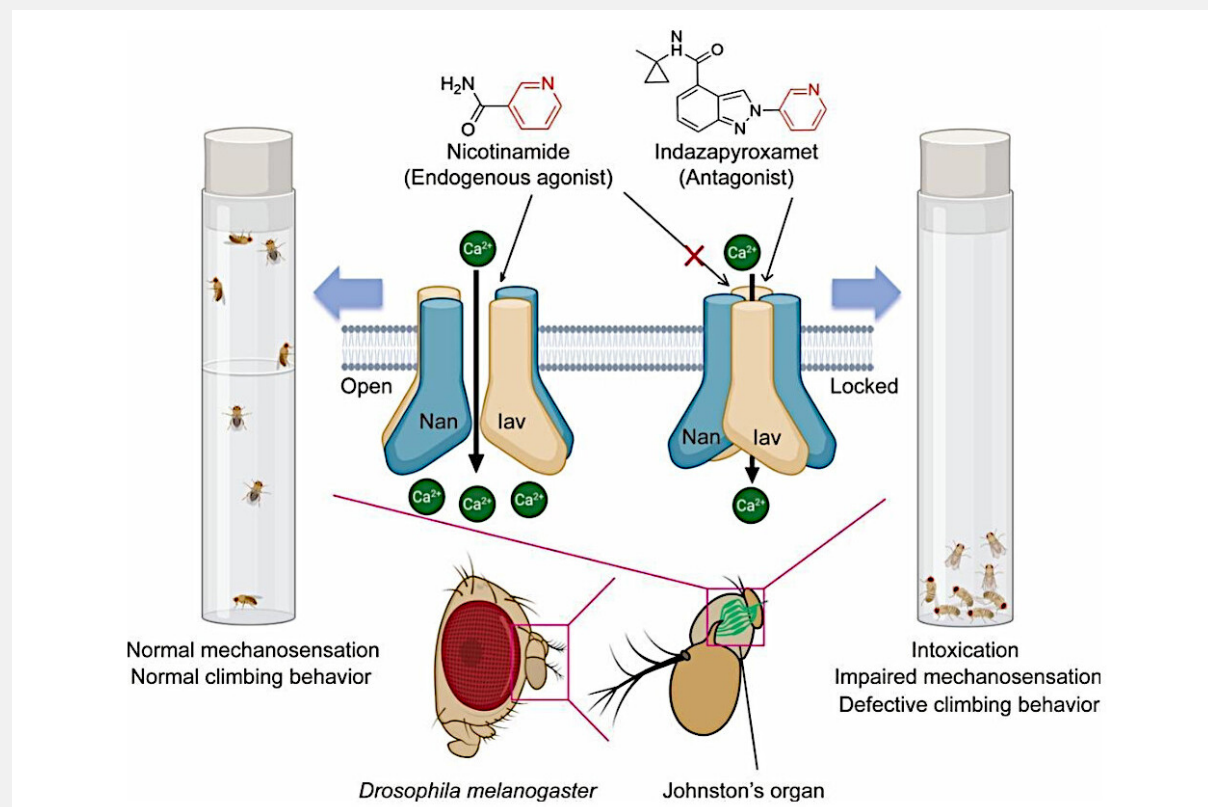
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Indazaproxamet acts as a TRPV channel antagonist

Study identifies molecular target of insecticide and points to implications for resistance management in sucking pests

21.05.2026 | 07:11 (UTC -3)

Schubert Peter, Cultivar Magazine



doi.org/10.1016/j.pestbp.2026.107177

Researchers at Zhejiang University have identified the indazapyroxamet as an antagonist of insect TRPV channels. Its mechanism of action is distinct from that attributed to commercial insecticides targeting the same target, such as pymetrozine, pyrifluquinazon, and afidopyropen.

Indazapyroxamet exhibits high efficacy against sucking pests. Among the targets cited in the study are *Myzus persicae*, *Aphis gossypii* and *Aphis craccivora*. Field trials also indicated effectiveness for crops such as rice, cotton, and fruit trees.

Despite this performance, the molecular target and mode of action of the compound remained poorly understood.

The team evaluated the insecticide from three angles. The researchers used calcium assays in S2 cells of *Drosophila* behavioral genetics in *Drosophila melanogaster* and structural modeling. The set of results indicated a direct action on the TRPV channel formed by the Nanchung and Inactive subunits, known as Nan and Iav.

In cell assays, scientists expressed the TRPV channel of *Nilaparvata lugens*, the brown leafhopper of rice. Nicotinamide induced a strong influx of calcium in cells with Nan and Iav. Indazaproxamet also caused calcium influx, but with low efficacy. Therefore, they classified the product as a partial agonist in vitro.

Central result

The central result appeared in the antagonism phase. Pre-application of indazapyroxamet suppressed the nicotinamide-induced response. Inhibition occurred in a concentration-dependent manner. The calculated IC50 reached 8,1 nM. Afidopyropen showed a similar profile, with an IC50 of 2,2 nM. TFNA-AM, however, neither activated the channel nor inhibited the response to nicotinamide.

Behavioral tests reinforced the physiological target. Adult wild-type flies were fed indazapyroxamet. Then, researchers measured negative geotaxis, a behavior used to assess climbing ability after mechanical stimulation. The

insecticide reduced climbing ability in a dose-dependent manner.

The same effect did not occur in mutants with loss of function in the TRPV subunits. nan and iav strains showed no detectable impairment in climbing after exposure to indazaproxamet. For the researchers, this result demonstrates the dependence of functional TRPV channels for the in vivo effects of the insecticide.

Molecular modeling

Molecular modeling indicated the likely reason for the antagonistic action.

Indazaproxamet occupies a binding pocket overlapping the region used by known TRPV agonists. The compound

forms an aromatic interaction with residue W322 of the Iav subunit. However, it does not exhibit the expected interactions with key residues of the Nan subunit, such as Y178. This absence may prevent the stabilization of the open conformation of the channel.

According to the researchers, this pattern explains the low direct activation and strong inhibition of the response to nicotinamide. The compound appears to occupy the target with high affinity and maintain the channel in a low-activity conformation. This prevents further activation by the endogenous agonist.

Insect TRPV channels are involved in mechanosensation, proprioception, locomotion, and gravity perception.

Interference with these channels affects motor coordination and feeding behavior. Until now, this group of targets appeared to be associated primarily with excessive activation by agonists. This study expands that understanding by demonstrating the possibility of control through antagonism.

Scientists highlight implications for insecticide development and resistance management. Because indazaproxamet acts through antagonistic modulation, its behavior may differ from that observed in TRPV agonists. This distinction can aid in assessing cross-resistance and designing usage strategies in management programs.

Further information at
doi.org/10.1016/j.pestbp.2026.107177

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Indofil bets on new pesticide for soybeans in Brazil

The company plans to distribute 3 million liters of the product in 2026

20.05.2026 | 10:23 (UTC -3)

Jaine Machado, Cultivar Magazine editor



Fabrício Pacheco and Juliano Uebel

Indofil has announced the launch of a new agricultural pesticide in Brazil. It is called Curatis, a solution that combines three

active ingredients: [mancozeb](#), [prothioconazole](#) and [picoxystrobin](#) in a water-based SC formulation.

The company expects to sell around 3 million liters of the product by the end of 2026, a volume that could have a significant impact on revenue and increase the structure of its Brazilian operation.

“For a company the size of Indofil, this is a very significant launch. With Curatis, Indofil competes on equal footing with the leading companies in the market. It's a transformation, both in portfolio and in personnel structure,” highlights Fabrício Pacheco, Marketing Manager at Indofil.

The launch comes at a challenging time for the field. Data from the National Supply Company (Conab) indicates that Brazil

leads the world in soybean production. In 2025, 169,49 million tons were harvested from an area of 47,61 million hectares. Despite this performance, diseases that directly affect the crop remain one of the main obstacles for producers, with a significant impact on productivity.

Among the most severe diseases are Asian soybean rust and target spot. The former is considered the most aggressive to soybeans, while the latter can reduce production by up to 50%. According to Embrapa, the country had already registered 144 outbreaks of rust in January 2026. In the case of target spot, the annual growth in Brazilian crops reaches 33%.

“There are other regional diseases, with different levels of impact, but these two are

the main ones in soybean cultivation and the ones that most lead farmers to seek specific solutions for control,” says Juliano Uebel, an agronomist at Indofil.

Innovation and operational gains in the field

According to Indofil, one of the key differentiators of Curatis is its liquid formulation of mancozeb, traditionally sold in powder or solid form. According to Uebel, this change simplifies the producer's daily routine, with practical benefits such as fewer steps in preparing the spray mixture, eliminating the need to handle powder, and reducing the risk of

filter clogging.

Discovered in the 1960s, mancozeb was initially widely used on vegetables. With the increasing resistance of diseases, studies began to indicate greater efficacy when combined with other active ingredients. Indofil's proposal was precisely to integrate the molecule with two other fungicides in a liquid formulation, enhancing its efficiency and making the product easier to use.

“Mancozeb, being a multi-site agent, acts on several mechanisms of the fungus, unlike other active ingredients that act on only one point in the cell. This helps reduce resistance and avoids the overuse of other products that have been losing effectiveness,” says the agronomist. In his

view, soybean cultivation depends on this active ingredient.

Indofil has announced that the introduction of Curatis to the market will be gradual.

The product will be showcased at field days and technical events, as well as being included in presentations given by the company's team and researchers.

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Gene alters host choice in *Aphis gossypii*

Silencing of AgosOBP3 changed the haplotype preference from cotton-specialized to cucumber

20.05.2026 | 08:54 (UTC -3)

Schubert Peter, Cultivar Magazine



Photo: Jim Baker, North Carolina State University

The AgosOBP3 gene acts as a determinant of host choice in [*Aphis gossypii*](#). Its silencing by RNAi reduced its expression by 46,8% and reversed the preference of the Hap1 haplotype,

specialized in cotton. After 48 hours, 70% of the aphids in the control group chose cotton. In the treated group, 65% chose cucumber. These conclusions are from a study by Chinese researchers.

Aphis gossypii exhibits strong intraspecific specialization for host plants. Therefore, it serves as a model for studies on olfactory-mediated adaptation. Hap1 is specialized for cotton. Hap3 is specialized for cucurbits. This study evaluated the role of AgosOBP3 in this process.

Researchers have identified 13 genes for odorant-binding proteins in the genome of *Aphis gossypii*. These proteins participate in host recognition in insects. They also appear as potential targets for RNAi.

Transcriptomic comparison showed higher expression of AgosOBP3 in Hap4, a polyphagous species, compared to Hap1. The difference reached 1,79 times, with $P < 0,05$.

Life table assays confirmed the specialization of Hap1. The haplotype performed well on cotton. On cucumber, it exhibited very low survival and reproduction rates.

Reproductive performance

Silencing AgosOBP3 also altered reproductive performance. Hap1 aphids treated with RNAi showed a 39,6% increase in fecundity in cucumber. In

cotton, there was a 39,5% decrease.

The results indicate a direct relationship between the expression level of AgosOBP3 and the preference for *Aphis gossypii* by specialized hosts. Interference in this gene disrupted the host selection pattern and redirected the cotton-specialized haplotype to a non-adapted plant.

The study identifies AgosOBP3 as a molecular target for olfactory disturbance-based management strategies against aphids.

Further information at
doi.org/10.1002/ps.70935

Regarding AgosOBP3

AgosOBP3 (*Aphis gossypii* Odorant-Binding Protein 3) is a crucial protein for the olfactory system of the cotton aphid. Located in the insect's antennae, its function is to capture odor molecules suspended in the air (the volatiles released by plants) and transport them to nerve receptors. It is thanks to this protein that the aphid can "smell" its environment to find food and mates.

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Chloris virgata has confirmed resistance in Córdoba

Tests conducted by INTA Manfredi have identified biotypes resistant to glyphosate and haloxyfop-R-methyl

19.05.2026 | 15:40 (UTC -3)

Peter Schubert, Cultivar Magazine, based on information from INTA.



Photo: INTA

Dose-response trials conducted by the National Institute of Agricultural Technology (INTA) in Manfredi confirmed the presence of two biotypes of feather grass (*Chloris virgata*) with distinct resistance profiles in the center of the province of Córdoba, Argentina. One biotype, collected in Costa Sacate, showed resistance to [glyphosate](#). Another one, collected in Colonia Cocha, showed resistance to [haloxyfop-R-methyl](#). This confirmation updates an alert issued in 2024, when multiple resistance was suspected in a single biotype of the species.

This information has a direct impact on weed management in agricultural areas. *Chloris virgata* belongs to the Chlorideae group. The genus had a history of

glyphosate tolerance, with varying responses to the herbicide. Confirmation of resistance changes the framing of the problem in part of the Argentine production region.

The technical work was conducted by agricultural engineer Diego Ustarroz, a researcher at INTA. The team evaluated seeds collected in areas with control failures in Colonia Cocha and Costa Sacate. They also used material from batches at Manfredi's own experimental station as a susceptible reference.

Pot trials

The trials were conducted in pots. The plants received treatments at the two- to

four-leaf stage. The researchers applied increasing doses of glyphosate, haloxyfop-R-methyl, and clethodim. Twenty days after application, the team measured plant survival and dry biomass relative to the herbicide-free control. Resistance indices resulted from comparing the doses capable of causing 50% mortality or 50% biomass reduction in the resistant and susceptible biotypes.

The Costa Sacate biotype showed resistance to glyphosate. At the label dose, equivalent to 756 grams of acid equivalent per hectare, 60% of the plants survived. The resistance index reached 4 for survival and 2,97 for biomass. The study classified these values ??as moderate, but recorded low growth suppression in field trials with plants at the beginning of tillering and good

soil moisture.

This biotype maintained susceptibility to haloxyfop-R-methyl and clethodim.

According to information from INTA, these herbicides can control Costa Sacate's material. This information reinforces the need to know the biotype profile present in each area before choosing a post-emergent herbicide.

The Colonia Cocha biotype showed resistance to haloxyfop R-methyl.

Resistance indices reached 65 for survival and 48,3 for biomass. The study recorded survival of some plants up to 16 times the label dose, equivalent to 864 grams of active ingredient per hectare.

This biotype was not considered resistant to glyphosate, as the dose control as

prescribed resulted in complete control under the assay conditions. Even so, the material showed less susceptibility compared to the Manfredi biotype. INTA also reported partial control and regrowth in assays with tillering plants.

Clethodim controlled all biotypes in the label dose evaluation, but control of the Colonia Cocha biotype did not reach full control 20 days after application. For this material, researchers recommend a mixture of glyphosate and clethodim.

Chloris virgata

Chloris virgata has an annual summer cycle and produces tillers. The plant can exceed one meter in height, produce more

than 40 seeds per plant, and generate up to 600 grams of dry matter per square meter under favorable conditions. The seeds are dispersed by wind and water. Emergence occurs in staggered flushes, from the end of winter to summer, which reduces the effectiveness of single interventions.

Surveys by the Aapresid Pest Management Network indicate an advance of the group. *Chloris* sp. / *Leptochloa* sp. in Argentina. By 2025, the group had appeared in 185 departments and in more than 11 million hectares of agricultural land. Córdoba, Santa Fe, and Santiago del Estero concentrated the largest affected areas. In plots with high infestation, yield losses in summer crops can exceed 80%.

The management recommended by INTA combines post-emergence herbicides with residual herbicides applied pre-emergence. Piroxasulfone, sulfometuron + chlorimuron, and diclosulam are cited as options with high proven efficacy for pre-emergence control of the species. The use of haloxyfop remains an alternative only in areas with biotypes lacking resistance to the product, such as the material from Costa Sacate.

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Weeds keep whiteflies in the field

Study identifies species with the potential to harbor *Bemisia tabaci* MEAM1 and sustain populations of the pest

19.05.2026 | 10:15 (UTC -3)

Schubert Peter, Cultivar Magazine



Photo: Syngenta

Common weeds in Brazilian agricultural areas can act as alternative hosts for

whiteflies [Bemisia tabaci](#) MEAM1. The warning is based on a study conducted by researchers from Esalq and FCA. The research compared 15 weed species and four cultivated plants in tests with and without a choice for the insect.

The results indicated a higher risk for *Emilia sonchifolia*, *senna obtusifolia* and *Euphorbia heterophylla*. These species demonstrated the ability to attract adults, receive eggs, and allow colonization.

According to scientists, the management of these plants should be integrated into whitefly management programs in areas where the pest is present.

Free choice

In the free-choice test, the tomato plant had the highest average infestation of adult weeds among all the materials evaluated. The average reached 282,06 adults per plant across the three evaluation periods. Among the weeds, *senna obtusifolia*, *Emilia sonchifolia* and *Euphorbia heterophylla* formed the group with the highest infestation levels, with averages between 151,57 and 189,43 adults per plant.

Oviposition also separated the hosts. In the free-choice assay, *Solanum lycopersicum*, *Emilia sonchifolia* and *senna obtusifolia* recorded the highest rates, with 16,58 to 22,52 eggs per cm². In contrast, *Richardia brasiliensis*, corn and *Amaranthus viridis* presented averages of

less than 1 egg per cm².

No choice available.

In the no-choice test, *Euphorbia heterophylla* had the highest number of eggs and nymphs. The species recorded 42,35 eggs per cm² and 22,70 nymphs per cm². *Galinsoga parviflora* and *Spermacoce latifolia* also showed significant colonization. Corn had the lowest values, with 0,24 eggs per cm² and 0,27 nymphs per cm².

The study also evaluated leaf characteristics related to whitefly preference. There was a positive correlation between oviposition and trichome density. There was also a

positive correlation between the number of adults and the intensity of yellow in the leaves. The correlations were negative for light intensity and green intensity, according to the colorimetric indices used in the study.

The tomato plant showed the highest density of trichomes, with 134,50 trichomes per 25 mm². *Spermacoce latifolia* came next, with 85,00, and *Conyza canadensis*, with 73,63. The researchers highlighted, however, that the whitefly's response does not depend solely on the density of these structures. The type of trichome, chemical compounds, and other plant signals can also interfere in host selection.

Preference and performance

The scientists also calculated the preference-performance index, used to integrate egg laying, egg viability, and development time. *Solanum lycopersicum* displayed the highest value. Among the weeds, *Emilia sonchifolia*, *Sida rhombifolia* and *Euphorbia heterophylla* appeared with relatively high values. Corn, *Richardia brasiliensis*, *Amaranthus viridis* and *bidens pilosa* had the lowest results.

Whiteflies exhibit high polyphagy. They infest soybeans, cotton, tomatoes, brassicas, cucurbits, weeds, and ornamental plants. This wide range of hosts makes management in agricultural

systems difficult. Weeds can maintain populations throughout the year and allow the insect to migrate between crops. They can also harbor pathogens, especially viruses.

Research recommends paying special attention to prominent weeds in regions with high whitefly populations throughout the year. Controlling these species can reduce conditions favorable to the insect and potential sources of inoculum. This point is particularly important in tomato-producing areas because *Euphorbia heterophylla* has already been identified as a host of the begomovirus Tomato severe rugose virus in a region of the Brazilian Midwest.

The work was developed by Matheus Gerage Sacilotto, Rodrigo Donizeti Faria, Felipe Saviato Furquim de Souza, Vinícius Fernandes Canassa, Edson Luiz Lopes Baldin, and André Luiz Lourenção.

Further information can be found at doi.org/10.1590/1678-992X-2025-0062

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Elicit Plant announces Reinaldo Bonnecarrere as Commercial VP for Brazil and Latin America

The executive joins the company with over 20 years of experience in agricultural innovation and business leadership

19.05.2026 | 08:48 (UTC -3)



Elicit Plant has announced Reinaldo Bonnecarrere as its new commercial vice president for Brazil and Latin America. The executive assumes the role with the mission of accelerating the adoption of technologies in the field and expanding the company's presence among Latin American farmers.

Bonnecarrere has over 20 years of experience in agricultural innovation and business leadership. His career includes working at Indigo Ag, where he led product and sales teams in Brazil.

According to Elicit Plant, the executive's international experience, integrated business vision, and involvement in strategic projects in Latin America and Europe will support the company's next

phase of growth in the region.

“I see Elicit Plant as an opportunity to bring innovation to agribusiness through high-performance products, helping producers to produce more sustainably and positively impacting the sector's profitability,” said Bonnacarrere.

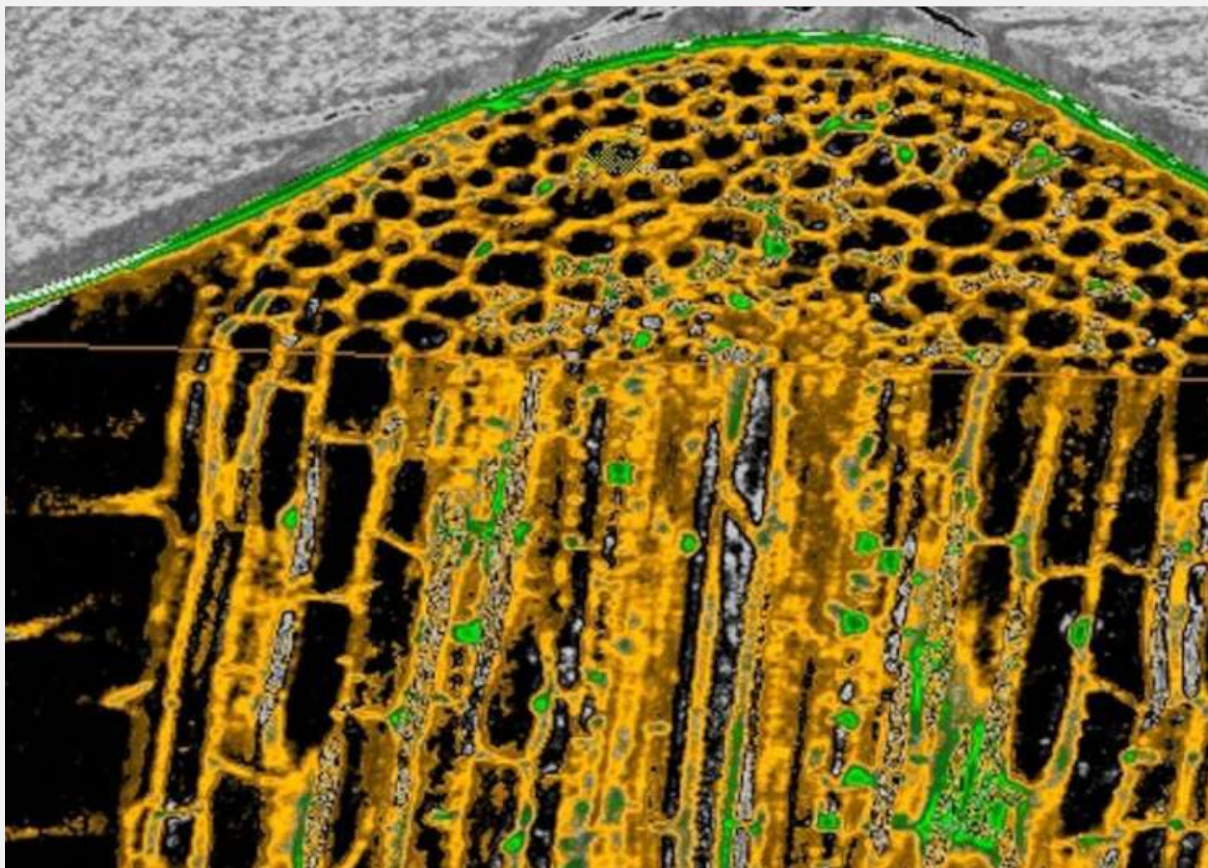
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Micro-CT reveals how Fusarium invades tomato roots

Study shows appressorium-like structures and mechanical colonization of the apoplast by *Fusarium oxysporum*

19.05.2026 | 08:38 (UTC -3)

Schubert Peter, Cultivar Magazine



doi.org/10.1038/s41467-026-72805-x

Researchers have identified physical mechanisms of root penetration and colonization by *Fusarium oxysporum*, vascular pathogen associated with wilt in tomato and other crops. The research employed phase-contrast X-ray micro-computed tomography and advanced microscopy. This approach allowed for the visualization, in three dimensions, of stages of root invasion that were previously difficult to access using conventional techniques.

The study analyzed the interaction between *Fusarium oxysporum* f.sp. *lycopersici* and tomato roots (*Solanum lycopersicum*). The authors observed bulbous structures similar to appressoria (appressoria-like structures). These

structures generated thin invasive hyphae, capable of penetrating epidermal cells and advancing through internal root spaces.

Interpretation of infection

The discovery alters the interpretation of soil vascular pathogen infection, the scientists explain. The literature describes classic appressoria in foliar pathogens, such as *magnaporthe oryzae*. The study indicates the presence of similar functional structures in *Fusarium oxysporum*, even without classic fasteners.

Microtomography revealed clear colonization of host tissues three days after inoculation. By day five, researchers

recorded an increase in fungal biomass and the formation of air spaces. These spaces were associated with the presence of hyphae. The article links this process to the loss of tissue integrity and physical interference with water transport.

The fungus showed high morphological plasticity. According to the study, hyphae with a normal diameter of 4 μm to 6 μm were able to traverse passages of up to 220 nm. This reduction exceeds 20 times the initial diameter. The researchers tested this capacity in PDMS microfluidic devices, in nylon membranes with defined pores, and in cellophane barriers without pores.

Invasion mechanism

The results indicate an invasion mechanism dependent on mechanical force. Mutants deficient in cellulolytic activity were able to cross cellophane membranes without pores. Therefore, the authors concluded that enzymatic degradation of cellulose alone does not explain surface rupture. The study attributes a central role to adhesion, the formation of invasive hyphae, and the generation of force.

Colonization occurred predominantly through the apoplast. Images of infected roots showed thin hyphae at intercellular junctions and localized cell wall separation. Confocal microscopy confirmed hyphal networks in intercellular spaces. Controls without inoculation showed no fungal

signal under the same acquisition conditions.

Three MAPK waterfalls

The study also described the role of three MAPK cascades. The Fmk1 pathway regulated the formation of appressorium-like structures and force-dependent penetration. *fmk1*⁻ mutants showed almost no internal colonization and remained restricted to the root surface. The fungal biomass of these mutants decreased by 99% compared to the wild type.

The Hog1 pathway played a role in osmotic adaptation during colonization in narrow spaces. *Hog1*⁻ mutants penetrated the surface, but showed reduced

colonization efficiency. This limitation increased as pore diameter decreased and osmotic conditions deviated from isotonicity.

The Mpk1 pathway participated in guiding growth towards vascular tissues. *mpk1*? mutants maintained colonization close to that of the wild type in total volume, but induced greater formation of air spaces and exhibited less vascular colonization. The article associates this pattern with loss of orientation by host signals.

Scientists propose a step-by-step model. Fmk1 controls adhesion and penetration. Hog1 allows survival during extreme hyphal remodeling in confined environments. Mpk1 directs growth towards the xylem. This set of responses

allows the pathogen to cross physical root barriers and occupy internal tissues.

The research points to potential targets for resistance strategies against vascular wilt.

The study highlights signaling pathways and mechanical processes linked to invasion, rather than focusing solely on cell wall-degrading enzymes.

Further information can be found at doi.org/10.1038/s41467-026-72805-x

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Elevated carbon dioxide levels increase production, but change soybean quality

Study using modeling points to gains under climate stress, but indicates a decrease in starch and protein

18.05.2026 | 10:06 (UTC -3)

Schubert Peter, Cultivar Magazine



Experiment with soybean plants under high CO2 and high temperature - photo: Lafieco / IB-USP

Increased carbon dioxide concentration can offset some of the losses caused by heat and drought in soybeans, but it alters the nutritional composition of the grains. A study combined controlled trials and predictive modeling to evaluate yield, carbohydrates, lipids, proteins, and amino acids in scenarios associated with climate change.

Researchers observed up to a 142% increase in grain production under elevated carbon dioxide conditions.

Conversely, high temperatures reduced production by 91%, and drought reduced it by 60%. The so-called "Triple Effect" scenario, with elevated carbon dioxide, high temperatures, and drought, indicated a potential increase of 50% in grain

production, as well as a 35% increase in soluble sugars and a 175% increase in amino acids. The same scenario projected a 20% decrease in starch and a 6% decrease in protein.

Study form

The study used soybean plants of the MG/BR-46 Conquista cultivar, from Embrapa. Cultivation took place in open chambers in São Paulo, between September 2018 and February 2019. The treatments compared ambient carbon dioxide, at 400 ppm, and elevated carbon dioxide, at 800 ppm. One experiment added a temperature 5°C above ambient. Another evaluated water deficit after flowering, with irrigation suspended and

then a restricted supply of 100 mL of water every three days until physiological maturity.

The plants were harvested at 60 and 125 days after emergence. Researchers used dry biomass at 60 days as an initial indicator. Then, they compared this data with grain yield and composition at 125 days. The analyses involved soluble sugars, starch, amino acids, lipids, carbon, nitrogen, and protein.

High carbon dioxide

The response to elevated carbon dioxide maintained a positive pattern for grain production in both experiments. In combination with high temperature,

elevated carbon dioxide attenuated heat stress. Treatment with elevated temperature alone led to 0,63 g of grain per plant. The combination of elevated carbon dioxide plus temperature reached 16,9 g per plant.

The drought also affected grain formation. The water deficit treatment reached 2,78 g per plant. The combination of high carbon dioxide and drought reached 4,04 g per plant. Scientists point out that this is still a significant reduction, but less than under drought conditions without high carbon dioxide.

Grain quality

The quality of the grains changed distinctly between the treatments. Elevated carbon dioxide favored carbon assimilation and carbohydrate storage. High temperature and drought induced metabolic adjustments, with alterations in sugars and amino acids. These changes have implications for the nutritional quality of the grains.

In the oil, high temperature increased the proportion of palmitic, stearic, and oleic acids. The increases reached 14%, 7%, and 28%, respectively. Treatments with high temperature and with high carbon dioxide plus high temperature reduced the polyunsaturated fatty acids linoleic and linolenic. Drought reduced the relative abundance of palmitic, linoleic, and linolenic acids, but increased oleic acid.

Amino acids responded strongly to stress. The combination of high carbon dioxide plus temperature showed the highest level, five times higher than the ambient treatment. Temperature alone led to a fourfold increase. Drought increased amino acids threefold. The combination of high carbon dioxide plus drought increased them twofold. Despite this, total nitrogen and crude protein did not vary significantly between experimental treatments.

Modeling in the study

Modeling played a central role in the study. Generalized linear models used total biomass at 60 days to predict production and quality at 125 days. The models showed good approximation between

observed and predicted values. Production under elevated carbon dioxide, for example, had an observed value of 16,9 g and a predicted value of 16,56 g.

Path analysis indicated a significant relationship between biomass at 60 days and grain yield at 125 days. Elevated carbon dioxide and the combination of elevated carbon dioxide plus temperature had positive effects on yield. Temperature, drought, and elevated carbon dioxide plus drought had negative effects.

For the “Triple Effect,” the researchers used machine learning. XGBoost showed the lowest error in estimating production under the combined scenario. The model projected 10,46 g of grains, with an RMSE of 0,04. CatBoost projected 10,51 g, with

an RMSE of 1,50. For the other quality attributes, XGBoost also outperformed CatBoost.

Scientists highlight an important limitation: the “Triple Effect” has not undergone direct experimental validation. The projection resulted from the integration of validated data from dual stresses, such as elevated carbon dioxide plus temperature and elevated carbon dioxide plus drought. The study also took place in open chambers and with a specific cultivar. Therefore, the researchers indicate a need for validation under field conditions.

The study was conducted by Janaina da Silva Fortirer, Adriana Grandis, Carmen Eusebia Palacios Jara, Débora Pagliuso, Leandro Francisco de Oliveira, Eveline

Queiroz de Pinho Tavares, Lauana Pereira de Oliveira, Plínio B. Camargo, Eny Iochevet Segal Floh, Cibele M. Russo, and Marcos S. Buckeridge.

Further information can be found at doi.org/10.1016/j.foodres.2026.119004

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The tomato plant's defense persists in detached leaves

Study evaluated gene expression after infestation by *Tetranychus urticae* in two tomato varieties

18.05.2026 | 08:38 (UTC -3)

Schubert Peter, Cultivar Magazine



Photo: Bruce Watt, University of Maine

Detached tomato leaves retain defense responses induced by two-spotted spider mite (*Tetranychus urticae*) for up to 14 days, according to scientific study data. Researchers evaluated the expression of genes linked to plant defense in intact plants and in detached leaves of the Moneymaker and Castlemart varieties. The results indicate the possible use of detached leaves in plant-herbivore interaction studies, but point to variation according to the variety and the gene analyzed.

The research measured the expression of three defense genes in tomato plants. Two of them, PPO-D and PI-IIc, participate in the jasmonate signaling pathway. The third, PR-1a, participates in the salicylic acid-associated pathway. These pathways

are part of the mechanisms used by plants against herbivores and pathogens.

Scientists compared intact plants with detached leaves after two days of infestation. In both treatments, leaves received adult mites. Uninfested plants and leaves served as controls. The team also assessed the persistence of the response in detached Moneymaker leaves after 1, 4, 7, and 14 days of infestation.

Induction of defense

Defense induction occurred in both intact plants and detached leaves. However, the intensity of the response varied. PPO-D expression was higher in Moneymaker than in Castlemart and, in general, higher

in leaves of intact plants than in detached leaves. This pattern appeared more strongly in Moneymaker.

For PI-IIc, the behavior differed.

Expression was higher in detached leaves than in intact plants, but only in Castlemart. In Moneymaker, the levels did not differ significantly between the two treatments. For PR-1a, expression was higher in intact plants than in detached leaves, but only in Moneymaker.

The study also showed increased expression of the three genes over time in detached leaves. PPO-D showed a smaller increase during the 14 days. PI-IIc and PR-1a had a more pronounced increase and peaked on the 14th day. The authors classify PPO-D as an early-expression

gene, while PI-IIc and PR-1a fall into the group of late-expression genes.

Dependency hypothesis

The results contradict the hypothesis of absolute dependence on plant integrity for the activation of local defenses against herbivores. The literature usually associates intact plants with systemic responses, since hormonal signals and precursors circulate between tissues. Even so, infestation by *Tetranychus urticae* generated a local response in highlighted sections.

The experiment used adult females of *Tetranychus urticae* kept under controlled

conditions. They were grown in a climate chamber without herbivores. Samples underwent RNA extraction and qRT-PCR analysis. Relative gene expression considered uninfested controls for each treatment.

Methodological implication

Scientists highlight a methodological implication. Detached leaves can be useful in assays on interactions between herbivores and plant defenses, including long-term studies with mites. However, experiments focused on the function of specific genes need to consider the effect of plant integrity, variety, and the defense

pathway being evaluated.

Further information can be found at
doi.org/10.1111/een.70101

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DVA announces new CEO for Global Agro Division

Vicente Gongora has over 40 years of experience in international agribusiness

15.05.2026 | 15:05 (UTC -3)

Cultivar Magazine



DVA announced the appointment of Vicente Gongora (pictured) as CEO of its Global Agro Division. An agricultural engineer, the executive has over 40 years

of experience in international agribusiness, with a background in leadership, business development, and organizational transformation.

Throughout his career, Gongora held senior leadership positions at companies such as FMC, UPL, and DVA itself. He also participated in structuring the company's operations in Brazil in the early 2000s.

In his new role, he will be responsible for leading the next phase of DVA's growth in the global market. "It all starts with people. Strong teams and continuous innovation are essential to creating long-term value," the executive stated.

According to the company, the appointment reinforces DVA's commitment

to business expansion and offering differentiated solutions to clients and partners in different markets.

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