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Cultivar Semanal

Tires or tracks?

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How bacteria coordinate attacks on plants

Study reveals that subpopulations of Pseudomonas syringae alternate between mobility and toxin secretion

11.06.2025 | 17:24 (UTC -3)

Cultivar Magazine

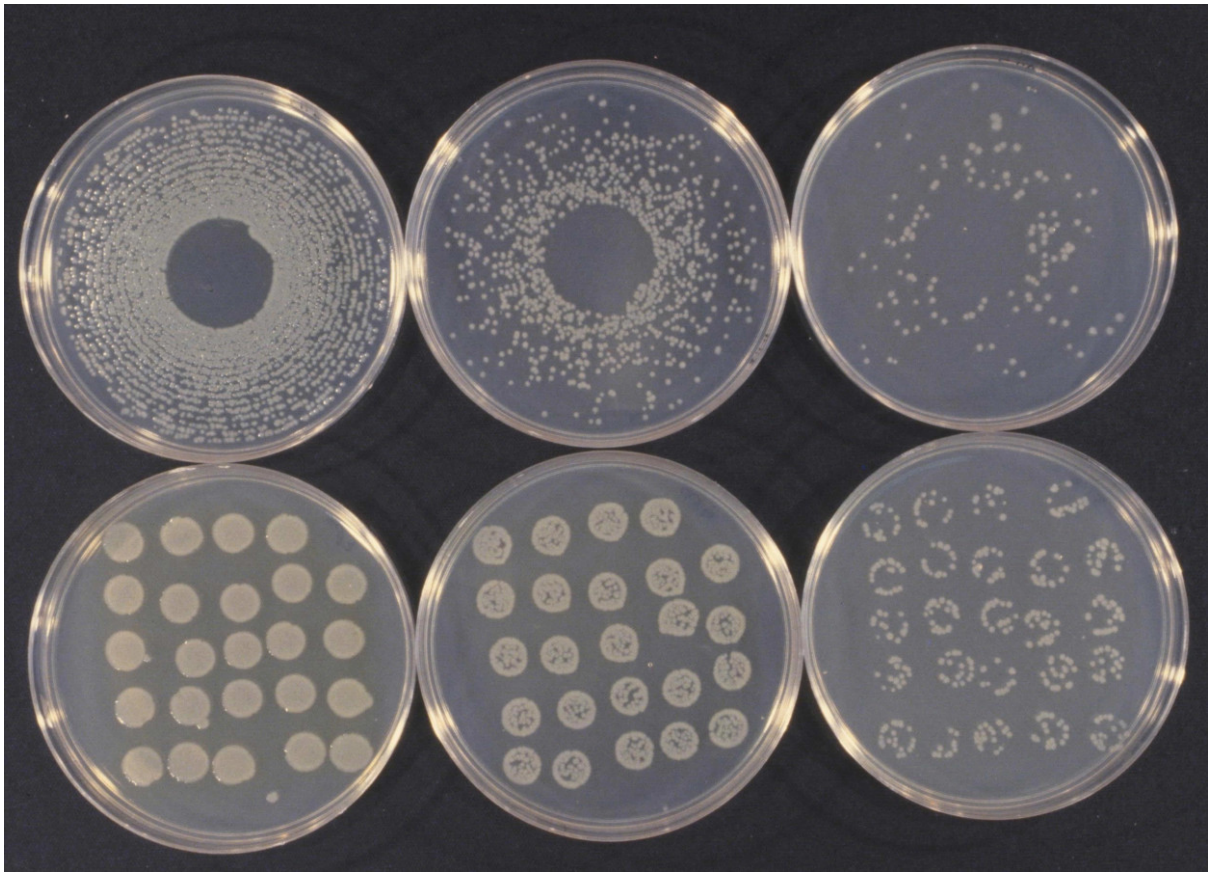

Photo: HF Schwartz

Bacteria *Pseudomonas syringae* They do not operate as homogeneous armies. Instead, they organize themselves into specialized squads that alternate between producing toxins to sabotage the plant's immune system and using flagella to migrate. This division of labor, revealed by European researchers, redefines the understanding of bacterial virulence in agricultural crops.

Using confocal microscopy and flow cytometry, scientists identified remarkable phenotypic heterogeneity. In bean leaves (*Phaseolus*), each bacterial cell adopts a distinct behavior: either it activates genes of the type III secretion system (T3SS) to inject toxic proteins into the plant cells, or it produces flagella to move around. They rarely do both at the same time.

This emergent behavior does not depend on genetic differences. Even clonal populations revealed distinct patterns of gene expression, resulting from stochastic and environmental factors. Bacteria close to host cells preferentially activate the T3SS. As the infection progresses, others, further away, start producing flagella. This spatial distribution suggests a functional architecture within the apoplastic microcolonies.

The toxins secreted by T3SS function as “common goods,” suppressing plant immunity for the collective benefit. This creates an environment conducive to the escape of motile bacteria with activated flagella from the plant tissue before necrosis occurs. Early escape increases the chances of survival and dissemination,

especially under the humid conditions simulated in the sprayed leaf experiment.

The metabolic costs of these behaviors are real. Expressing T3SS reduces bacterial growth, as demonstrated by experiments with mutants that grow faster when deprived of this system. The production of flagella, on the other hand, imposes a smaller but still measurable cost. When both functions are activated simultaneously, the damage is exacerbated.

These findings point to a form of bacterial cooperation rarely documented in plant pathogens. Phenotypic heterogeneity confers adaptive advantages to the group as a whole. Cell-specific specialization creates a coordinated network of actions

that promotes efficient leaf colonization and orderly host exit.

More than a biological phenomenon, it is a sophisticated evolutionary strategy. By preventing all individuals from simultaneously activating costly and immunogenic systems, bacteria balance efficiency and discretion. This logic is reminiscent of the organization of multicellular systems, where the distribution of tasks maximizes the survival of the group.

This model, based on "division of labor", contrasts with the "bet-hedging" hypothesis, in which different behaviors emerge as random preparation for future events. In the case of P. *syringae*, cooperative functionality and spatial

distribution of phenotypes indicate more refined biological planning.

More information at doi.org/10.1038/s41564-025-01966-0

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Ihara launches new fungicides for apples, grapes, melons and mangoes

Migiwa and Property control scab and powdery mildew without compromising fruit quality and increasing safety for exports

13.06.2025 | 13:30 (UTC -3)

Cultivar Magazine, based on information from Iara Soriano

Ihara has introduced two new solutions for controlling diseases affecting high-value fruit trees: Migiwa (ipflufenoquine) and Property (pyriofenone).

Migiwa (see leaflet) acts against apple scab with high efficacy even in adverse weather conditions. The product prevents russeting, a deformation in the fruit's skin that reduces its commercial value.

With prolonged action, Migiwa protects the productivity of orchards and improves the commercial classification of fruits. According to Archimedes Nishida, fungicide product manager at Ihara, the product outperforms its competitors in controlling scab without compromising the appearance of the fruit.

For crops such as melon, grape, mango and rose, the company launched the Property (see package insert). The fungicide combats powdery mildew with a molecule exclusive to Brazil. The solution meets the maximum residue limits required by the markets in Europe, the United States and Japan, increasing safety for exports.

Brazilian apple production is expected to reach 915 tons in the 2024/25 harvest, up 10% from the previous cycle. Santa Catarina and Rio Grande do Sul account for 97% of national production. The fruit was the tenth most exported in 2024, generating US$9,4 million.

Melon, with a production of 826 thousand tons, is a highlight in the Northeast,

responsible for 98% of the total. The fruit maintains good acceptance in the international market, with recognized quality and flavor.

The 2025 grape harvest in Rio Grande do Sul is expected to reach 750 tons, an increase of 38,5%. The region accounts for 80% of national production. The expectation is to strengthen domestic consumption and increase exports.

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Tires or tracks on agricultural machinery?

By Francisco Faggion, Tiago Pereira da Silva Correia, Victoria Linhares and others

13.06.2025 | 13:23 (UTC -3)

When it comes to soil compaction caused by agricultural machinery, especially heavy

tractors, harvesters and forestry machines, the types of wheels can have a direct influence. Pneumatic wheels (or simply tires) and tracks are the main types of agricultural wheels, with tires being the predominant type. However, both have undergone technological evolution in recent years.

There are two main types of tires: bias ply and radial ply. Bias ply tires have the construction characteristic of plies arranged from bead to bead and in a transverse direction (at angles of 30 to 45°) to them, occupying the entire tread and sidewalls. This type of construction gives bias tires an “oval” tread, in an elliptical shape, with a low contact area with the ground. Radial tires, on the other hand, are constructed with plies arranged

perpendicularly to the beads and from sidewall to sidewall, with the tread being increased and reinforced with longitudinal plies to the tread, giving it a “flatter” and more rigid shape, less elliptical and with less deformation, with a high contact area with the ground.

Modern agriculture has an advanced tire option, low-pressure, high-flotation radials (BPAF) with construction characteristics that are intermediate between diagonal and radial, with the main differences between this type being the reinforcement of the sidewalls and the possibility of using low inflation pressures for work, which gives it greater flexibility.

Considering the construction differences, in practice, radial tires and especially BPAF tires, when properly assembled and inflated, have the advantages of causing less soil compaction, slippage and specific fuel consumption, and greater traction capacity, engine power transfer efficiency and operational performance than bias

tires. However, bias tires are more resistant to damage such as punctures and tears, due to thicker sidewalls, as well as lower acquisition costs.

Tracked wheels do not have a formally defined and updated classification, so they are simply subdivided according to the construction material into steel (rigid) or rubber (flexible), and can be full track or semi-track (half-track). In addition, both tracks and semi-tracks can be oblong (elongated) or triangular.

For agricultural purposes, steel tracks are falling into disuse, as they predominantly have greater weight, less flexibility in the reduction hubs and in the terrain, lower working speed and operational efficiency and higher specific fuel consumption than

rubber tracks.

Which one to use?

Tires or tracks, which one to use? The answer does not follow a consolidated rule and the decision-making process must take into account the agricultural fleet (types of tractors, harvesters and implements), agricultural operations to be carried out, main crops, soil type, topography and level of technical development of the property. Agronomically, the choice prioritizes the aspect of soil compaction, for which common sense from research indicates an advantage for tracks.

When compared to tires, tracks have a larger contact area with the ground, and therefore better dissipate the static (weight) and dynamic load of the machine, especially tractors with medium/high power and weight, slowing down and reducing soil compaction rates. However, the use of modern tires generates controversy among

experts, as doubled (tipped) tires with a large contact area with the ground can be used.

Due to the presumably larger track contact area, tractors equipped with them tend to have greater traction capacity due to reduced slippage and better power transfer efficiency and wheel/ground interaction. These characteristics provide tracked tractors with higher operating speed and consequently higher operational efficiency. As a result, they are more suitable for flat and extensive areas.

Regarding ergonomics and drivability, which can be translated into human well-being and overall system performance, tractors equipped with tires are smoother and softer on uneven terrain. Another

situation in which tires have an advantage is when traveling on roads, in addition to having less wear and fuel consumption. In terms of costs, including acquisition, installation and maintenance, tires are cheaper. There are more moving parts on a track, especially metal ones, than in the wheel hub of a tractor with tires.

In the sugar and energy sector, tracks have been gaining ground, being installed on tractors, transshipments and agricultural trucks, enabling operations to be carried out even in wet soil conditions. There are reports of producers using tracked tractors in the production of vegetables with the justification that it is possible to remove harvested products from the field even on rainy days and waterlogged soil, thus allowing them to

obtain better prices, which may justify the investment.

An alternative offered to producers is the semi-track configuration, when in 4 x 2 TDA agricultural tractors the front axle is equipped with tires and the rear axle (main drive) is equipped with semi-tracks. This configuration does not apply to 4 x 4 agricultural tractors, since in these all the wheels must be of the same type, and may have four tires or four semi-tracks. In the case of grain harvesters, the semi-tracks occupy the front axle, which is the main drive. The semi-track configuration can be understood as the balance between tires and tracks, with the possibility of equalizing costs and obtaining good traction capacity, fuel consumption and operational performance, in addition to

enabling operation on waterlogged terrain.

In lowland rice cultivation where the soil remains flooded for a few days before harvesting and even during harvesting, semi-tillers are widely used and their performance is superior to tires. However, it should be noted that in these areas soil compaction is not a major concern, as

flood irrigation facilitates root penetration into the soil and, eventually, compaction is beneficial as it reduces problems caused by the lack of support in these soils, reducing the risk of machinery getting stuck.

Currently, some properties have adopted controlled traffic of machinery in the fields, in which the path of the machines is predetermined and guided by georeferencing systems and automatic pilot, always following the same routes, from sowing to harvesting. The system aims to avoid random soil compaction and crushing of plants, systematizing the trampling of the wheels on defined and known paths where compaction is acceptable.

Each system has its pros and cons, so it is important to better understand the characteristics and peculiarities of each one, and decisions should not be made in a generalized manner. It is suggested that a case study be carried out and that the farmer seek technical assistance in order to evaluate the best type of wheel for his/her situation, so that the one selected is capable of carrying out the work in the best possible way.

By **Francisco Faggion**, **Tiago Pereira da Silva Correia**, **Victoria Linhares**, **Aline Biazioli of Pine**, **Haniel Carlos Gomes da Cruz**, **Brenda Jhully Alves Moreira**, **Pedro Henrique Gomes Alves**
(Lamagri/UnB)

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Decentralized plant thermosensing could revolutionize agriculture

Plants use decentralized genetic networks to sense heat, study finds

13.06.2025 | 13:10 (UTC -3)

Cultivar Magazine

Plants don’t rely on a single internal sensor to detect heat. They integrate thermal information through a decentralized genetic network. The discovery challenges long-held theories about how plants sense and respond to temperature.

The study was led by researchers from Monash University in Australia, in partnership with institutions in India and the United States. They showed that proteins and biological processes spread throughout the plant organism react to heat in a coordinated way, without a "central thermometer".

According to Professor Sureshkumar Balasubramanian, who coordinated the research, the discovery could transform the way agricultural varieties adapted to

climate change are developed.

“We can create customized crops for different regions, which becomes vital in the face of extreme weather events such as droughts and floods,” he said.

The new theory allows us to pinpoint temperature-sensitive elements within plants, making targeted genetic manipulation possible. “It’s like personalized medicine, but applied to plants,” said co-author Sridevi Sureshkumar.

This approach could outperform existing genetically modified crops. It opens up the possibility of producing food in places previously considered unsuitable due to climate.

More information at science.org/doi/10.1126/science.adv5407

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Rivers release ancient carbon into the atmosphere on a global scale

Study reveals that more than half of the CO? emitted by rivers comes from ancient carbon

12.06.2025 | 15:49 (UTC -3)

Cultivar Magazine

Aerial image of rivers in north-east Siberia known to emit ancient carbon - Source: University of Bristol

Most of the carbon dioxide released by rivers and streams around the world comes from very old carbon stores. Scientists' analysis shows that 59% of river CO2 emissions result from the release of ancient or even petrogenic carbon, which has been stored for more than 55 years.

Until now, it was believed that the CO2 emitted by rivers came mainly from the respiration of fresh organic matter, captured by photosynthesis on time scales of less than ten years. This assumption underpinned the main models of the terrestrial carbon cycle.

The new study, led by scientists at the University of Bristol, suggests that river

carbon, by contrast, carries the signature of much older sources, implying a real loss of carbon stored in soils, sediments and rocks.

Global database reveals age

The research used a global database of 1.195 measurements of radiocarbon (F14C) content in dissolved inorganic carbon (DIC), CO2 and methane (CH4) from rivers on all continents.

Both previously published measurements and new collections from rivers in China, the United Kingdom, Cambodia, Taiwan and Antarctica were considered. The analysis showed that the average age of

river CO2 ranges from 320 to 722 radiocarbon years, with some samples indicating much older ages.

To explain these data, the researchers modeled the proportion of carbon sources. The results indicate that about 1,2 ± 0,3 petagrams of carbon per year (Pg C/yr) emitted by rivers comes from “old” carbon – ancient or petrogenic. This is equivalent to more than half of all CO2 emissions from rivers, estimated at 2,0 Pg C/yr. In comparison, carbon sequestration by terrestrial plants is around 2,9 Pg C/yr.

Stored carbon conduits

The discovery forces a rethink of the role of rivers in the carbon cycle. Rather than

simply recycling short-term carbon, these waterways act as conduits that release carbon stored over thousands of years. This means that some of the carbon previously thought to be stable in soils and rocks is actually being released into the atmosphere.

The origin of this older carbon is associated with two main mechanisms.

The first is the chemical weathering of sedimentary rocks, especially those rich in carbonates and fossil organic matter.

The second involves the degradation of organic carbon deep in soils, released by subsurface hydrological flows and erosion.

Both processes were not properly accounted for in current carbon cycle

models.

Lithology, biome and climate

The analysis also showed that terrain characteristics strongly influence the age of the carbon emitted. Watersheds over sedimentary lithologies, such as limestone, presented the lowest F14C values, indicating the presence of very old carbon. Larger basins, with higher altitudes and less forest cover, also tend to release more ancient carbon.

Other factors such as precipitation, temperature, carbon content and soil sand influence the type of carbon released. Basins with higher average annual

temperatures and heavy rainfall tend to release younger carbon, but up to a certain limit. In extremely humid or arid regions, the release of older carbon increases.

Models need to be revised

The implications are relevant for understanding climate change. Some of the CO? emissions attributed to the respiration of recent ecosystems actually come from the loss of ancient stocks.

Furthermore, contrary to what was previously thought, the size of the river does not reduce the influence of ancient carbon. Even large rivers, such as the Mekong or the Amazon, release significant

amounts of ancient CO2.

By reassessing the global carbon budget, the authors show that the contribution of rivers to past carbon emissions directly affects the estimate of how much anthropogenic carbon the terrestrial biosphere is capable of storing. If part of the river emissions does not correspond to recent carbon, then the sequestration capacity of vegetation may be underestimated.

More information at doi.org/10.1038/s41586-025-09023-w

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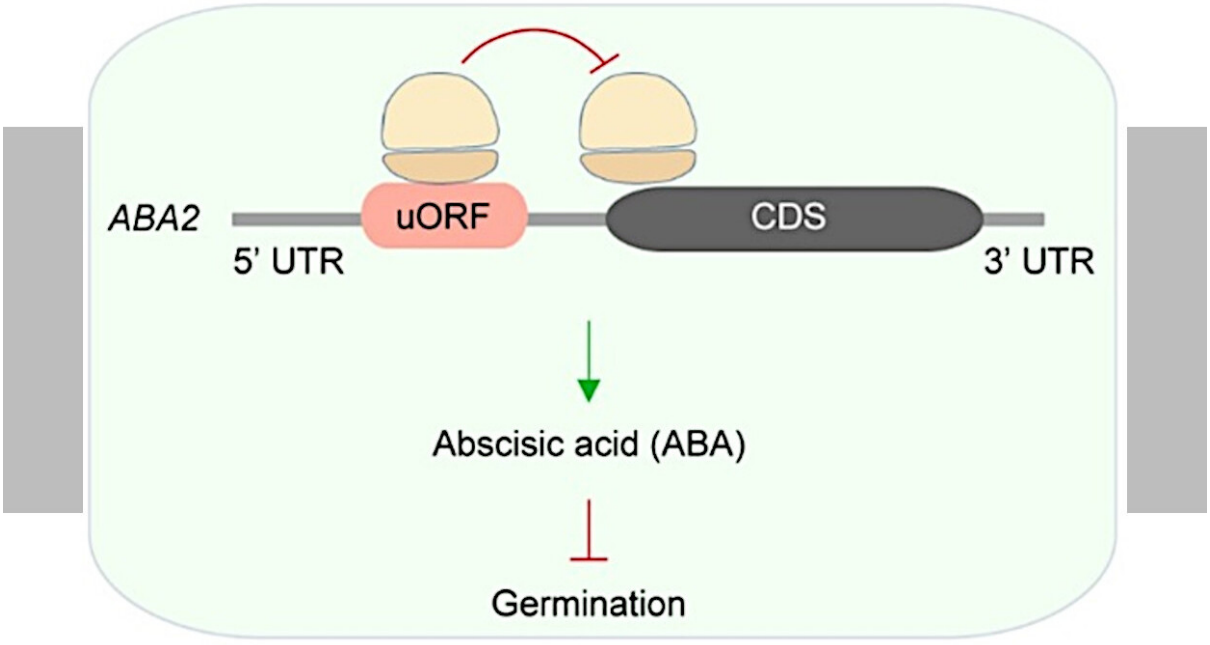
Discovery indicates mechanism to control early germination

Researchers identify genetic element that regulates ABA hormone translation

12.06.2025 | 14:10 (UTC -3)

Cultivar Magazine



Researchers have uncovered a central translational regulation mechanism that

controls the transition from seed to seedling. The study paves the way for genetic strategies to prevent early sprouting in cereals — a recurring problem that compromises agricultural productivity in several countries.

Germination marks the end of dormancy and the beginning of active plant growth. This phase depends on internal hormonal signals, such as the balance between abscisic acid (ABA) and gibberellins (GA), and also on external factors such as light, temperature and humidity.

When seeds germinate before harvest, while still attached to the ear, the phenomenon is called preharvest sprouting (PHS). The consequence is severe losses in grain production. To

overcome this challenge, the study investigated the molecular processes that regulate germination, with an emphasis on the translation of messenger RNAs stored in the seeds.

The team used combined transcriptome and translatome analyses to map gene expression during germination. In mutants with defective ribosomes, germination was delayed. The cause was traced back to the ABA2 gene, which is essential for ABA production. They found that a regulatory sequence at the beginning of the messenger RNA — called the upstream open reading frame (uORF) — acts as a brake, inhibiting the translation of the ABA2 protein.

By genetically editing this uORF with CRISPR-Cas9 in rice, scientists were able to eliminate early sprouting. The technique removed the sequence that inhibits ABA2 production, allowing greater accumulation of the hormone that maintains seed dormancy.

Two major uORF haplotypes were identified among rice cultivars. These natural genetic variations modulate the expression of the OsABA2 gene and, as a result, influence the degree of resistance to early sprouting. This shows that translational regulation of ABA2 plays a decisive role in controlling germination and that genetic diversity can be used in breeding programs.

The work also revealed that the mechanism is conserved in *Arabidopsis thaliana*, a model plant in plant biology. Mutants with translation deficiency or treated with translation inhibitors also showed delayed germination. The data reinforce the importance of the stored RNA translation machinery in the first hours of germination.

In addition to identifying a critical link between dormancy and gene translation, the results provide a practical strategy: genetically modifying the uORF to control germination. The study also proposes the selection of favorable haplotypes in current cultivars as a non-transgenic alternative.

More information at doi.org/10.1073/pnas.2502155122

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Federal Government publishes decree regulating Self-Control Law

Decree defines rules for the application of fines, processing of cases and operation of the Special Appeals Committee

12.06.2025 | 13:47 (UTC -3)

Cultivar Magazine

The federal government regulated this Thursday (12/6) Law 14.515/2022, which deals with self-control in agricultural defense. Decree 12.502/2025 establishes rules for administrative inspection processes and details procedures for applying fines and appeals. One of the main innovations is the possibility of converting penalties into a Conduct Adjustment Term (TAC), under specific conditions.

Companies that have their registration, listing or accreditation suspended or revoked may request the execution of a TAC. The agreement has the effect of an extrajudicial executive title and allows the penalty to be replaced by a fine, in addition to providing for additional obligations. The measure aims to prevent the interruption of

economic activities, provided that the offender complies with the agreed terms.

The rule defines deadlines and instances for defense and appeal.

The process begins with a notice of violation, which must contain legal grounds and a clear description of the irregularity. The defense may be presented electronically or in person, including at inspection units. Appeals may be processed up to the third instance, under analysis by the Special Committee for Agricultural Defense Appeals.

The decree also establishes criteria for calculating and paying fines in installments. The amount will be determined according to the severity of the offense, recidivism and size of the

offender.

Payment in full within 20 days, without recourse, entitles you to a 20% discount. Installments, when possible, must be requested within 20 days and paid in up to five installments.

Specific recidivism increases the penalty by 10% for each new infraction within a five-year period. Generic recidivism is treated as an aggravating factor. The decree also provides for the publication, on the website of the Ministry of Agriculture and Livestock, of the data of sanctioned companies after a final decision.

The Special Appeals Committee will be composed of representatives from the Ministries of Agriculture and Justice, as well as members of the industry and

agricultural sector. The committee will ultimately judge appeals and decide on the viability of the TACs. Members will serve for two years, with the possibility of reappointment.

The decree comes into force on the date of its publication and revokes provisions of previous normative acts that dealt with the subject. The Secretariat of Agricultural Defense will be responsible for issuing complementary norms, including on the deadlines and procedures for concluding a TAC.

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Diversification increases profitability and reduces risks in soybean production

Studies by Embrapa Soja show that more diverse systems improve fertility and guarantee greater economic returns

12.06.2025 | 11:22 (UTC -3)

Cultivar Magazine

The low diversification in soybean farming systems is a concern for researchers. Simplified arrangements predominate in Brazil, such as second-season soybean and corn in warm regions; and soybean and wheat or idle areas in the fall-winter in colder regions. This limitation compromises soil health and increases production costs, warns Embrapa Soja researcher Henrique Debiasi.

According to Debiasi, repeated crops degrade the biology and structure of the soil. The result is more diseases, nematodes and compaction. This reduces root growth, limits water infiltration, increases herbicide costs and compromises productivity. "Less diversity creates more risk, especially in dry years," he says.

Even in the face of this evidence, diversification is progressing slowly. Debiasi attributes this to the short-term vision of some producers. Different systems, although sometimes less profitable in a single harvest, bring consistent gains after four or five years. “We need to think about the system as a whole,” he emphasizes.

Studies by Embrapa confirm the economic viability of diversification. An experiment in partnership with Copacol, started in 2020, evaluates different production models at the Cafelândia (PR) experimental station. The corn-brachiaria consortium, for example, increased the profitability of the system by 11%. The increase did not come from corn or soybeans alone, but from the whole. “Brachiaria improves the

soil, which favors the soybeans grown next,” he explains.

Other models also showed positive results. The introduction of wheat as a third crop increased profitability by 7%. The use of black or white oats increased profitability by 10%. Losses due to frost, such as that which affected wheat in one of the years evaluated, do not offset gains in the full cycle. “Even with specific risks, the balance is positive,” the researcher points out.

The research also shows that, in the conditions of western Paraná, it is possible to carry out up to five harvests in two years, combining soybeans, corn and wheat or oats, with a focus on grains or straw. In addition to economic gains, the

intensified and diversified models improve the physical and biological fertility indicators of the soil.

Debiasi recommends that producers start with small areas. “Two, five or ten hectares. The important thing is to learn little by little,” he suggests. He emphasizes that Brazilian agriculture is already advanced, but can evolve further with different systems. “Diversifying is not about acknowledging mistakes, it is about seeking efficiency and sustainability,” he concludes.

Read also

- Fertile soil reduces nematodes
- Diversifying crops in succession between corn and soybeans can increase producer profits by up to

11%

- Experts recommend technological strategies to mitigate water shortages in soybeans

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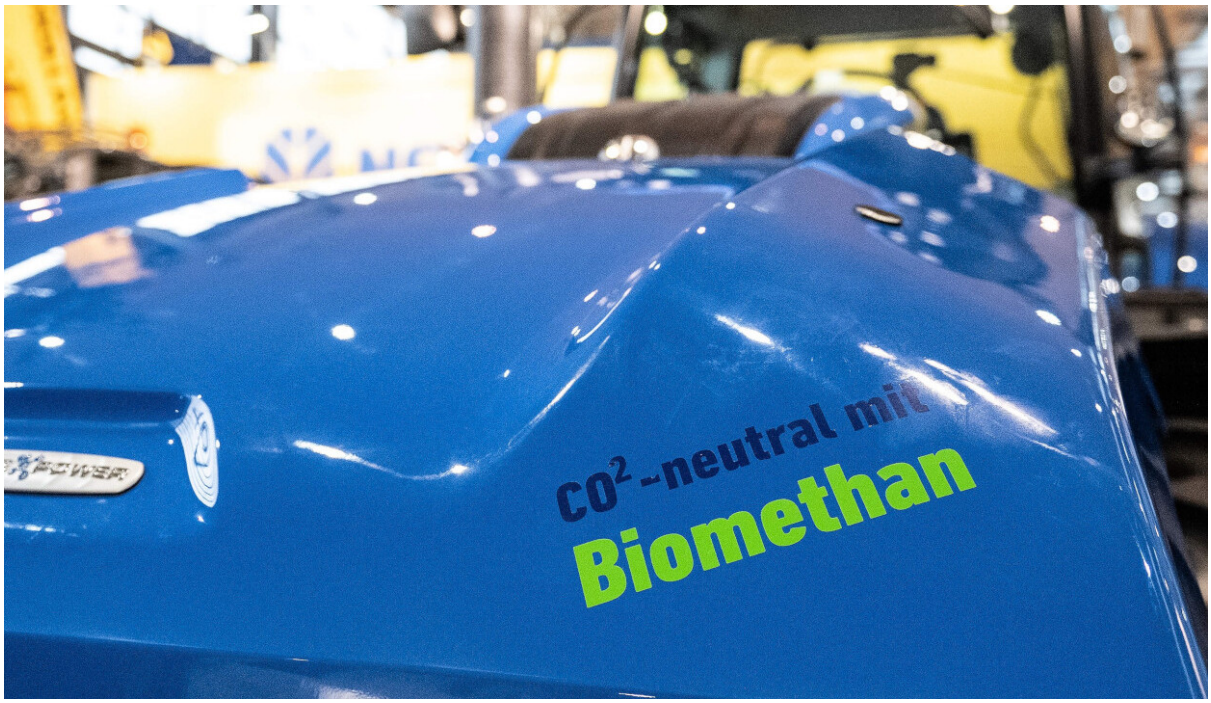
Carbon-neutral technology advances at Systems & Components 2025

Event highlights hybrid solutions, hydrogen engines and optimized diesel for agricultural machinery

12.06.2025 | 10:56 (UTC -3)

Cultivar Magazine, based on information from Malene Conlong



Diesel engines remain predominant in agricultural mechanization, but share space with low-carbon solutions at Systems & Components 2025. The event, promoted by DLG (German Agricultural Society), takes place from November 9 to 15 in parallel with Agritechnica.

Currently, more than 80% of off-road mobile machines use diesel engines. According to experts, this reality should persist until 2035 for equipment above 56 kW. The appeal remains: robustness, low operating costs and fast refueling. However, manufacturers are investing in the evolution of combustion engines. Operation in lean mixture and advanced emission treatment stand out in the new generations of diesel.

The Systems & Components proposal: a neutral technological approach. Exhibitors adopt hybrid and versatile platforms, capable of operating with fuels such as natural gas, e-fuels and hydrogen. The highlight is solutions such as the Liebherr hydraulic air booster, which improves engine response in lean burn conditions and also in hydrogen applications.

Among the decarbonization routes, hydrogen combustion engines are gaining traction. Adapting to current production lines and infrastructure makes this technology viable for smaller-scale applications in the short term. Multi-fuel and dual-fuel engines expand the options, offering transition alternatives with lower environmental impact.

Renewing the existing fleet is also on the radar. Renewable fuels such as HVO and ethanol reduce up to 90% of CO? emissions and can be used in engines already in operation. Manufacturers such as Bosch develop injectors and components compatible with multiple fuels, favoring adaptation and operational continuity.

“The discussion about low-emission alternatives is mobilizing manufacturers of mobile machines. Even high-powered engines are in the focus of engineers, who are trying to comply with emissions limits and reduce fuel consumption,” says Petra Kaiser, Brand Manager at Systems & Components.

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Study reveals delays in symbiotic nitrogen fixation in trees

Research shows that nitrogen fixation adjustment takes weeks or months

12.06.2025 | 08:39 (UTC -3)

Cultivar Magazine

Gliricidia sepium - Photo: Fernanda Birolo

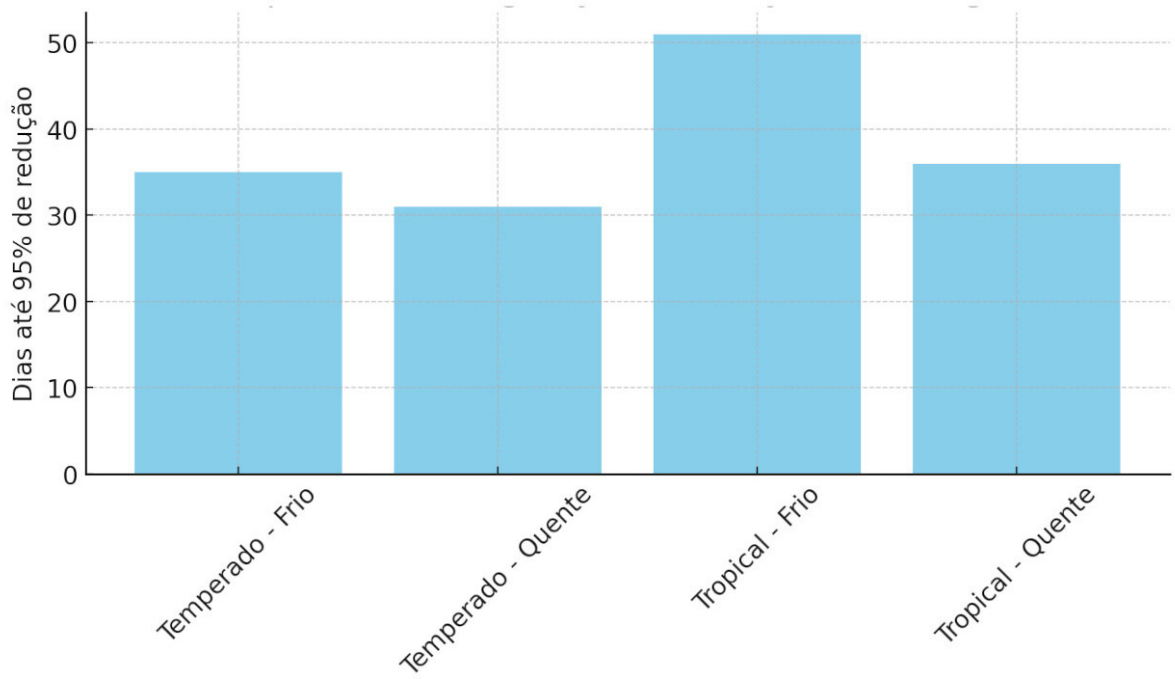
Symbiotic nitrogen fixation (SNF), the process by which plants capture atmospheric nitrogen with the help of bacteria, occurs more slowly than previously thought. The revelation comes from a study conducted by researchers at Columbia University and the University of Texas, who quantified for the first time the delays in SNF adjustment in young trees. The results indicate that these delays compromise the performance of fixing species in environments where the supply of nitrogen in the soil varies rapidly.

The research involved four tree species with different climatic origins and types of symbiosis: two tropical (*Gliricidia sepium* e *Morella cerifera*) and two seasoned (*Robinia pseudoacacia* e *Red Alnus*).

Each belongs to one of two known symbiotic groups: rhizobial and actinorhizal. The plants were grown under controlled temperature conditions, in both cold and hot environments, and underwent abrupt changes in nitrogen supply to simulate natural challenges.

The results... The reduction in SNF after nitrogen addition took between 31 and 51 days to complete. The increase in fixation after nutrient removal took between 108 and 138 days, considering the entire cycle. After the first detection of activity, the system still took between 21 and 57 days to reach the maximum rate. These numbers contradict previous assumptions, which estimated adaptations in a few days.

The experiment revealed that plants from temperate climates and those grown in hot environments reduce SNF more quickly. Tropical species and those exposed to cold conditions showed a slower rate of reduction. This difference reinforces the hypothesis that climatic and evolutionary factors affect the physiological response capacity.



Time course of nitrogen fixation reduction after increasing soil N

Another highlight is the differences between the symbioses. Plants with rhizobia initiate SNF earlier, but the growth rate of fixation is greater in actinorhizal plants, once the process begins. The structure of the root nodules helps to explain this behavior. Actinorhizal nodules are larger and more woody, which requires more time to build, but allows faster growth after activation.

According to the scientists, the methodology used in the study represents a breakthrough. They employed a continuous, non-destructive analysis system known as ARACAS, which measures the activity of nitrogenase, the enzyme responsible for fixation. The system provides real-time data on ethylene production and CO2 exchange, allowing

SNF to be monitored over months with unprecedented precision.

From an ecological perspective, the data reinforce a well-known paradox: tropical forests, despite containing trees that regulate SNF in response to excess nitrogen, continue to lose large volumes of the nutrient.

The explanation may lie in the delays in regulation itself. When the SNF takes weeks to adjust to the new scenario, the plant continues to fix nitrogen even when it is not needed, generating surpluses that escape the ecosystem through leaching or gas emissions.

The theoretical model that underpinned the study predicted that delays of more than two days would compromise the

competitiveness of nitrogen-fixing species in relation to non-fixing species. The empirical results, with lags of more than one month, confirm that nitrogen-fixing species may lose ground in ecosystems where nitrogen supply fluctuates rapidly.

This phenomenon may explain, at least in part, the lower presence of fixing trees in high latitudes, where cold weather prolongs the delays. Interestingly, even under high temperatures, the geographic origin of the species maintained an influence on the pace of adjustment. This suggests that evolutionary adaptation to the original environment persists as a determining factor in the physiological response.

The study also highlights important limits to phenotypic plasticity. Although SNF is theoretically adjustable to environmental conditions, the time required for this adjustment limits its effectiveness. Plants do not respond instantly, and this slowness can mean the difference between ecological success and failure.

More information at doi.org/10.1111/nph.70295

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Use of soil and foliar fertilizers in beetroot

By Emmanuel Zullo Godinho, Amanda Alves Arruda, Meirieli Nunes Beladeli

11.06.2025 | 17:38 (UTC -3)

Beetroot stands out as a vegetable of great economic and agricultural

importance for Brazil. Brazil is close to planting 20 thousand hectares (ha) of this vegetable, produced on more than 100 thousand properties.

The beetroot (*Beta vulgaris* L.) is a tuberous root, native to Europe, belonging to the Chenopodiaceae family. Like chard and spinach, it has a dark red coloration, due to betalain, a natural pigment that can be used as a dye, which also occurs in the veins and petiole of the leaves, it is globular-flattened and has a markedly sweet flavor.

Beetroot has specific characteristics among vegetables that place it among the main foods, as it has a nutritional composition above other plants, especially in B vitamins. Its consumption occurs both

in the leaves and in the root, which is eaten raw or cooked. Its root is considered tuberous and consists of the swelling of the hypocotyl-root axis and a limited upper portion of the taproot, being its main organ for storing reserves and for its growth.

In Brazil, its cultivation is predominant in the Southeast Region, which represents around 250 thousand tons per year, generating income for more than 500 thousand people per year, with a turnover of approximately R$ 256,5 million per year in retail. The value of the production chain of this vegetable reached around R$ 841,2 million in the last 10 years. In the country, its cultivation is designated exclusively for the table, unlike European countries, which use the crop as a source of sugar.

However, beetroot is a very demanding crop in nutritional terms, requiring a balanced fertilization program capable of replacing the nutrients extracted by the crop, thus avoiding soil depletion.

Therefore, soil management regarding its structure and fertility must be judicious in terms of fertilization, leading to high productivity. However, to achieve this, producers must satisfy the nutritional needs of the crop by adopting techniques that provide greater efficiency in the use of fertilizers, with the rational application of mineral and organic fertilizers.

Agriculture, in general, has sought forms of cultivation that present lower implementation costs, that cause the least possible damage to the environment,

especially to the soil, aiming at conservationist management and that the use of inputs, such as fertilizers and pesticides, is as low as possible.

Two types of fertilizers stand out. Mineral fertilizers, which have high concentrations of nitrogen, phosphorus and potassium, as well as other macro and micronutrients. And organic fertilizers, which are fertilizers that contain high levels of organic matter in their structure.

The cultivation of vegetables with organic fertilizers has increased in recent years, due to the high costs of mineral fertilizers and the beneficial effect of organic matter on intensively cultivated soils. The staggering productivity obtained by the intensive use of inorganic fertilizers and pesticides. In addition to the high cost,

questions have also been raised not only about economic and environmental conflicts, but also the neglect of important quality aspects of agricultural production. Several studies have shown the beneficial effects of the use of organic fertilizers in agriculture, especially in combination with mineral fertilizers, and when used in the system, it can reduce or even eliminate the need for mineral fertilizers.

However, in some specific regions of Brazil, the use of organic fertilizer may be unfeasible or even unnecessary due to the lack of nutrients in the soil. The vast majority of Brazilian soils have acidic reactions and low fertility, with a high phosphorus retention capacity, which leads to the need to apply high doses of this nutrient and a reduction in the non-

renewable natural resources that produce these inputs.

Phosphorus is of significant importance for plant growth and is related to protein synthesis, as it constitutes nucleoproteins necessary for cell division, acting in the process of ionic absorption, favoring the development of the root system of vegetables, increasing the absorption of water, nutrients, quality and yield of harvested products.

In addition to phosphorus, nitrogen (N) is an important macronutrient, as its internal chemical reactions can be decisive in achieving high beet yields. Proper fertilization management tends to emphasize and enhance the use of organic and mineral fertilization methods.

However, excessive fertilization containing N can affect root quality, causing the accumulation of glutamine, in addition to the plants becoming visually unattractive.

In specific doses of correction in the soil and for the plant, nitrogen contributes to the increase in crop productivity by promoting leaf expansion and the accumulation of green mass. In addition to being a constituent of several organic molecules, such as proteins, nucleic acids and chlorophylls, it also has a great effect on plant growth and the quality of plant products.

It is important for the reader and the producer to always follow the research that is involved in their commercial exploitation crops, as many researchers from the North

to the South of Brazil are studying various and various factors, methods and methodologies that meet the management of fertility issues.

In a study conducted by Damasceno and other researchers in 2011 in Minas Gerais, doses of 0, 100, 200 and 300 kg per hectare (kg/ha) of nitrogen were tested on beetroot. A linear increase was observed as the doses increased, and the maximum productivity of fresh matter of the aerial part and root, and root diameter, was obtained with the dose of 300 kg/ha of N. Similar results were obtained by Oliveira and other researchers in 2003 in the coriander crop, in which doses of 0, 20, 40, 60, and 80 kg/ha of N were analyzed, meaning that the use of nitrogen in beetroot crops is of utmost importance, but

in specific doses, always observing the analysis of soil and leaves.

By applying phosphorus (P) to beetroot, some researchers observed that there was an increase in growth, in the foliar phosphorus P content and in the fresh mass of the tuberous root.

Observing the accumulation of nutrients in beets, Grangeiro and other researchers in 2007 determined that this vegetable has a greater demand for calcium between 40 and 50 days after sowing, which accumulates preferentially in the leaves. Its low concentration in the roots is associated with low mobility in the plant. And, according to the authors, after being absorbed by the roots, the nutrient is translocated to the leaves and is not redistributed. On the other hand, magnesium is required in greater quantities from 40 to 60 days of the beet cycle, also accumulating in greater quantities in the leaves because it is part of the chlorophyll molecule.

When it comes to organic fertilizers, the increase in doses both in association with

mineral fertilizers and in exclusive use, allowed linear increases in the fresh and dry mass of tubers. Thus, the highest productivity values ??were observed in studies with the association of poultry litter and mineral fertilizer, presenting a productivity of 41,12 t/ha of fresh mass of tubers, 18,8% higher compared to cattle manure associated with mineral fertilizer. An increase of 0,456 t/ha and 0,246 t/ha was observed in the productivity of beet for each ton of poultry litter and cattle manure applied, respectively. When exclusively organic fertilization was used, the plants with poultry litter reached a productivity of 28,39 t/ha of fresh mass of tubers, 47,06% higher compared to fertilization with cattle manure.

It can be observed that at a dose of approximately 30 t/ha of poultry litter, there was a yield of 29 t/ha of fresh mass of tubers, values ??higher than exclusively mineral fertilization, with 27,44 t/ha. Thus, the use of poultry litter has a characteristic appropriate for beetroot.

When talking about organomineral fertilization, increases of 30% are observed for each ton of bedding and 20% with the use of cattle manure in partnership with mineral fertilizers.

Therefore, it is known that the fresh and dry mass of tubers has a better response to the use of fertilizers when an organomineral (mineral + organic) is applied in relation to the pure organic and only the mineral, as in this fertilizer model

it has high doses of minerals and organics.

Observing similar results, some researchers analyzed the dry mass of leaves in an application of an organomineral fertilizer, obtaining an increase of 80% in results when the fertilizer dose was 20% higher. On the other hand, even increasing the dosage of the mineral fertilizer, the increase in results was less than 10%.

In general, treatments under organomineral fertilization interaction present the highest values ??of yield and product quality components, except when evaluating the total soluble solids content.

With the use of exclusively organic fertilization, treatments that receive poultry litter present higher average values ??than

those obtained with cattle manure, for variables: fresh and dry mass of tubers and fresh mass of leaves.

By **Emmanuel Zullo Godinho** *(USP),* **Amanda Alves Arruda** *(UNESP/FCA),* **Meirieli Nunes Beladeli** *(UFPR)*

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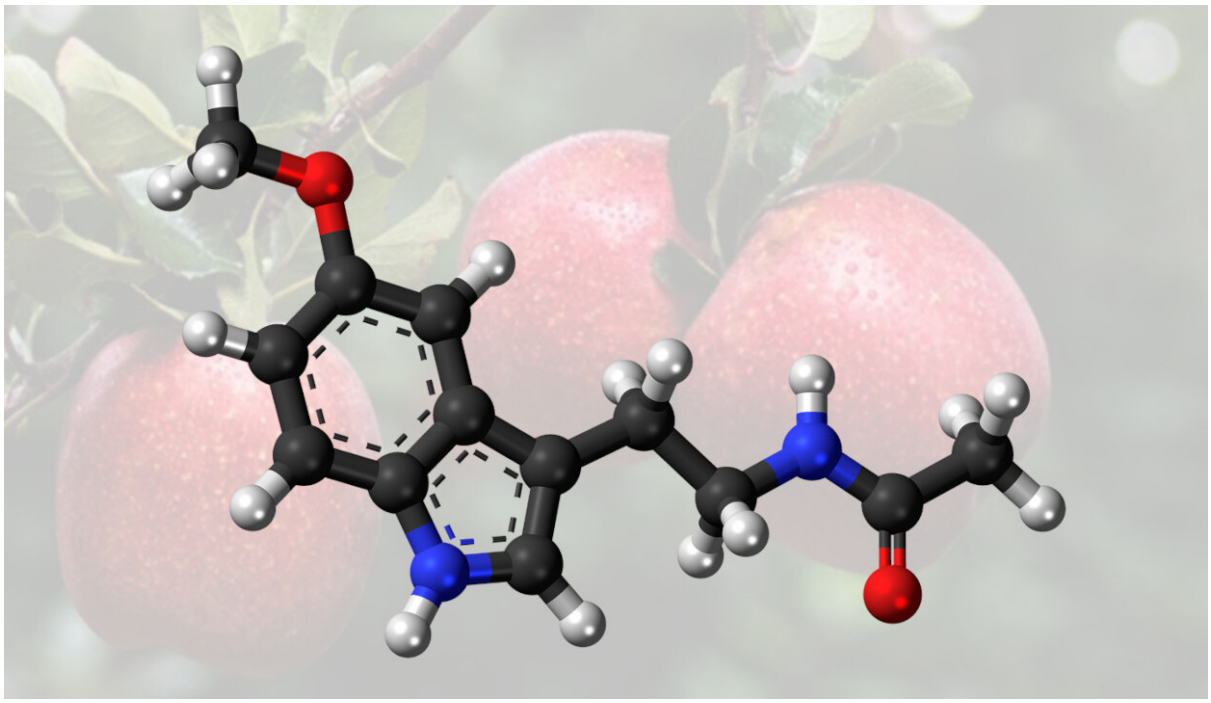
Scientific review points to the effects of melatonin on vegetables

Researchers point out how the plant hormone strengthens resistance to bacteria, fungi and viruses

11.06.2025 | 13:30 (UTC -3)

Cultivar Magazine



The exogenous application of melatonin, known for its regulatory function in animal metabolism, has gained ground as a strategy for disease management in horticultural crops. A study by Ningxia University in China compiled robust evidence of its effectiveness against several pathogens that affect fruits and vegetables.

Research on tomatoes, apples, mangos, cucumbers, oranges and other species shows that melatonin activates defense mechanisms related to antioxidant enzymes, plant hormones and gene expression. The compound improves tolerance to biotic stresses, including infections by bacteria, fungi and viruses.

In bacterial control, melatonin has been shown to reduce the effects of cassava bacterial wilt and *huanglongbing* in citrus fruits. The substance increased the levels of salicylic acid and jasmonate, in addition to reducing the population of the bacteria *Candidatus Liberibacter asiaticus*.

In fungal diseases, the data are even more comprehensive. In apples, it mitigated leaf spot caused by *Diplocarpon mali*. In mango, it improved resistance to anthracnose by increasing the synthesis of lignin and flavonoids. In cucumber, it helped control downy mildew by increasing antioxidant activity and reducing damage to cell membranes.

The results are also consistent against viruses. In apples, the application reduced

the viral load of stem notch virus. In cucumbers, it activated genes linked to antiviral immunity. In eggplant, it improved the response to alfalfa mosaic virus, increasing levels of chlorophyll and antioxidant enzymes.

In addition to its direct action against pathogens, melatonin promoted physiological gains in plants: increased leaf area, root growth, higher photosynthetic rate and hormonal balance. These effects were observed in crops such as apples, pears, tomatoes, cucumbers and bananas.

The molecular mechanisms identified include regulation of genes related to the salicylic acid, jasmonic acid, ethylene and auxin pathways. Melatonin also activates

defense pathways such as the phenylpropanoid and pentose phosphate pathways.

However, the use of the substance requires caution. In citrus infected by *Penicillium digitatum*, the application of melatonin reduced resistance, worsening symptoms of the disease. The substance decreased hydrogen peroxide (H?O?) and compromised the action of antioxidant enzymes.

Another relevant limitation is the scarcity of field studies. Most experiments were carried out under controlled conditions. There is insufficient data on interactions with insects, nematodes or weeds. There is also a lack of information on the behavior of melatonin in different soil types

and climates.

More information at doi.org/10.1093/hr/uhaf150

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Ourofino launches Dotte fungicide to combat Asian soybean rust

Systemic action allows the fungicide to act on different parts of the plant

11.06.2025 | 10:09 (UTC -3)

Cultivar Magazine, based on information from Fernanda Chiossi

Ourofino Agrociência launched the Dotte fungicide (picoxystrobin + prothioconazole) for the control of Asian rust e leaf spots on soybeans. According to information released to the press, the pesticide, developed by the company's research area, has an exclusive formulation with high adhesiveness.

This feature minimizes losses due to rain and ensures permanence on the leaves. Gradual absorption increases selectivity and improves performance in the field. Photoprotection prevents degradation of active ingredients due to UV rays.

Systemic action allows the fungicide to act on different parts of the plant. According to Kaiê Miranda, product manager, the launch represents the result of years of

research focused on Brazilian tropical conditions. Slow absorption and low degradation preserve effectiveness for longer.

The company expressed expectations of expanding the use of Dotte to other crops, such as wheat.

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AGCO’s OutRun Awarded for Innovation in Harvest Automation

Autonomous grain transshipment solution offers practical answer to labor shortages in the field

11.06.2025 | 09:52 (UTC -3)

Cultivar Magazine, based on information from Bob Blakely

AGCO announced that its PTx Trimble brand has received a World Changing

Ideas Award for OutRun, an autonomous system for grain trailer operations. The award recognizes products that have a positive impact on global sustainability and safety. With automation technology, OutRun helps reduce costs, overcome operator shortages and increase crop profitability.

The system works as a retrofit kit. It transforms existing row tractors into autonomous machines focused on grain transshipment. The proposal allows the harvest to continue even with a labor shortage. It also makes it easier to use operators during the peak harvest period.

OutRun can now be installed on John Deere 8R or 8000R tractors with IVT transmission. It is expected to hit the

market on Fendt models from 2026 onwards. The company plans to make the solution compatible with other brands and models, expanding the offering to different property profiles.

The technology also received the Davidson Award this year, granted by ASABE to outstanding innovations in agricultural engineering. In addition to harvesting operations, PTx Trimble plans to integrate OutRun into other activities, such as soil preparation, using the same autonomous base for spring and fall tasks.

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Pesticides will have mandatory traceability throughout the country

Ministry of Agriculture Ordinance instituted the digital system

10.06.2025 | 16:12 (UTC -3)

Cultivar Magazine

Pesticide packaging sold in Brazil will now have identification codes to allow product tracking. The requirement is set out in Ordinance No. 805, published by the Ministry of Agriculture on Tuesday. The text creates the National Program for Traceability of Agrochemical Products (PNRA), which aims to ensure safety in the production chain and prevent fraud and risks to health and the environment.

Traceability will be achieved through an Integrated Traceability System (SIR), a platform that will store information from manufacturing to the return of packaging. The information will be linked to a Pesticide and Related Product Traceability Identifier (IRA), such as a QR Code, barcode or RFID tag. These identifiers must guarantee electronic reading and

permanence during transportation and use.

The new program will be implemented in three phases: structuring, gradual expansion and consolidation with reverse logistics. The adherence schedule will be defined by the Secretariat of Agricultural Defense within 60 days. The mandatory nature of registrations will depend on the effective availability of technological systems.

Logistics traceability will be achieved through integration with the Brasil-ID/Rastro-ID system, a platform that uses RFID to identify, authenticate and monitor cargo in real time. Transporters, warehouses, traders, distributors and users will also need to integrate the

system. The measure includes issuing an electronic transit certificate for cargo.

The Ministry of Agriculture will require that all data be processed in accordance with the General Data Protection Law. Strategic and commercial information will only be accessed by competent authorities. Data will be stored for at least five years.

The platform will allow interoperability with public systems such as SISPA, SEI, SISCOMEX and Bolsa Família. Companies involved in the production chain must adopt the system, which also includes a public tracking application. The goal is to strengthen fiscal control and standardize information among government agencies.

The Secretariat of Agricultural Defense will be responsible for regulating the program, defining technical standards, conducting periodic safety audits and updating technology. It will also be responsible for establishing agreements to encourage private agents to join the national traceability system.

The program will seek to simplify and integrate inspection and transportation processes. The measure affects all links in the pesticide chain: from registration holders to packaging collection centers. The ordinance also provides for periodic reviews of the system every five years, or as needed.

Failure to comply with the rules provided for will subject offenders to the penalties set out in Law No. 14.785/2023, in addition

to other applicable legal sanctions.

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RNA control doubles mortality of Frankliniella occidentalis

The result obtained is comparable to the effectiveness of commercial insecticides

10.06.2025 | 15:21 (UTC -3)

Cultivar Magazine

Experiment revealed promising strategy for population control of ***Frankliniella***

occidentalis (thrips). Through oral delivery of double-stranded RNA (dsRNA) capable of silencing the gene for the enzyme trehalose-6-phosphate synthase (TPS), the insect suffered a drastic reduction in fecundity and an increase in mortality, with a population impact of 97% in just 100 days.

Frankliniella occidentalis attacks field and greenhouse crops, damaging plant tissue and transmitting phytopathogenic viruses. Since the 1960s, it has spread rapidly to at least 57 countries. Resistance to insecticides and the elimination of natural predators have made its control difficult.

The study evaluated the potential of RNA interference (RNAi) as an alternative. The target was the TPS gene, essential for the

production of trehalose, a sugar vital for the metabolism, development and reproduction of insects. When they ingested the dsRNA synthesized in the laboratory or produced by modified bacteria (*Escherichia coli*), thrips showed a strong decrease in enzyme expression.

The effects were observed at different stages of the life cycle. In the first three days after dsRNA consumption, nymph mortality increased up to 5,5 times compared to the control group. Adults survived for less time and laid fewer eggs. The duration of the pre-reproductive period was extended. Life expectancy was reduced from 52,7 to 29,9 days. Fecundity fell from 209 to 54 eggs per female.

The analyses used stage-based life tables and population growth simulations. Within 100 days, the population that ingested dsTPS bacteria had reached 166 individuals—compared to 5,7 million in the control groups. That’s a decline of 1 in 34. The intrinsic growth rate and net reproduction rate also fell substantially.

This result is comparable to the efficacy of commercial insecticides. Furthermore, since the trehalose metabolic pathway does not occur in vertebrates, the method presents high specificity and low environmental risk.

The technique used two approaches: direct application of dsRNA in bean sprouts and use of *E. coli* modified to express the target gene. The second

method proved to be more effective in the long term, even with partial degradation of the RNA by the insect's intestinal enzymes.

More information at doi.org/10.3390/insects16060614

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Brazilian apple harvest 2024/25 reaches 850 thousand tons

Reduction in rainfall during critical periods helped to concentrate the flavor and ensure firmness of the pulp

10.06.2025 | 14:52 (UTC -3)

The 2024/25 Brazilian apple harvest totaled 850 thousand tons. The volume repeats the level of the previous cycle and reinforces the stability of national production. The main highlight, however, is the quality of the fruit. According to the Brazilian Association of Apple Producers (ABPM), the flavor exceeded expectations and consolidated the harvest as one of the best ever recorded in the country.

Francisco Schio, president of ABPM, describes the harvest as historic. According to him, the fruit harvested this year had an above-average flavor. “We can safely say that this is one of the best harvests in our history in terms of quality,” he says.

The reduction in rainfall during critical periods helped to concentrate the flavor

and ensure firmness of the pulp, characteristics valued by the market. The orchards in Santa Catarina and Rio Grande do Sul lead production.

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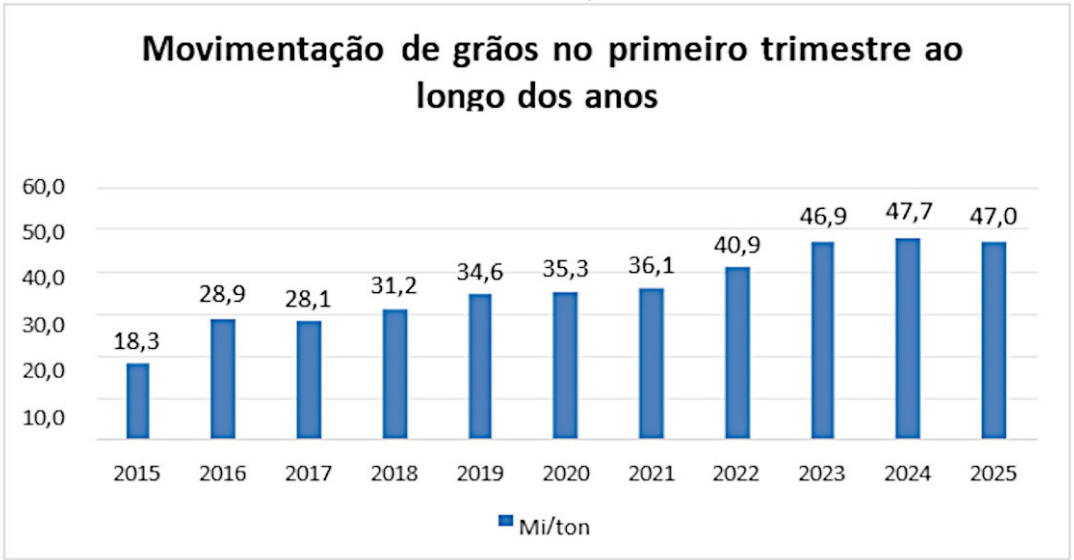
Drought in rivers reduces grain transport by inland waterways in Brazil

Port movement fell 1,4% in the first quarter; soybeans lead exports

10.06.2025 | 14:37 (UTC -3)

Cultivar Magazine, based on information from Gustavo Villela



Brazil's private port terminals handled 47 million tons of grain between January and

March 2025. The volume represents a 1,4% drop compared to the same period last year. The main cause was the drought that affected rivers used for inland navigation, especially in the North Region.

The decline in river navigation had a strong impact on terminals in the North, which recorded a 13,7% drop in grain transportation. This information comes from the Association of Private Port Terminals (ATP), which represents 70 terminals and is responsible for 60% of national port cargo.

In the opposite direction, long-haul shipping grew 3,4%, driven by exports. China purchased more than 17 million tons of Brazilian grains in the period. Iran and Egypt increased their purchases by 63,5%

and 62,3%, respectively, reinforcing the diversification of destinations.

Soybeans were the main exported product. There was a 4,5% increase in movement compared to the first quarter of 2024, according to ATP.

Among the Private Use Terminals (TUPs), the highlights were Cotegipe, in Bahia, with growth of 50,5%, and Portochuelo, in Rondônia, with 15,8%.

ATP Executive Director Gabriela Costa believes that the sector demonstrates resilience and the ability to adapt even in the face of adversity.

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Rumo begins operations with 135-car trains to Santos

With an investment of R$350 million, railway operator increases transport capacity

10.06.2025 | 11:36 (UTC -3)

Cultivar Magazine, based on information from Mariana N. Marciano

Rumo began operating the new trains with 2025 wagons in the first quarter of 135. The trains depart from terminals in Mato Grosso, Mato Grosso do Sul, Goiás and Tocantins bound for the Port of Santos.

The new model represents the third phase of Rumo's evolution. The company started with 80-car trains in 2015, increased to 120 in 2021 and now has 135. The advance is a response to the expansion of agricultural production in the regions served. Each train transports 1.200 more useful tons. The trip is now one hour shorter and around 530 trucks per day are no longer on the highways.

In February, grain shipments totaled 3 million tons heading to the port. “We worked for three years to make this project viable, which guarantees faster deliveries

with the same number of trains," says Bruno Casarini, operations and maintenance director at Rumo.

The company invested R$350 million to expand maneuvering yards and adapt the railways. Studies with sensors on the couplings helped to understand the technical requirements of the new operation.

TREM COM 80 VAGÕES GRANELEIROS	TREM COM 120 VAGÕES GRANELEIROS	TREM COM 135 VAGÕES GRANELEIROS
Transporta cerca de 7.600 toneladas brutas	Transporta cerca de 15.500 toneladas brutas – ganho aproximado de 50% de capacidade	Transporta cerca de 17.200 toneladas brutas – ganho aproximado de 9 % de capacidade referente ao de 120 vagões.
Comprimento do trem: 1,5 quilômetros	Comprimento do trem: 2,25 quilômetros	Comprimento do trem: 2,4 quilômetros
Peso total: 10,3 mil toneladas brutas	Peso total: 15,5 mil toneladas brutas	Peso total: 17,2 mil toneladas brutas
Equivalente à capacidade média de 173 caminhões*	Equivalente à capacidade média de 261 caminhões*	Equivalente à capacidade média de 294 caminhões*

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São Martinho inaugurates Trichogramma galloi biofactory

Unit in Pradópolis received R$15 million in investment and reinforces sustainable management against the sugarcane borer

10.06.2025 | 10:53 (UTC -3)

Cultivar Magazine, based on information from Rodrigo Pinto

São Martinho has opened a new biofactory *Trichogramma galloi* in Pradópolis. With an investment of R$15 million, the 3-square-meter structure will produce wasps for biological control of the sugarcane borer in more than 400 hectares. The method is part of total integrated management (MIT), a strategy that combines technology and sustainability in the fight against pests.

The initiative reduces the use of chemical pesticides and reinforces the company's role in controlling *Diatraea saccharalis*. ***Trichogramma galloi*** parasitizes the pest eggs, complementing the work of *cotesia flavipes*, used by the company for over 40 years to attack the larval stage.

The new biofactory is distinguished by its own production of the alternative host

Ephestia kuehniella, essential for the microwasp cycle.

The structure will serve the company's four units. More than 85% of pest control is already carried out using biological agents. Reducing the use of chemicals preserves soil, water and biodiversity, in addition to generating savings and predictability in the production process.

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Adama appoints new vice president for Latin America

Francisco López Aufranc assumes regional leadership with focus on growth

10.06.2025 | 07:17 (UTC -3)

Cultivar Magazine, based on information from Tal Moise

Adama Ltd. announced the appointment of Francisco López Aufranc as Executive Vice President for Latin America. The

executive will lead the company’s commercial operations in the region. The goal involves increasing customer engagement and driving new growth opportunities.

With over 20 years in the agribusiness sector, López Aufranc brings experience in finance, operations and management. He previously worked at Syngenta, where he held the position of global CFO for the major crop seeds division. He also led the seed operations in southern Latin America and held senior positions in South and North America.

Eric Dereudre, Adama’s commercial director, highlighted the new vice president’s technical knowledge and international experience. He believes that

López Aufranc has the skills to strengthen the company’s presence in key Latin American markets.

López Aufranc said he was motivated by the new challenge. According to him, the region plays a strategic role in global food production. He also highlighted Adama's commitment to offering practical and innovative solutions for producers.

The executive holds a master's degree in Finance from the University of London and an industrial engineering degree from Universidad Austral in Argentina. He also participated in executive training programs at INSEAD and the London School of Economics.

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Optional sex harms the wasp Lysiphlebus fabarum

Study reveals that asexual females face greater reproductive failure when they opt for facultative reproduction

09.06.2025 | 15:52 (UTC -3)

Cultivar Magazine

Photo: C. Vorburger

The parasitoid wasp *Lysiphlebus fabarum*, known for attacking aphids on crops in Europe, has an intriguing biological peculiarity. Some of its populations reproduce exclusively by parthenogenesis — a form of asexual reproduction that does not require males. Others reproduce sexually. But among them, there is a group that can alternate between the two modes.

This behavior, known as facultative sex, has been considered by evolutionists as a way to combine the genetic benefits of sex with the reproductive efficiency of parthenogenesis.

However, a recent study suggests that this flexibility can be a burden. Females that usually reproduce without males but occasionally mate suffer significant losses

in reproductive success. Instead of “having the best of both worlds,” they appear to reap the worst.

Rebecca Boulton of the University of Stirling investigated seven asexual lines and one sexual population of the species. Females were either exposed to males or kept virgin. In both cases, they were given aphids as hosts for parasitism.

Those that mated were evaluated to determine whether they actually used sperm to fertilize their eggs. The reproductive performance of these females and their daughters was then monitored for two generations.

The results were clear. Sexual reproduction by normally asexual females resulted in a higher rate of reproductive

failure. They produced fewer "mummies"—dead aphids with developing wasp larvae—and fewer adults emerged from these. The daughters of these females were also less successful at parasitizing new aphids.

Contrary to expectations, the classic advantage of asexual reproduction — avoiding the so-called "male cost", that is, producing only daughters — was not confirmed. Sexual females produced as many daughters as asexual females. The reason? Higher fertility of sexual females. Even investing in children of both sexes, they managed to keep the number of daughters at a similar level.

Furthermore, there were additional unforeseen costs to facultative sex. Some

of the hybrid offspring—the result of genetic mixing between asexual and sexual lineages—may suffer from genetic problems such as triploidy or outcrossing depression between genetically distant individuals. The hypothesis of "genetic drift," where coadapted genetic combinations fall apart at random, has gained traction to explain the failure of the offspring of females that crossed.

Despite being reproductively inefficient, sexual behavior remained present in all seven asexual lineages tested, even after hundreds of generations without contact with males.

This persistence raises the question: why have costly sexual traits, such as copulation acceptance and sperm use, not

been eliminated by natural selection?

One hypothesis involves the "bet against risk" strategy. At the end of summer, populations of *L. fabarum* increase rapidly before a seasonal collapse. At this stage, encountering males becomes more likely and the environment more unstable. Sex, in this context, can generate genetic diversity useful for surviving the winter. The immediate cost of lower fertility may be offset by a greater chance of future adaptation.

Another important factor is the social and behavioral structure of the species. Wasps tend to parasitize in the same place where they emerged, which favors crossbreeding between siblings. Inbreeding, in this case, can reduce the negative effects of

crossbreeding between very different lineages, as would be the case of an asexual female mating with a distantly sexual male.

The study also points out that the occurrence of sex between asexual females and sexual males — or even between rare males generated by parthenogenesis — can maintain the genetic diversity observed in asexual populations of *L. fabarum*.

More information at doi.org/10.1098/rsos.242162

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Albaugh Brasil announces new commercial director for the South and Paraguay

Adolpho Lemos takes over the position with the mission of expanding the brand's presence

09.06.2025 | 13:52 (UTC -3)

Cultivar Magazine, based on information from Fernanda Domiciano

Albaugh Brasil has appointed Adolpho Coelho Lemos Neto as the new commercial director for its Southern and Paraguayan units. The company is among the ten largest in the world in the agricultural pesticides sector. The executive arrives with the mission of strengthening the brand's presence and expanding relationships with regional partners.

With over 15 years of experience in agribusiness, Adolpho has worked in sales, planning and marketing. He has led sales teams in distribution channels, large producers and agricultural companies. He was also responsible for herbicides in Latin America and directed strategic operations.

Adolpho is a chemical engineer from Unicamp. He has an MBA in strategic management from FGV and leadership training from Fundação Dom Cabral.

“We want to get even closer to customers in the South and in Paraguay, offering high-quality products that increase production efficiency and sustainability,” says Adolpho.

Cesar Rojas, president of Albaugh Brazil and Paraguay, highlights the profile of the new director. “Adolpho has recognized experience in the sector and will continue our market access strategy.”

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Fungus Beauveria bassiana reduces root-knot nematode action in tomato plants

Entomopathogenic fungus inhibits and repels juveniles of Meloidogyne incognita and induces defense in plants

09.06.2025 | 09:17 (UTC -3)

Cultivar Magazine

Fermented fungus ***beauveria bassiana*** inhibit egg hatching and reduce the survival of juveniles ***Meloidogyne incognita***, scientists indicate. The tests were carried out in the laboratory and on tomato plants, with the application of the fungus or its fermentation broths.

In vitro bioassays showed that the fermented broth of *B. bassiana* compromises the initial development of the nematode. The presence of the extract also caused a strong repellent effect on second-stage juveniles, according to olfactometer tests.

In plant experiments, application of the fungus or fermented broth reduced root colonization by *M. unexplained*. The effect coincided with the increase in defense

hormones in tomato plants, suggesting induced systemic action.

The results indicate that the use of fermented *B. bassiana* can integrate nematode management with a focus on sustainability. In addition to direct action on the pathogen, the strategy activates the plant's natural resistance mechanisms. The approach paves the way for the development of biological solutions that are less aggressive to the environment.

More information at doi.org/10.1002/ps.8948

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Itaconate identified as growth regulator in corn

Previously known for its immunological action in mammals, the acid also regulates metabolism in plants

08.06.2025 | 16:48 (UTC -3)

Cultivar Magazine

Scientists have discovered that itaconate also acts on plants. The compound, derived from the Krebs cycle, acts as a regulator of gene expression and protein modifications in plant species. Its endogenous presence has been confirmed in **corn** e *Arabidopsis*. The discovery expands horizons on plant metabolism.

The external application of itaconate produced divergent effects. In corn, it stimulated the growth of the aerial part. In *Arabidopsis*, inhibited cell formation and division in the roots.

The responses were dose-dependent. High concentrations suppressed cell divisions and root elongation. When using a cell cycle marker line, a decrease in the number of actively dividing cells was

evident after treatment with the compound.

Itaconate also altered ATP levels, chlorophyll and response to abiotic stresses. In *Arabidopsis*, reduced chlorophyll and hydrogen peroxide levels. The compound inhibited cytokinin hormonal pathways and altered abscisic acid signaling. In interaction with salt and mannitol stresses, there was no additional effect, indicating overlapping mechanisms.

The study used several molecular techniques. Transcriptomic analyses revealed hundreds of altered genes. Photosynthesis and oxidative response pathways emerged as affected. Crucial proteins such as SDH1-1 and ABA1 showed affinity for itaconate.

The chemoproteomic approach detected modifications in cysteines of carbon cycle and glycolysis enzymes. Some of these proteins also undergo modification in human macrophages.

XAL2, a key transcription factor in root development, was downregulated. Mutants for this gene showed resistance to itaconate. Overexpressing lines showed the opposite response: root growth increased under itaconate.

To test its endogenous production, scientists introduced the IRG1 gene into *Arabidopsis*. The resulting plants exhibited taller stems and higher itaconate concentrations. Interestingly, these lines showed favored, not suppressed, growth, suggesting that the origin and context of

production influence the effects of the compound.

The study points to itaconate as a link between metabolism, stress and hormonal regulation. Its action on central pathways could pave the way for agricultural applications. However, there is still a lack of clues about the gene that synthesizes it in plants.

More information at doi.org/10.1126/sciadv.adt7463

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*The **Cultivar Semanal** magazine is a technical and scientific publication focused on agriculture in Brazil.*
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