

Aug 29, 2026

N ° 94

Cultivar[®] *Semanal*

**Mutation
alters herbicide
choice**

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Resistance mechanisms can guide herbicide selection

Study shows how mutations and metabolism help define the rotation and use of active ingredients in animal management

27.08.2026 | 05:40 (UTC -3)

Schubert Peter, Cultivar Magazine



Identifying the mechanism of herbicide resistance can broaden weed management options and guide the selection of active ingredients. Scientists advocate the use of molecular and genomic diagnostics to bring information about resistance to field decision-making. Their work brings together results on resistance at the site of action and outside the site of action, focusing on the consequences of each mechanism for management.

The analysis was conducted by Luan Cutti and Aldo Merotto, from the Federal University of Rio Grande do Sul; Eric L. Patterson, from Michigan State University; and Todd A. Gaines, from Colorado State University. The researchers start from a

scenario with increasing multiple resistance and few new chemical alternatives. The survey cites 113 records of weed populations resistant to two or more modes of action (doi 10.1002/ps.71187).

Main strategy

Rotating or mixing herbicides with different modes of action remains the primary strategy available for preventing and managing resistance. However, researchers point to room for more specific decisions. Knowledge of the mutation present in the population can indicate differences in sensitivity between chemical groups and even between active ingredients belonging to the same mode of

action.

Site resistance involves alterations in the herbicide target. Known mechanisms include amino acid substitutions, deletions, insertions, and increased expression of the gene responsible for the target protein. A single alteration can reduce the affinity between the herbicide and the enzyme. The effect varies depending on the species, mutation, and molecule.

Acetolactate synthase inhibitors, classified in Group 2, exemplify this variation. The ALS gene has nine positions associated with resistance. Among the most frequent mutations are Trp574Leu and Pro197Ser. The Trp574Leu mutation usually confers resistance to different chemical groups of ALS inhibitors. In this case, the review

does not recommend rotation to another herbicide from Group 2.

Different answers

Other mutations exhibit distinct responses. In *Echinochloa crus-galli*, for example, populations resistant to imazethapyr were controlled with penoxsulam, despite both herbicides being classified in the same mode of action group. The response depends on the mechanism present. For researchers, this type of information can prevent the automatic exclusion of all molecules from a group after confirmation of resistance to only one active ingredient. The same principle appears in acetyl-CoA carboxylase inhibitors, Group 1. Mutations

in the ACCase gene produce different resistance patterns among FOP, DIM, and DEN herbicides. In some cases, clethodim maintained activity on plants resistant to other herbicides with the same mode of action. The response also varied among species carrying the same genetic alteration.

In protoporphyrinogen oxidase inhibitors, from Group 14, alterations in the PPX2 gene appear among the main described mechanisms. The ?Gly210 deletion, found in *Amaranthus* species, confers resistance to different herbicides in the group. Even in this scenario, molecules may exhibit distinct sensitivity to alterations in the enzyme. Scientists cite epyrifenacil and trifludimoxazin among examples with

activity against certain biotypes carrying known mutations.

Influence of ploidy

The researchers also highlight the influence of ploidy and homozygous or heterozygous status on the level of resistance. In polyploid species, a mutation present in only part of the subgenomes may produce a smaller effect. The expression of each subgenome also interferes with the response. In hexaploid *Echinochloa crus-galli*, the presence of the Trp574Leu mutation in different subgenomes resulted in distinct levels of resistance.

Changes in the site of action can impose an adaptive cost on resistant plants. This effect depends on the mechanism. In *Eleusine indica*, the combination of Thr102Ile and Pro106Ser mutations in the EPSPS gene increased glyphosate resistance but reduced growth and seed production. Scientists consider these costs a possible management opportunity. More competitive crops, cover crops, reduced row spacing, and increased seeding density can increase competitive pressure on resistant individuals in situations with adaptive penalties.

Amount of target protein

Another mechanism involves an increase in the amount of the target protein.

Amplification of the EPSPS gene appears in glyphosate-resistant species, including *Amaranthus palmeri*, *Bassia scoparia*, *Lolium multiflorum*, *Amaranthus tuberculatus*, and *Eleusine indica*. Plants with a higher number of copies produce more of the enzyme. Therefore, they require a greater quantity of the herbicide for equivalent inhibition. Researchers point to the rotation of modes of action as a better alternative for this type of resistance, since continuously increasing the dose can select for individuals with a higher number of copies and exceed the registered doses.

Resistance outside the sphere of action

Resistance outside the site of action increases complexity. This group includes reduced absorption, decreased translocation, vacuolar sequestration, rapid necrosis, and increased herbicide metabolism. Metabolic resistance receives special attention. A single mechanism can affect molecules belonging to multiple modes of action.

Among the enzymes associated with herbicide metabolism are cytochrome P450 monooxygenases, glutathione S-transferases, UDP-glycosyltransferases, aldo-keto reductases, and ABC transporters. Scientists also cite ?-

ketoacyl-CoA synthase among families related to off-site mechanisms of action. In *Lolium rigidum*, elevated expression of a single metabolic gene has been associated with resistance to herbicides of five modes of action.

For researchers, advances in genomic resources can bring this characterization closer to everyday management. The first relevant genome of a weed species, *Echinochloa crus-galli*, appeared in 2017. Since then, new genomes have facilitated the identification of genes involved in resistance, including in polyploid species.

The perspective presented in this work includes field molecular diagnostics capable of identifying predominant mutations in a population. This data can support recommendations by species,

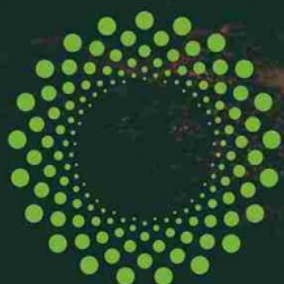
mutation, and active ingredient. The proposal replaces some current generalizations with decisions based on the resistance mechanism. The goal is to preserve the effectiveness of available herbicides and increase the precision of integrated pest management programs.

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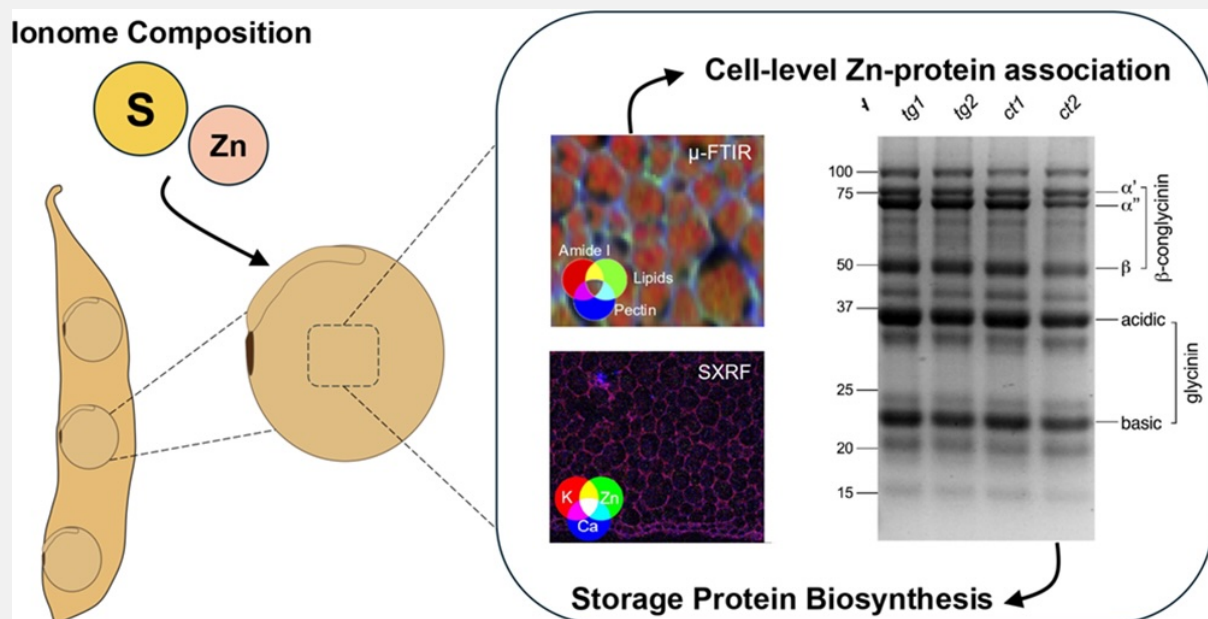
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Soy protein binds to sulfur and zinc in the seeds

Genotypes with higher protein levels accumulated more sulfur and zinc and increased the ratio between glycinin and beta-conglycinin

28.08.2026 | 14:32 (UTC -3)

Cultivar Magazine



doi 10.1021/acsagascitech.5c01032

Researchers have identified an association between protein content and mineral composition in soybean seeds. Genotypes

with higher protein concentrations also showed more sulfur and zinc, as well as a higher proportion of glycinin relative to beta-conglycinin. The result indicates a genotypic interaction between the seed ionome and the synthesis of storage proteins.

The study monitored four genotypes grown in the field in Iracemápolis, São Paulo. The group included two IPRO transgenic cultivars and two conventional cultivars. The evaluations covered the beginning of seed filling, at R5.5, until maturity, at R8.

The protein content started at approximately 23% at R5.5 and reached between 35% and 39% at R8. Sulfur and magnesium followed a similar trend during development. The other nutrients analyzed

decreased in concentration throughout seed formation.

Higher protein content

At maturity, conventional genotypes showed higher levels of protein, sulfur, zinc, and copper. Globulin analyses also indicated a higher ratio between glycinin and beta-conglycinin in these materials. Glycinine has a greater proportion of sulfur-containing amino acids, such as methionine and cysteine.

Cell mapping showed a higher concentration of zinc inside the cotyledon cells. The distribution coincided with regions of higher protein presence. However, the researchers highlight the

specific nature of the associations observed in the four genotypes. Further studies will be needed to assess whether the increased availability of sulfur and zinc can alter the protein content and profile of the seeds (doi [10.1021/acsagscitech.5c01032](https://doi.org/10.1021/acsagscitech.5c01032)).

The research was conducted by Gabriel Sgarbiero Montanha; Lucas Coan Perez; Andrea Lepri; Chiara Longo; Davide Marzi; Eduardo Santos; Felipe Sousa Franco; Gustavo Paparotto Lopes; Nicolas Gustavo da Cruz da Silva; João Paulo Rodrigues Marques; Eduardo de Almeida; Alex Virgilio; Carlos Alberto Pérez; Paola Vittorioso; Sabrina Sabatini; Francisco Scaglia Linhares; and Hudson Wallace Pereira de Carvalho.

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Scientists analyze methomyl resistance in *Dalbulus maidis*

Rotation of action methods and integrated management are gaining importance to minimize the problem

28.08.2026 | 09:15 (UTC -3)

Schubert Peter, Cultivar Magazine



Photo: Charles Martins de Oliveira

Continuous exposure to methomyl increased the initial resistance level of a corn leafhopper (*Dalbulus maidis*) population collected in Rio Verde by more than 16 times. Brazilian scientists identified autosomal, incompletely dominant, and polygenic inheritance. The aim of the study was to measure the evolutionary potential of resistance, identify its inheritance pattern, and evaluate the population's response to other chemical groups.

Researchers Matheus Gerage Sacilotto, Gabriel Silva Dias, Mariana Yuki Iuanami, and Celso Omoto, from the Department of Entomology and Acarology at the Luiz de Queiroz School of Agriculture, University of São Paulo, conducted the work (doi 10.1002/ps.71254). The team started with a population of *Dalbulus maidis* collected

in December 2022 in a commercial cornfield in Rio Verde.

The lethal concentration for 50% of individuals in the field population reached 157,49 micrograms of active ingredient per milliliter after one generation in the laboratory. In the susceptible reference strain, the value was 16,18 micrograms of active ingredient per milliliter. The difference resulted in an initial resistance ratio of 9,73 times.

Selection with methomyl

Selection with methomyl widened this difference across generations. In the 11th generation, the lethal concentration for

50% of insects reached 1.239,83 micrograms of active ingredient per milliliter, with a resistance ratio of 76,62 times. In the 26th generation, the value reached 2.644,44 micrograms of active ingredient per milliliter. The resistance ratio increased to 163,42 times.

The behavior changed in the lineage maintained without exposure to the insecticide. After 28 generations without selection pressure, the lethal concentration for 50% of the insects fell from 157,49 to 66,20 micrograms of active ingredient per milliliter. The resistance ratio decreased from 9,73 to 4,09 times. The result indicates a reduction in resistance in the absence of selection with methomyl.

Legacy of resistance

Crossbreeding between resistant and susceptible insects allowed researchers to characterize the inheritance of resistance. The two heterozygous offspring showed similar responses. The lethal concentration for 50% of individuals reached 364,90 and 415,41 micrograms of active ingredient per milliliter. The researchers detected no maternal effect or sex link. The data indicated autosomal inheritance.

The degree of dominance calculated for the two heterozygous lines reached 0,44 and 0,49. These values ??characterize incompletely dominant resistance.

Dominance decreased as the concentration of methomyl increased.

Field doses

In the field doses evaluated, the behavior also varied according to the concentration. At the lowest recommended concentration, of 645 micrograms of active ingredient per milliliter, mortality reached 100% in the susceptible line and 2% in the resistant line. Heterozygous lines registered mortality of 56% and 42%.

At the highest concentration, 1.290 micrograms of active ingredient per milliliter, mortality reached 84% in the susceptible strain, 94% and 100% in heterozygotes, and 48% in the resistant strain. According to the study, resistance assumed a functionally recessive character in this condition.

Backcrossing also ruled out the hypothesis of control by a single gene. The observed mortality differed from the mortality predicted for monogenic inheritance in most of the concentrations evaluated. The results indicate a polygenic architecture, with the participation of more than one locus.

Other insecticides

The team also evaluated the response of the methomyl-resistant strain to other insecticides. Carbosulfan and acephate showed low cross-resistance, with ratios of 5,63 and 8,93 times, respectively. The growth regulator buprofezin showed a ratio close to ten times.

The scenario changed with pyrethroids and neonicotinoids. The resistance ratio reached 53,62 times for bifenthrin and 331,21 times for lambda-cyhalothrin.

Among neonicotinoids, the value reached 1.044,05 times for acetamiprid and 104,56 times for imidacloprid.

Researchers classify this pattern as possible multiple resistance. The original population collected in the field already showed high resistance to pyrethroids and neonicotinoids. Therefore, the mechanism selected by methomyl does not necessarily explain the resistance observed in these groups.

Chlorfenapyr showed a resistance ratio of 1,03 times. For cyantraniliprole, the rate was 4,47 times. Isocycloseram showed a

ratio of 1,67 times. The study did not detect relevant cross-resistance to these three active ingredients.

Resistance management

Researchers point to chlorfenapyr, cyantraniliprole, and isocycloseram as candidates for methomyl resistance management programs. Chlorfenapyr and isocycloseram have recent registration for the control of *Dalbulus maidis* in Brazil. Cyantraniliprole does not have registration for this pest in the country, despite its registration for the control of *Spodoptera frugiperda* in corn.

The study recommends rotation between modes of action without cross-resistance. The team also cites the elimination of volunteer corn, reduction of planting windows, use of resistant hybrids, entomopathogenic insecticides, and parasitoids as components of integrated management of *Dalbulus maidis*. These measures can reduce the selection pressure caused by successive insecticide applications.

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Agricultural Market - August 28, 2026

Soybeans react positively in Chicago, improving the environment for grains

28.08.2026 | 07:47 (UTC -3)

Vlamir Brandalitze - @brandalitzeconsulting



The international grain market saw price increases, with rising prices for soybeans,

corn, and wheat. Chinese purchases of soybeans from the United States, a decline in the quality of US crops, and restrictions in wheat supply supported prices. In Brazil, external factors boosted prices at ports. Rice and beans also showed recovery in the domestic market.

Soybean situation

In the soybean market, the trend is closely monitoring the progress of the US crop. The latest report indicates that 60% of the crops are in good or excellent condition. The previous week, the figure was 61%. During the same period last year, it was 69%.

The development of North American crops is also showing progress. Most areas have already entered the pod formation phase. Maturation has reached nearly 9%, compared to the historical average of 6% for this period.

Chinese purchases provided additional support to prices. The United States Department of Agriculture confirmed China's acquisition of over 333 tons of US soybeans. Lower global wheat supplies also contributed to the upward movement of soybean prices.

Chicago saw prices above US\$12,50. The July 2027 contract approached US\$13. In the Brazilian market, prices at ports ranged between R\$156 and R\$162.

The sale of the available harvest has reached 80%. Last year, the rate was 82%, the same level as the aforementioned average. Producers still hold 36,1 million tons unsold. A year earlier, the volume totaled 30,9 million tons.

The new crop also saw increased sales. Sales are on track to reach 36,5% by the end of August, compared to 38% last year. The average is 39%. The total volume already traded amounts to approximately 67,9 million tons, compared to 68,6 million tons in the previous cycle.

Brazilian planting should begin in a few weeks. The projections cited indicate an increase in area in the 2026/27 season. Soybean cultivation could exceed 50

million hectares in the country.

Corn situation

Corn also gained support from worsening crop conditions in the United States. The cited report indicates that 57% of the areas are in good or excellent condition. Crop development is progressing well in some phases. Maturation is approaching 10%, while grain filling exceeds 55%. Ear formation surpasses 90%.

The aforementioned estimate for US production reaches 389,7 million tons. This figure is below the 406,8 million tons indicated by the USDA in August and the 432,3 million tons harvested the previous year.

There are indications of a reduction exceeding 10 million tons in Europe. The combined losses in the United States and Europe could represent a loss of close to 50 million tons.

Chicago began trading above US\$5 in the aforementioned positions. The July 2027 contract approached US\$5,60. In Brazilian ports, prices ranged between R\$72 and R\$76. On the B3 (Brazilian Stock Exchange), almost all the mentioned positions exceeded R\$80. March 2027 reached close to R\$83.

Wheat situation

Wheat prices rose sharply on the international market. Supply problems in

Eastern Europe and difficulties with shipments via the Black Sea reduced availability. Russia also began controlling wheat exports, according to reports.

Prices in Chicago rose from around \$7,30 to levels close to \$8. This movement placed the grain at its highest levels in the last three years.

The external environment could increase the cost of Brazilian imports. In the domestic market, Rio Grande do Sul works with reference prices between R\$ 1.330 and R\$ 1.340 per ton. In Paraná, the values ??vary from R\$ 1.440 to R\$ 1.450 per ton.

Rice situation

The rice market maintains firm prices in Rio Grande do Sul. Producers took advantage of the recovery to make sales and build up cash reserves. Reference prices range from R\$ 75 to R\$ 76 at the lowest levels for commercial rice. Higher quality lots reach R\$ 82 to R\$ 83, with reports of deals at R\$ 85 in the coastal region of Rio Grande do Sul.

Projections for planting in Rio Grande do Sul indicate a reduction in area between 5% and 15%. Tocantins and Mato Grosso are also reporting limited supply. Retailers are seeking to replenish stock in anticipation of higher demand in September.

Bean situation

The bean market is also showing price increases, even during the harvest of the third crop in irrigated areas of the central states. Higher-quality carioca beans have gained strength due to expectations of lower supply in September.

The first harvests of the first crop are expected to take place in the first half of October. The initial yields are likely to come from southwestern and northern São Paulo and areas of Paraná.

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Producers demand evidence to adopt RNAi biopesticides.

An Australian study points to efficacy, safety, regulation, and cost as key factors for adoption in the field.

27.08.2026 | 13:43 (UTC -3)

Cultivar Magazine



Australian farmers have expressed interest in RNA interference (RNAi)-based biopesticides, but have conditioned adoption on proof of efficacy, environmental safety, regulatory approval, and economic viability. The study also identified low familiarity with the technology and highlighted the importance of reliable sources and transparent validation processes.

The research surveyed 17 producers, representatives of sectorial entities, and consultants linked to viticulture, grains, fruits, cotton, and vegetables. The participants worked in four Australian states. The work was qualitative in nature and evaluated initial perceptions, without predicting future adoption rates (doi

10.1002/ps.71239).

double-stranded RNA

RNAi biopesticides use double-stranded RNA to silence essential genes in target organisms. The technology differs from genetic modification and can be integrated into integrated pest management programs. Target specificity emerged as the main perceived benefit. Respondents also cited potential for resistance management, biodegradability, and integration into production systems.

The main concerns involved field performance, effects on non-target organisms and human health, application cost, compatibility with current practices,

and regulatory requirements. Some respondents confused RNAi with genetically modified organisms or messenger RNA vaccines.

Participants valued independent field trials, technical data, usage recommendations, and face-to-face communication. They also placed trust in independent agronomists, universities, public bodies, industry associations, manufacturers, and retailers. According to the researchers, adoption will depend on transparent validation, competitive pricing, and evidence-based communication.

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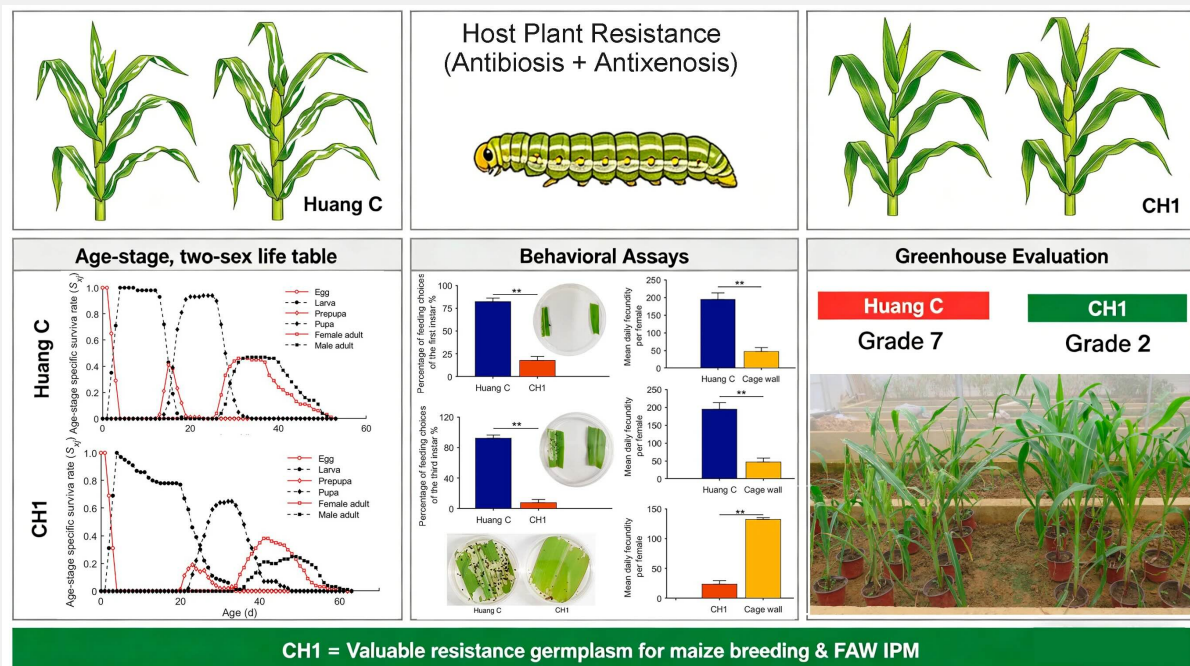


CH1 corn germplasm resists fall armyworm

Study points to lower survival, fecundity, and preference of *Spodoptera frugiperda* for the lineage

27.08.2026 | 09:28 (UTC -3)

Cultivar Magazine



doi 10.3390/insects17090897

The CH1 corn germplasm showed resistance to the fall armyworm, *Spodoptera frugiperda*, in laboratory and greenhouse tests. Larvae fed with CH1

took longer to complete development, had lower survival rates, and produced females with lower fecundity. The insects also preferred another corn line for feeding and egg-laying.

Researchers from the Guizhou Academy of Agricultural Sciences in China compared CH1 with the susceptible Huang C strain. The larval period reached 21,61 days in CH1, compared to 12,49 days in Huang C. Survival to adulthood dropped from 94% to 65% (doi 10.3390/insects17090897).

Fertility also decreased. Females from larvae fed with CH1 produced an average of 689 eggs. In the Huang C treatment, the figure reached 1.368,93 eggs per female.

Population parameters

Population parameters reinforced the effect. The intrinsic growth rate fell from 0,1926 in Huang C to 0,1282 in CH1. The net reproduction rate decreased from 629,71 to 275,60. The mean generation time increased from 33,47 to 43,84 days.

Choice tests showed a preference among larvae for Huang C. Females also concentrated egg laying on this strain. In the choice test between materials, the daily average reached 177,89 eggs in Huang C and 3,33 eggs in CH1.

Greenhouse

In the greenhouse, CH1 plants received a median score of two on the Davis scale and were placed in the resistant class.

Huang C received a median score of seven and was placed in the susceptible class.

Researchers identify CH1 as a promising genetic source for breeding programs focused on resistance to the fall armyworm. Their study recommends field validation and agronomic evaluations before commercial use.

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CONECTE-SE AO NOVO



Bayer appoints Paula Munhoz Antunes to lead trials

Professional expands role in company's research and development with a focus on crop protection trials

27.08.2026 | 09:03 (UTC -3)

Cultivar Magazine



Paula Munhoz Antunes has started a new role at Bayer. The executive has assumed the position of Crop Protection Trial Lead, based in Paulínia. She also holds the position of Global Hub Lead in Research and Development (R&D).

Her career at Bayer includes positions related to research, crop protection, seeds, and biotechnology. Between July 2021 and June 2024, Paula served as Trait Testing Latam Director. Prior to that, she led the Brazilian trait testing platform between 2019 and 2021.

From February 2016 to September 2019, she held the position of Director of R&D Operations for Crop Protection in Brazil. She also worked in seed and trait operations management and led a

sugarcane biotechnology program.

Paula graduated in agronomy from the Luiz de Queiroz Higher School of Agriculture. She holds a master's degree in Sustainable Agriculture and Ecology from Cena/USP, a specialization in intellectual property from the State University of Campinas (Unicamp), and executive training from FIA Business School.

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Telenomus remus performs better on Spodoptera litura eggs

Host posture strategy influences parasitism,
emergence, and functional response of the
parasitoid

27.08.2026 | 08:41 (UTC -3)

Cultivar Magazine



The oviposition behavior of pests influences the performance of *Telenomus remus* in controlling noctuid moths. The parasitoid showed better results on *Spodoptera litura* egg masses than on *Agrotis ipsilon* and *Helicoverpa armigera* eggs.

Chinese researchers evaluated how different egg-laying patterns affect parasitism (doi 10.1002/ps.71242).

Spodoptera litura forms large, cohesive masses. *Agrotis ipsilon* lays eggs in small clusters. *Helicoverpa armigera* lays eggs scattered.

Telenomus remus showed a preference for *Spodoptera litura* masses. In this host, the parasitoid achieved higher parasitism and emergence rates. It also produced a higher

proportion of females and completed immature development in less time.

Analysis of the functional response reinforced the result. In *Spodoptera litura*, the attack rate reached 0,082 per hour.

The handling time reached 0,55 hours, the shortest among the hosts evaluated.

Egg age also affected performance.

Increased age reduced parasitoid output.

Longer exposure periods favored parasitism.

The data indicate that the host's oviposition strategy is an important factor in the efficiency of *Telenomus remus*.

According to the study, this relationship can guide the choice of target pest, the timing of release, and the duration of exposure. The researchers emphasize the

need for field validation before applying these findings to integrated pest management programs.

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Research revises the role of mitochondria in the onset of germination

Results indicate that mitochondria already possess the structure and machinery necessary to support the beginning of germination

27.08.2026 | 07:18 (UTC -3)

Schubert Peter, Cultivar Magazine



Photo: Uni MS - Bettina Roessmann / Plant Energy Biology Lab

Mitochondria from dried *Arabidopsis thaliana* seeds maintain a developed structure, assembled respiratory complexes, and proteins necessary to initiate energy production after water intake. This helps explain the rapid onset of respiration during imbibition. The data also challenge the idea of ??an immature organelle inside the dried seed, dependent on reconstruction before reaching full respiratory capacity.

German researchers combined transmission electron microscopy with cryopreservation, mitochondrial isolation, protein electrophoresis, mass spectrometry, and cell localization analyses. Their work assessed the mitochondrial structure and proteome

composition of seeds. The team also measured oxygen consumption in nine angiosperm species.

Oxygen consumption

All species analyzed began consuming oxygen within the first few hours after imbibition (doi 10.1016/j.cub.2026.07.044). *Arabidopsis thaliana* showed the fastest response. Consumption became detectable within 15 minutes of contact with water. The experiment also included *Capsella rubella*, *Brassica napus*, *Setaria italica*, *Panicum miliaceum*, *Solanum lycopersicum*, *Capsicum annuum*, *Nicotiana tabacum*, and *Nicotiana benthamiana*. The results indicate

widespread conservation of rapid respiratory activation among angiosperms.

Proposed explanation

Structural analysis provided an explanation for this response. Researchers found well-defined mitochondrial cristae in dried seeds of *Arabidopsis thaliana*. The team recorded 24 mitochondria with cristae in 19 images of dried seed cells. After soaking at four degrees Celsius for 48 hours, 27 mitochondria observed in 20 images also showed well-defined inner membranes. Dried maize embryos showed mitochondria with developed cristae.

According to the study, classical sample preparation techniques may have

contributed to previous descriptions of cristae-less mitochondria. The difficulty of infiltrating the embedding media into dry seeds would have limited the visualization of the organelles. These previous works gave rise to the model of so-called promitochondria. In this model, dry seeds would carry poorly developed organelles, without a complete internal structure and with limited respiratory capacity.

Before germination

Protein analysis also revealed a respiratory machinery assembled before germination. Researchers identified complexes linked to oxidative phosphorylation and their supercomplexes in preparations obtained from seeds.

Activity assays confirmed the presence of complexes I and IV in dried material.

A proteomic survey of seeds subjected to low-temperature imbibition identified 11.105 protein groups. The team assembled 1.026 groups in the high-resolution mitochondrial subproteome.

This set corresponded to approximately 10% of the proteins identified in the seeds. The profile included proteins related to the main functions performed by mitochondria in vegetative tissues.

Comparison with mitochondria from cell cultures showed a similar overall composition. Subunits of the oxidative phosphorylation complexes occupied about one-third of the mitochondrial proteome in both materials. Seeds showed

a greater proportion of components from complex V. Mitochondria from cell cultures showed a greater relative abundance of components from complexes I and III.

Tricarboxylic acids

The tricarboxylic acid cycle also presented all eight canonical components in the seeds, in addition to the pyruvate dehydrogenase complex and pyruvate dehydrogenase kinase. Despite the complete presence of the pathway, its proteins represented about 4% of the mitochondrial proteome of the seeds. In cell cultures, this participation reached 11%. The researchers interpret this pattern as an indication of a lower relative capacity for the degradation of organic acids during

the beginning of germination.

Amino acid metabolism showed a different profile. Enzymes involved in the catabolism of certain amino acids appeared in greater abundance in the seeds. Among them were proline dehydrogenase 1 and proteins associated with the degradation of branched-chain amino acids. The observed composition supports the hypothesis of preferential use of amino acids as metabolic substrates in the early stages of germination. The study relates this process to the degradation of storage proteins. The mobilization of storage lipids occurs in later stages of seedling establishment.

Succinate semialdehyde dehydrogenase, a component of the gamma-aminobutyric

acid shunt, showed an abundance more than twice that found in mitochondria from cell cultures. This enzyme catalyzes the final and rate-limiting step of this pathway. Researchers suggest a possible role of the system in protecting against oxidative stress during rehydration.

Differences in proteins

The study also identified differences in transport proteins, protein import, and nucleotide metabolism. The mitochondrial import machinery retained its main components. Some proteins showed greater abundance in seeds. This arrangement suggests an organelle prepared to import new proteins during repair and biogenesis processes after

imbibition.

Affinity purification also revealed hundreds of mitochondrial protein candidates not previously identified in this organelle.

Scientists tested five candidates using fluorescent protein fusions. Four showed mitochondrial localization or association with mitochondria. The result expands the known set of proteins in the plant mitochondrial proteome.

Preserved mitochondria

The data support a model in which the dry seed preserves mitochondria with structural and functional competence. The entry of water allows for the rapid resumption of respiration without requiring

the initial assembly of the entire energy machinery. The study does not rule out a subsequent increase in mitochondrial biogenesis during germination.

The relationship between respiration and seed vigor reinforces the agronomic importance of the topic. The research itself highlights oxygen consumption as a parameter used in vigor assessments. The preservation of mitochondria during desiccation and storage can influence the capacity for metabolic recovery after sowing.

The researchers also identified specific or enriched proteins in seeds that may play a role in protecting mitochondria during desiccation. The exact functions of these components remain under investigation.

The group points to the need for studies on

metabolic regulation, post-translational modifications, seed aging, and mitochondrial performance under unfavorable conditions.

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Syngenta Group announces first half 2026 figures

Sales total US\$12,2 billion; crop protection
grows 4% and Brazil advances 7%

27.08.2026 | 06:40 (UTC -3)

Cultivar Magazine



Syngenta Group reported sales of
US\$12,2 billion in the first half of 2026, a

2% decrease compared to the same period in 2025. At constant exchange rates, the decline reached 7%. EBITDA reached US\$2,4 billion, a 2% increase in reported results and a 3% increase at constant exchange rates. The EBITDA margin increased by 0,9 percentage points, from 18,6% to 19,5%. The indicator grew in all four of the group's business units.

The company attributed the revenue reduction to business restructuring, particularly the reduction of lower-margin grain trading operations in China. The strategy focused efforts on higher-profitability activities, innovation, artificial intelligence, and cost control.

Syngenta Crop Protection

Syngenta Crop Protection reported revenues of US\$6,6 billion in the first half of the year. This result represents a 4% year-over-year increase. However, sales decreased by 1% at constant exchange rates. According to the company, demand for higher-value innovations and branded formulations supported the performance.

Plinazolin, Adepidyn, and Tymirium technologies maintained strong performance in strategic markets.

Plinazolin is part of the insecticide portfolio and features a new mode of action.

Adepidyn acts as a broad-spectrum fungicide. Tymirium is intended for the

control of nematodes and fungal diseases. The company also recorded growth in sales of biological products in all regions.

In Brazil, crop protection sales grew by 7%, despite price pressure. The company attributed the growth to its commercial strategy and the adoption of technologies such as Tymirium, Plinazolin, and Adepidyn.

Europe saw an 8% growth in crop protection sales, driven by currency effects. Asia, the Middle East, and Africa, excluding China, advanced 5%. China registered a 20% expansion, supported by demand for new technologies and biological products.

In Latin America, crop protection sales fell by 11%. Price pressure, reduced volumes,

high stock levels in distribution channels, and decreased inventories influenced performance. Argentina accounted for part of this decline. The launch of Plinazolin in Mexico offset some of the regional contraction. In North America, sales fell by 4% due to differences in the stock building schedule of distribution channels.

The crop protection unit obtained nearly 900 new registrations, registration renewals, and label extensions in the first half of the year. Among the new products, the company launched Virestina in Argentina. According to the company, the product is the first selective herbicide launched against resistant grasses in almost 40 years. Miravis Duo received accelerated regulatory approval in

Thailand and registration in Indonesia.

Syngenta Seeds

Syngenta Seeds achieved sales of US\$2,5 billion during the period. Revenue grew 1% in reported values ??and fell 3% in constant currency terms. The extensive crops segment showed growth in different markets, led by Brazil.

In extensive crops, sales in Brazil increased by 18%. Europe grew by 7%, Asia, the Middle East and Africa increased by 6%, and China registered a 3% increase. Latin America showed an 8% decrease, while North America declined by 13%. The company attributed these reductions to restructuring activities and the contraction of the area planted with

corn in the United States, which affected the entire sector.

In Brazil, the performance was boosted by second-crop corn, corn licensing, the launch of the NK301VIP3 hybrid, and the introduction of ten soybean varieties.

Syngenta presents NK301VIP3 as its first ultra-early hybrid for the premium summer corn segment.

Syngenta Vegetable Seeds has opened a research and development center in Spain. The investment reached US\$10 million.

The facility aims to reduce the time required for conventional vegetable breeding programs, focusing on tomatoes, peppers, and cucumbers. The vegetable seed business recorded growth in the first half of the year in Western Europe, Central

and Eastern Europe, North America, and China.

Syngenta Group China

Syngenta Group China reported revenues of US\$2,5 billion in the first half of the year, a 15% decrease year-on-year and a 20% decrease at constant exchange rates. The planned reduction in lower-margin grain trading and the optimization of the MAP business influenced the result. The unit also stopped incorporating Sinofert after the transfer of its shareholding at the end of 2025.

Within its Chinese operations, sales of branded formulations grew by 15% and seed sales increased by 4%. Yangnong

Chemical expanded its sales by 12%. In January, Syngenta opened a crop protection formulations plant in Nantong. Commercial production began in May.

Adama

Adama reported sales of US\$2,1 billion in the first half of the year, unchanged year-over-year. In constant currency terms, this represents a 3% decrease. Volumes grew in most regions, amid price pressure. The company attributed the improved gross profit and margin mainly to increased volumes and a more favorable and lean portfolio composition. The company also reported implementing cost control initiatives during the period.

Adama's sales grew 9% in Europe, Africa, and the Middle East. North America advanced 5%, and the Asia-Pacific region, excluding China, grew 2%. Latin America declined 3%. In China, the drop reached 23%, amid planned reductions in basic chemicals and lower-margin items.

Syngenta Group Summary Financials

H1 2026

	H1 2026	H1 2025	H1 2026	H1 2025
Sales	\$bn	\$bn	¥bn	¥bn
Syngenta Group	12.2	12.5	83.9	89.5
Syngenta Crop Protection	6.6	6.4	45.9	46.0
ADAMA	2.1	2.1	14.5	15.0
Syngenta Seeds	2.5	2.4	17.0	17.5
Syngenta Group China	2.5	2.9	17.0	21.1
Eliminations	-1.5	-1.3	-10.5	-10.1
EBITDA	2.4	2.3	16.3	16.7

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Protein from the tomato leafminer reduces the oxidative defense of the tomato plant

The effector TaCRVP activates plant catalase, reduces hydrogen peroxide, and promotes pest feeding

26.08.2026 | 15:39 (UTC -3)

Schubert Peter, Cultivar Magazine



Photo: Marja van der Straten / Bugwood

Researchers have identified a mechanism used by the tomato leafminer (*Tuta absoluta*, *Phthorimaea absoluta*) to reduce the defenses of tomato plants. The caterpillar releases the protein TaCRVP through oral secretion. This effector enters plant cells and acts on the catalase SICAT2. This action reduces the accumulation of hydrogen peroxide and weakens defense responses associated with jasmonic acid, without altering salicylic acid levels.

TaCRVP accumulates at feeding sites, reaches peroxisomes, and physically interacts with SICAT2. Glutamine located at position 51 of TaCRVP has been shown to play an essential role in this binding. Substitution of this amino acid eliminated

the interaction and the effector's ability to suppress the oxidative response.

Two fronts

The mechanism acts on two fronts. TaCRVP promotes the formation of SlCAT2 tetramers, a configuration associated with catalase activity. This increases the decomposition of hydrogen peroxide. The protein also protects SlCAT2 from degradation by the 26S proteasome. To do this, it competes with the ubiquitin E3 ligase SlAdBiL for interaction with catalase. The effector also binds, to a lesser extent, to catalases SlCAT1 and SlCAT3, a redundancy that sustains the suppression of hydrogen peroxide even in the absence of SlCAT2.

Reducing TaCRVP through RNA interference increased responses mediated by hydrogen peroxide, jasmonic acid, and jasmonoyl-isoleucine.

Caterpillars consumed less leaf area and gained less weight on tomato plants. The effect on weight did not appear on an artificial diet, a result indicative of a specific protein function in overcoming plant defenses.

Plants with higher SlCAT2 expression showed less hydrogen peroxide accumulation and better caterpillar performance. Lines with inactivated SlCAT2 showed the opposite response, but also reduced growth, indicating the physiological cost of total enzyme loss. Therefore, the authors propose editing the catalase binding interface, rather than

silencing the gene, as a breeding strategy. The study points to the SICAT2-SlAdBiL module as a component of tomato plant resistance and a possible molecular basis for the development of cultivars resistant to *Tuta absoluta* (doi 10.1002/adv.77331).

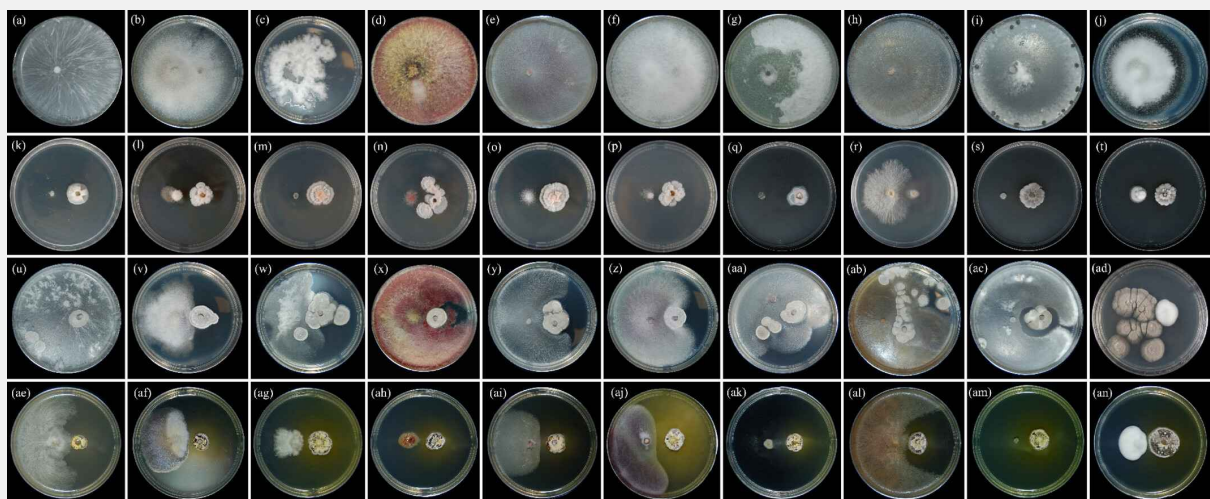
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Streptomyces netropsis reduces fungi in wheat and tomato

The Strep_22 strain reduced root diseases and promoted plant growth in a greenhouse

26.08.2026 | 14:44 (UTC -3)

Cultivar Magazine



doi 10.1002/ps.71213

The bacterium *Streptomyces netropsis* Strep_22 reduced the incidence of diseases caused by soil fungi in durum wheat and tomato. The strain also favored plant growth parameters. Researchers at

the University of Foggia, Italy, evaluated three isolates of *Streptomyces* in laboratory and greenhouse tests.

In in vitro assays, Strep_22 showed an average inhibition of 91,52% of fungal growth. The isolate suppressed 100% of the growth of *Agroathelia rolfsii*, *Fusarium solani*, and *Sclerotinia sclerotiorum*.

Activity exceeded 85% against the other pathogens evaluated, with the exception of *Rhizoctonia solani*, at 55,45%.

Scientists selected Strep_22 for greenhouse testing. In wheat, the treatment reduced the average root infection rate from 68,80% to 19,64%.

Against *Fusarium culmorum*, the rate fell from 69,60% to 14,94%. For *Fusarium oxysporum* f. sp. *dianthi*, the reduction was

from 79,06% to 19,65%.

In tomatoes, Strep_22 reduced the overall root damage index from 23,44% to 6,08%. The treatment decreased damage caused by *Agroathelia rolfsii* from 43,06% to 15,29% and by *Fusarium oxysporum* from 27,08% to 0,69%.

The bacterium also influenced plant growth. Treated wheat plants reached greater height and accumulated more dry matter. In tomatoes, the treatment reduced the effects of pathogens on height and biomass. Researchers point to Strep_22 as a candidate for the development of biofertilizers and biopesticides (doi 10.1002/ps.71213).

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Barley cultivation expands to new regions of Paraná.

Integrada Cooperativa's pilot project seeks to expand income alternatives for its members.

26.08.2026 | 14:16 (UTC -3)

Ana Silvia Oliveira



Photo: Fernanda Yamashiro

Barley cultivation is expanding into new regions within the area of operation of Integrada Cooperativa Agroindustrial.

Following positive results obtained in the Mauá da Serra region, the crop is now being tested in the Arapongas Regional area, in a pilot project that brings together producers from Arapongas and Rolândia.

Among the cooperative members who accepted the challenge is the Cocatto family, from Rolândia. Traditional wheat and corn producers, Raul Cocatto and his brothers João Marcelo and Gilberto Cocatto allocated 32 of the 560 hectares cultivated on their property to barley planting.

For Raul Cocatto, the crop represents an opportunity to diversify winter production, generate income, and create mulch.

"Besides providing good mulch, barley can also bring a financial return. It's a new

option for the property, and I believe it will work out," he states.

The crop has been performing well and the harvest is expected in the coming days.

"I'm still getting to know the crop, but from what we've been observing, the expectation is for a very satisfactory harvest," he says.

The decision to participate in the project came from a recommendation by Integrada's technical assistance team.

"The important thing is not to be stuck with a single alternative. The agronomist recommended it, and I decided to try out the new possibilities," Cocatto emphasizes.

Project evaluates cultural adaptation.

In the Arapongas region, the project covers a total of 290 hectares. The Cocatto family and cooperative members Alceu José Ambrosio and Mauro César Tribulato are participating in the pilot project.

According to Rodrigo Ambrosio, an agronomist from the Arapongas regional office, the objective is to evaluate the behavior of barley in a region with characteristics different from traditional cultivation areas. "It's a pilot project, and we have high expectations to follow the results. We have been seeking information from the team at the Mauá da Serra

regional office, which has been planting barley for over three years. Based on their results, we decided to try the crop here," he explains.

In addition to commercial areas, Integrada is also conducting a cultivar trial to identify the best-performing varieties in the region. The initial expectation is to achieve at least 62 sacks per hectare, but the results will depend on climatic conditions. "Since barley is new to our region, we are still evaluating how this adaptation will be. The winter is usually drier, with less rainfall at harvest time, which can contribute to obtaining better quality grains and maintaining good productivity levels," explains Rodrigo.

The experience of Integrada in Mauá da Serra demonstrates the potential for expansion of the crop. Started in 2022, in partnership with the Agrária Agroindustrial Cooperative, the work began with five hectares in Marilândia do Sul. Currently, the cultivated area reaches approximately 5 hectares, involving 48 producers.

From property to industry

After the harvest, the barley from the Arapongas Regional office will be delivered to the Mauá da Serra Regional office and subsequently sent to Guarapuava, where it will be processed by Agrária.

For Integrada, the expansion of the crop broadens the possibilities for diversifying production and generating value for cooperative members; "it is another step in the search for new cultivation and income alternatives for our associates," concludes Rodrigo Ambrósio.

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The cost of diesel in soybean production has more than doubled in 8 years.

The price of oilseeds did not keep pace with the surge in fuel costs, which rose by 87,5% in the historical series.

26.08.2026 | 14:09 (UTC -3)

Darlene Santiago



Diesel fuel has begun to directly erode farmers' profits, ceasing to be an item on

the cost spreadsheet that often went unnoticed. Fuel accounted for 3,90% of the cost of soybean production per hectare in 2018. In 2024, it peaked at 5,54% and decreased slightly in 2025 to 5,25%.

The average price paid by producers rose from R\$ 3,50/L in 2018 to R\$ 6,56/L in the partial analysis for 2026, up to August.

This represents an increase of 87,5% in eight years, registering a new historical high, even above the price recorded during the global energy shock of 2022, when the price per liter reached R\$ 6,54.

The data comes from a study by Aegro Insights, which analyzed 507 invoices for the purchase of diesel fuel for Brazilian farms, issued between 2018 and August 2026.

Record diesel prices and the 2026/27 soybean harvest.

The accumulated data shows that diesel consumption per hectare of soybeans increased by 180,4% between 2018 and 2025, while the total cost of soybean farming grew by approximately 108% during the same period. “Since 2018, diesel inflation has been proportionally much higher than the increase in soybean prices. This is related to the war, diesel availability problems, and the rise in the dollar. Several factors explain the increase in diesel prices, and soybeans have not been able to keep pace with this increase,” explains agricultural engineer Mathias

Bergamin, market intelligence coordinator at Aegro.

Now, concerns are turning to planning for the 2026/27 soybean crop. According to Bergamin, the current scenario calls for caution and monitoring, with the goal of preventing producers from being forced to purchase fuel during peak price periods.

“The producer needs to plan more carefully when buying diesel. Before, the cost of fuel wasn't as significant as it is now. The producer needs to buy the ideal volume of diesel for soybean planting operations, assessing the distributor's availability to guarantee delivery at the beginning of September and mitigate the risk of running out of diesel at planting time,” he advises.

Diesel-soybean exchange rate

According to research by Aegro Insights, the exchange rate has deteriorated. While in 2018, one sack of soybeans bought 20,74 liters of diesel, this ratio fell to 17,46 liters per sack in 2026, representing the worst exchange rate in the historical series analyzed by the study. In 2018, each hectare consumed the equivalent of 1,43 sacks of soybeans in diesel (R\$ 103,95/ha, within a total cost of R\$ 2.666,29/ha, not considering lease and depreciation). In 2025, consumption rose to 2,44 sacks per hectare (R\$ 291,45/ha, on a total cost of R\$ 5.550,89/ha).

As diesel fuel has become a significant expense for farms, producers need to find ways to save money. “One recommendation is to try to increase the operational efficiency of agricultural machinery to ensure lower fuel consumption. Producers can invest in optimizing their internal equipment, perform preventative maintenance, ensure that spray nozzles are clean, and seek greater control over diesel consumption,” says the market intelligence coordinator at Aegro.

Furthermore, to plan the 2026/27 soybean crop, producers must take into account local peculiarities because the weight of diesel in soybean production varies greatly depending on the region. According to research, Rio Grande do Sul and states on

the agricultural frontier suffered the most in the 2023 and 2024 harvests.

Mato Grosso had the lowest share of diesel in the cost of soybeans among the 12 states analyzed by the Aegro Insights survey. Although the total cost of the Mato Grosso soybean crop (R\$ 5.307,12/ha) is higher than the cost of soybeans in Rio Grande do Sul (R\$ 4.567,70/ha), diesel occupies a smaller share in the soybean production spreadsheet in the Central-West region.

A likely hypothesis that explains this is the scale and more consolidated logistical maturity of Mato Grosso, with shorter internal routes and a fleet spread over a larger area, while agricultural frontier states such as Maranhão, Bahia,

Tocantins, and Pará had diesel accounting for more than 5,1% of the cost of farming and probably still pay more for diesel because they have a developing infrastructure.

Regional disparities

The weight of diesel in the cost of soybean production:

- Maranhão: 6,28% of the cost, R\$ 378,70/ha (2,97 sc/ha).
- Rio Grande do Sul: 5,99%, R\$ 273,38/ha (2,14 sc/ha).
- Bahia: 5,86%, R\$360,24/ha (2,82 sc/ha).

- Goiás: 5,55%, R\$ 291,90/ha (2,29 sc/ha).
- Mato Grosso: 4,71%, R\$ 250,00/ha (1,96 sc/ha).

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Fendt 500 Vario receives gold medal for innovation at Agra

The jury highlighted the productivity, resource efficiency, and integration of technologies in the fourth generation of the tractor

26.08.2026 | 13:53 (UTC -3)

Cultivar Magazine, based on information from Fendt



Photo: Fendt

The fourth generation of the Fendt 500 Vario received the Gold Medal for Innovation at the 64th edition of Agra, held in Gornja Radgona, Slovenia. A jury composed of independent technical experts and specialized journalists chose the tractor for its focus on productivity and efficient use of resources. Fendt was represented at the event by its distribution partner Inter Agrar, which accepted the award at the fair.

The series integrates the VarioDrive traction system, the AGCO Power CORE50 engine, the Fendt iD low-speed concept, and the Fendt DynamicPerformance system. According to Vitezslav Chrapavy, product specialist for Fendt tractors in the CEE region, the combination aims to increase operational

capacity with lower fuel consumption.

The Fendt 500 Vario has a compact design and is applicable in various agricultural operations. Its configuration allows for high payloads and drawbar loads.

Available features include trailer braking assistance, a reversible fan, and drawbar lighting. The FendtONE system centralizes the operation of onboard functions.

Agra took place between August 22nd and 26th, 2026. The fair addressed topics related to digitalization, artificial intelligence in agriculture, sustainable production methods, forestry efficiency, climate change, and water resources.

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Fruit flies vary between dry environments in Argentina

Study records differences in species composition and population peaks in summer and autumn

26.08.2026 | 10:52 (UTC -3)

Schubert Peter, Cultivar Magazine



Photo: USDA Agricultural Research Service - Bugwood

A survey conducted in three dry environments in northwestern Argentina identified differences in the composition of fruit fly communities of the Tephritidae family. The study recorded 1.006 insects, distributed among seven native species and one exotic species. Sampling took place between February 2023 and January 2024 in the province of La Rioja.

Researchers installed 18 McPhail-type traps in areas of natural vegetation in the Dry Chaco, the Chaco Montane Forest, and the Sierras y Bolsones Mountains, six in each environment. The traps were filled with hydrolyzed protein containing borax and remained active during 17 collection periods.

Greater abundance

Rhagoletotrypeta xanthogastra showed the highest abundance, with 368 individuals.

Approximately 87% of the specimens of this species were captured in the Dry Chaco. *Anastrepha fraterculus* totaled 363 individuals and occurred in all three environments. This pest predominated in the Mount and Montane Forest of the Chaco, where it accounted for 59% and about half of the local captures, respectively.

The genus *Rhagoletotrypeta* dominated the total number of insects collected.

Rhagoletotrypeta parallela was most frequently found in the Chaco Montane Forest, while *Rhagoletotrypeta pastranai*

was most prevalent in Monte. The study also recorded *Anastrepha alveatoides* for the first time in the province of La Rioja.

Ceratitis capitata, an exotic species and a quarantine pest of importance, accounted for 2,2% of the captures. Researchers recorded the species only in the Chaco Mountains and Montane Forest.

Higher levels

Total abundance reached its highest levels in late summer and autumn. Catches fell to near zero in winter. Community composition also varied between environments: differences were statistically significant when comparing the Dry Chaco with each of the other two environments,

with the greatest contrast in relation to the Mount, but not between the Chaco Montane Forest and the Mount.

The results expand knowledge about tephritids in arid and semi-arid areas and provide information for studies on distribution, population dynamics and management of species of agricultural importance (doi 10.3390/insects17090895).

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John Deere advances in the autonomy of machines for orchards

Ouster's sensor enhances perception for navigation and obstacle detection in orchards and vineyards

26.08.2026 | 10:05 (UTC -3)

Cultivar Magazine, based on information from John Deere



GUSS Automation, a wholly owned subsidiary of John Deere, plans to integrate Ouster's Rev8 OS0 digital lidar into the next generation of autonomous orchard machines. The system aims to enhance the machines' perception in environments with dense vegetation, dust, spray, and variations in lighting.

The sensor offers a wide field of view and generates three-dimensional point clouds. This data allows for mapping tree trunks, rows, and terrain contours. The technology also supports navigation and obstacle detection. GUSS aims to reduce the limitations of traditional GPS systems in orchards and vineyards, where autonomous operation may require centimeter-scale precision.

Rev8 OS0 uses the L4 Ouster Silicon architecture and combines three-dimensional depth data, native color in high dynamic range, and outdoor-oriented construction. The planned integration will add sensing capabilities to the company's autonomous sprayers.

According to GUSS, an operator can monitor up to eight autonomous machines from a laptop. The control includes spraying operations performed by the Orchard GUSS and Mini GUSS models on permanent crops.

The company is also evaluating the use of the same lidar-based autonomy approach in other orchard and vineyard operations.

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Vitor Trabachin assumes the role of Regional Manager at Bayer

Executive returns to the company after five years and will now work in Mato Grosso

26.08.2026 | 09:00 (UTC -3)

Cultivar Magazine



Agronomist Vitor Trabachin took over as Regional Manager for Bayer in Mato Grosso in August. He returns to the company after five years and brings to his new position experience in commercial management, sales, seeds, biologicals, and plant nutrition.

Trabachin stated he was pleased to resume his career at Bayer. Before returning, he held the position of Senior Sales Manager at FMC Corporation. At the company, he led the sales team in Mato Grosso and Rondônia. He also participated in the implementation of account plans for large farmers and actions to expand the experimentation of the biologicals portfolio.

In the 2024/25 harvest, its area registered a 92% growth in POG (Percentage of Produced on Gross Revenue) in direct sales and a gain of 2,4 percentage points in market share, according to information presented by the executive.

Trabachin also worked at Nutrien Agricultural Solutions and Syngenta. At Nutrien, he led sales for the Agrichem brand in Mato Grosso and Rondônia. At Syngenta, he managed commercial operations for Nidera soybean and corn seeds in both states.

My first stint at Bayer Crop Science was between 2017 and 2021. During that period, I served as regional manager for the Dekalb and Agroeste brands. Prior to that, I worked at Monsanto as a senior

technical sales representative and at Bunge as a territorial manager for major clients.

Trabachin graduated in agronomic engineering from the Federal University of Mato Grosso. He holds a postgraduate degree in seed science and technology from the Federal University of Pelotas and an MBA in agribusiness management from Esalq.

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Soybean breeding has altered root architecture

Study identifies larger, more branched, and shallower roots in modern cultivars

26.08.2026 | 07:29 (UTC -3)

Schubert Peter, Cultivar Magazine



Photo: Clinton Weaver / Pexels

Decades of soybean breeding have modified the architecture of the root system, along with productivity gains. Modern cultivars have larger, more branched roots in the topsoil layer, with shallower angles. This process occurred even without direct selection for root characteristics.

Researchers evaluated 24 cultivars from maturity group IV, released in the United States between 1930 and 2005. The trials took place at two locations during 2016 and 2017. The team excavated root crowns within a 0,20-meter radius to approximately 0,20 meters deep and measured root characteristics in this layer, as well as nodulation and grain yield. Nothing was evaluated below this limit.

Root crown

The complexity of the root crown increased from 1,72 to 2,66 when comparing cultivars released before 1950 with materials released after 2000. The 0,94 point increase corresponds to 31,3% of the range of the visual scale, which goes from 1 to 4. The total root length increased by 28,3%. The area covered by the crown, measured as convex area, increased by 16,1%, and the fraction of this area effectively filled by roots increased by 16,7%.

The improvement also increased the number of lateral roots and root tips. The number of tips grew by 42,7%. At the same time, the crown angle of the lateral

roots decreased by 5,2%. The result indicates greater horizontal growth and exploration of the upper soil layers.

The nodulation followed the changes. The size of the nodules increased by 20% over the analyzed period. The density of nodules increased by 46%.

Four environments

Responses varied across the four environments tested. The reduction in lateral root angle was significant in only one of them, crown occupancy did not respond in the 2017 trials, and second-order lateral root density only increased in the 2016 trials. Scientists treat these traits as context-dependent phenotypes, shaped

by the interaction between genotype and environment.

Productivity showed an estimated gain of 18,13 kilograms per hectare per year.

Characteristics related to root size and branching showed an association with this increase. The researchers emphasize: the observed relationships do not demonstrate causality.

Cross-validation

The statistical model retained crown complexity, lateral root angle, total length, crown occupancy, and average root diameter among the variables most associated with productivity. In cross-validation, the ensemble predicted 67% of

the yield variation, a performance classified by the scientists as moderate.

The results point to root architecture as a possible target for programs focused on productivity, acquisition of soil resources, and adaptation to different environments (doi 10.1002/csc2.70355). The researchers add that future gains may depend on the balance between exploration of the surface layer and the ability of roots to penetrate deeper.

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Indigo launches Enai to develop agricultural biologicals

New company brings together 38 microbial strains and data from over 7,5 field trials

26.08.2026 | 06:05 (UTC -3)

Cultivar Magazine, based on information from Ashley Bruner



Indigo Agriculture announced the launch of Enai, an independent company dedicated

to biological products for crop protection and plant performance. The company aims to accelerate the discovery of microorganisms and expand partnerships in the agricultural sector.

Enai brings together a collection of over 38 microbial strains, including beneficial endophytes. Its technological portfolio has undergone more than 7,5 field trials in different crops, environments, and production systems.

The platform combines proprietary data on microorganisms and agronomic performance with artificial intelligence. The goal is to identify strains with the greatest potential to meet specific protection and performance demands. The selection considers crops, seed characteristics,

areas, and production conditions.

The products utilize endophytic microorganisms capable of living inside plants. According to the company, this characteristic allows for establishment early in the cycle and development alongside the crop. Solutions under development target diseases, insects, nematodes, and environmental stresses. The portfolio also includes applications focused on plant vigor, nutrient use efficiency, and yield potential.

Products, commercial materials, and digital channels will migrate from Indigo to Enai in stages over the coming months. Indigo Carbon will continue under the Indigo brand, maintaining its current programs, services, and support.

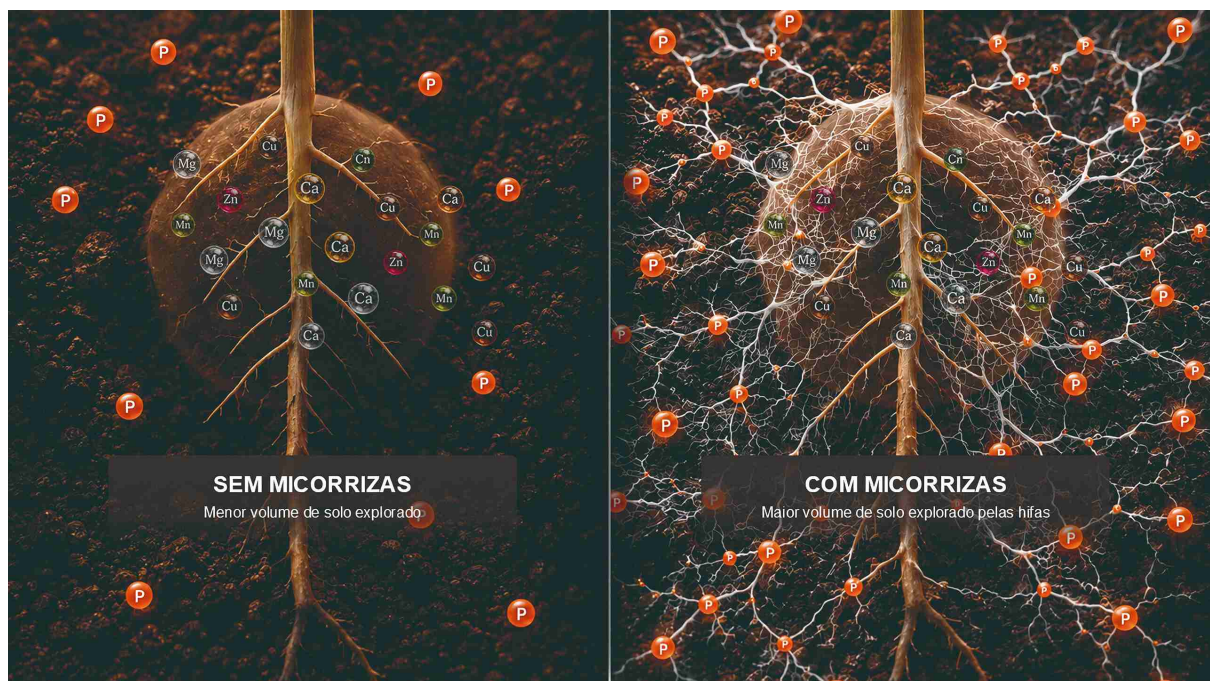
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Arbuscular mycorrhizae and plant development

The ancient alliance between fungi and plants continues to innovate agriculture.

25.08.2026 | 17:01 (UTC -3)

Fernando Dini Andreote, Esalq/USP



ADVERTISING

When we observe a crop growing, we usually think about soil fertility, available water, climate, plant genetics, and the management practices of the farmer. But

there is an invisible, very old, and extremely important partnership that helps explain how plants conquered terrestrial environments and how they can still grow in different soil conditions today. This partnership is called arbuscular mycorrhiza.

Arbuscular mycorrhizae are associations between roots and beneficial soil fungi. These fungi live in close contact with the roots and form a kind of underground network, capable of expanding the volume of soil explored by the plant. This association is very ancient. There is evidence that these relationships already existed hundreds of millions of years ago, when the first plants began to occupy terrestrial environments. At that point in evolution, leaving the water and living on

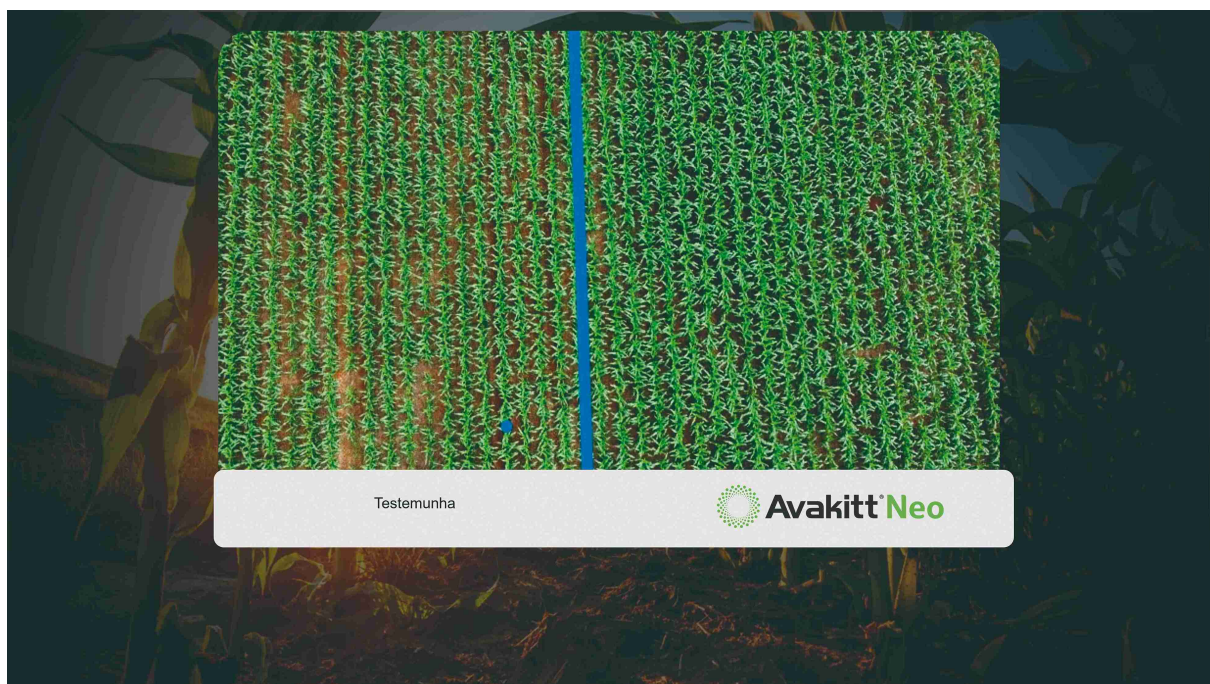
land represented a huge challenge. Plants needed to absorb water and nutrients from a new, often poor and unstable environment. The presence of these fungi associated with the roots was probably decisive for this process, functioning as an extension of the root system and favoring the adaptation of plants to the soil.

To this day, this partnership remains present in a large part of plant species. In many agricultural crops, arbuscular mycorrhizal fungi can contribute to better plant development, mainly due to greater efficiency in nutrient absorption, among which phosphorus deserves special mention. This nutrient is essential for plant growth, as it participates in processes related to energy, rooting, initial development, and productivity. However,

in the soil, phosphorus tends to have low mobility. This means that it does not easily move to the root. That's where mycorrhizae make a difference.

Mycorrhizal fungi form very fine structures called hyphae, which spread through the soil and reach regions that the root alone would have difficulty exploring. These hyphae function as an extension of the root, increasing the plant's ability to seek phosphorus and other nutrients. In addition to phosphorus, mycorrhizae can also contribute to the absorption of zinc, copper, nitrogen, and other elements. Another important role is related to water. By increasing the area of ??soil exploration, the network formed by the fungi can favor the plant's access to moisture available in small pores and in

regions further away from the root. This does not mean that mycorrhizae alone solve the problems caused by drought, but they can help the plant cope better with situations of water limitation, especially when associated with good soil management.



In many agricultural crops, arbuscular mycorrhizal fungi can contribute to better plant development, mainly through greater efficiency in nutrient absorption, among which phosphorus deserves special mention.

Mycorrhizae can also influence soil structure. The fungal hyphae contribute to

the aggregation of particles, helping in the formation of small clumps that improve porosity, water infiltration, and the preservation of the soil's physical structure. In well-managed agricultural systems, this interaction between roots, fungi, and soil can foster a more vibrant, balanced, and efficient environment for plant growth.

In exchange for the benefits received, the plant provides the fungi with some of the compounds produced by photosynthesis, facilitating the fungus's development and eliminating the need to compete with other soil organisms. It is, therefore, a cooperative relationship: the plant feeds the fungus, and the fungus helps the plant access resources essential to its development.

From a practical standpoint, a common question is: how can you tell if mycorrhizae are functioning in a crop? Mycorrhizae analysis can be done in a laboratory, mainly through observation of root colonization. In this type of evaluation, roots are collected, prepared, stained, and analyzed under a microscope to verify the presence of typical mycorrhizal fungal structures. It is also possible to evaluate spores in the soil or use molecular tools to identify groups of fungi present. It is important to note that mycorrhizal analysis is not done directly in the field, visually or immediately. This is because mycorrhizal fungi are microorganisms, of reduced size, and do not form visual structures in the soil or roots where they are present. Furthermore, these specific fungi are not

cultivated in common culture media, which prevents their development in culture plates or common culture media.

Therefore, their evaluation requires proper collection, sample preparation, and technical interpretation.



Fernando talks about the partnership between roots and fungi, called arbuscular mycorrhiza.

In recent years, arbuscular mycorrhizae have ceased to be merely a topic of academic research and have begun to occupy space in agricultural innovation. Today, this biological process is already

present in technologies available to producers, especially in the form of inoculants, developed to favor the association between mycorrhizal fungi and plants. These technologies are part of a larger movement in modern agriculture, which seeks to increase the efficiency of nutrient use, improve soil health, and reduce losses in the production system.

The future of mycorrhizae in agriculture lies precisely in integration. They do not replace agronomic knowledge, soil analysis, well-planned fertilization, or proper crop management. But they can complement these practices, increasing the efficiency of the system and bringing agricultural production closer to natural processes that have sustained plants for millions of years. In other words,

arbuscular mycorrhizae show that innovation in the field does not always arise from something entirely new. Often, it emerges when science learns to better understand, manage, and apply ancient natural processes. In the case of mycorrhizae, we are talking about an ancestral alliance between fungi and plants that helped vegetation conquer dry land and that can now help agriculture produce more efficiently, biologically, and sustainably.



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Releases of *Trissolcus japonicus* reduce damage to kiwifruit

The trial increased parasitism of *Halyomorpha halys* eggs and reduced fruit damage and drop

25.08.2026 | 14:59 (UTC -3)

Schubert Peter, Cultivar Magazine



Photo: Elijah Talamas / USDA

Increased releases of the parasitoid *Trissolcus japonicus* increased parasitism of *Halyomorpha halys* eggs and reduced feeding damage from the stink bug in organic 'Hayward' kiwi orchards. The study, conducted in northwest China, indicated one female parasitoid per egg mass and three consecutive weekly releases as the most efficient strategy among the treatments evaluated.

In open-field trials, the average proportion of parasitized sentinel egg masses reached 42% in orchards with releases. Controls recorded an average of 12%. The average incidence of fruit damage reached 20% in treated areas and 40% in controls. Researchers also recorded less severe damage and less fruit drop at the end of

the season in orchards with releases of the natural enemy (doi 10.1127/entomologia/4510).

Important pest

Halyomorpha halys, known as the brown marbled bug, is polyphagous and uses more than 300 plant species as hosts. Adults and nymphs bore into plant tissues and fruits while feeding. In kiwifruit, the attack can cause suberization of internal tissues, deformations, rot, and fruit abortion. The insect already causes problems in producing countries and represents a threat to fruit production systems.

The researchers first evaluated different release rates and frequencies of *Trissolcus japonicus* in 2021. The experiments took place in May and August, periods associated with the beginning of the two generations of *Halyomorpha halys* in the studied region. The tests used kiwi branches protected by exclusion cages.

Three ratios between female parasitoids and stink bug egg masses were compared: one to one, one to two, and one to three. The ratio of one female *Trissolcus japonicus* for each *Halyomorpha halys* egg mass showed the highest parasitism. The increase in the number of egg masses available per female reduced the effect of the parasitoid and allowed for greater emergence of stink bug nymphs.

another experiment

Another experiment compared four frequency schedules. The treatment with three consecutive releases, at seven-day intervals, achieved the highest average parasitism levels. Values ??reached 89% in May and 90% in August. The release period did not significantly alter the proportion of parasitized masses. The result indicates consistent performance of *Trissolcus japonicus* in the two main oviposition periods of the stink bug evaluated in the study.

Based on these tests, scientists estimated an operational rate of approximately 12.500 female *Trissolcus japonicus* per hectare, with weekly applications over

three weeks. This value was obtained by extrapolating the results from cage trials. The researchers themselves warn of the need for caution in this transition, as confinement increases the possibility of contact between the parasitoid and the host.

Field trial

The open-field trial took place in 2022 in six organic 'Hayward' kiwi orchards in the localities of Mei and Zhouzhi, in the Chinese province of Shaanxi. Three orchards received the parasitoid. The other three remained without releases. Each area was approximately 0,2 hectares and maintained a minimum distance of one hundred meters from the others.

The limited availability of parasitoids prevented the application of the planned dose during the three weeks. Each treated orchard received approximately 2.500 females in the first release, 1.250 in the second, and 625 in the third. Even with the progressive reduction in the quantity released, parasitism remained higher than in the controls during the first two weeks.

In the first week, orchards with parasitoid release registered 38% parasitism, compared to 6,3% in the control group. In the second week, the values ??reached 49% and 14,1%, respectively. Parasitism decreased in the third week. Researchers associate this result with the reduction in the amount of parasitoids available for the final release.

Untreated areas

The natural presence of *Trissolcus japonicus* in the region also explains the parasitism observed in untreated areas. The species occurs naturally in northwestern China. For this reason, the study did not include orchards completely free of the parasitoid. The minimum separation of one hundred meters aimed to reduce the possibility of displacement of released individuals between areas, although the researchers do not completely rule out this occurrence.

Fruit assessment took place between June and September. The team analyzed the incidence and severity of lesions associated with feeding by *Halyomorpha*

halys. Monitoring of fruit drop occurred between mid-August and early October. Areas with releases accumulated damage and fallen fruit at a slower rate compared to the controls.

The results provide an initial benchmark for integrated management programs in kiwi orchards. The work supports the use of augmentative releases of *Trissolcus japonicus* synchronized with the oviposition periods of *Halyomorpha halys*. However, the researchers emphasize limitations in extrapolating between cages and the field, and point to the frequency, release density, and timing of application as central factors for the performance of biological control.

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AGCO prepares product launches at the Farm Progress Show 2026

Fendt, Massey Ferguson, and PTx will showcase tractors, planters, selective spraying, and autonomous solutions in Iowa

25.08.2026 | 14:12 (UTC -3)

Cultivar Magazine, based on information from Bob Blakely



FENDT



AGCO will showcase new precision agriculture equipment and technologies at

the Farm Progress Show 2026, scheduled for September 1-3 in Boone, Iowa, USA. Fendt, Massey Ferguson, and PTx will be the focus of the group's launches. The portfolio includes tractors, planters, haymaking equipment, spraying systems, retrofit solutions for mixed fleets, and autonomous capabilities.

Fendt plans to unveil three new products in its tractor and planter platforms. The company will also present updates to the 500 Vario Gen4 and 800 Vario Gen5 tractor lines. The schedule includes a preview of transport speed options available across the different series.

The brand will also bring the IDEAL combine harvester to the event. The equipment precedes the 2026 edition of

the Fendt Harvest Tour, scheduled to return to the Midwestern United States in October.

Massey Ferguson

Massey Ferguson will present the new N-Series Split/Narrow Row planter line. The equipment features factory-installed Precision Planting technology and utilizes a modular design. According to the manufacturer, this combination aims to enhance performance during crop establishment.

Another highlight involves the new generation of double balers. The equipment uses an in-line system to form two bales and aims to speed up

harvesting. Massey Ferguson will also showcase the MF 5S series of tractors equipped with Dyna-VT transmission. The manufacturer associates the upgrade with increased operational versatility and machine availability.

PTx Solutions

PTx will focus on presenting solutions geared towards precision agriculture, automation, and adaptation of existing machinery. Among the technologies expected is ArrowTube, from Precision Planting. The system works by guiding seeds during deposition.

The company will also showcase the SymphonyVision Duo. This solution uses

cameras to support herbicide applications across the entire area and at specific points, depending on the presence of weeds. The proposal allows for combining conventional spraying and localized control within the same platform.

Another system planned for the fair, the DrySet Air, performs dosing and monitoring tower by tower in pneumatic seeders. The SmokeRow, on the other hand, was developed to support weed management on the edges of agricultural areas.

PTx Trimble will present FarmENGAGE, designed for fleet management and agricultural operations. The brand's booth will also cover OutRun, a platform focused on automating harvesting and soil preparation operations.

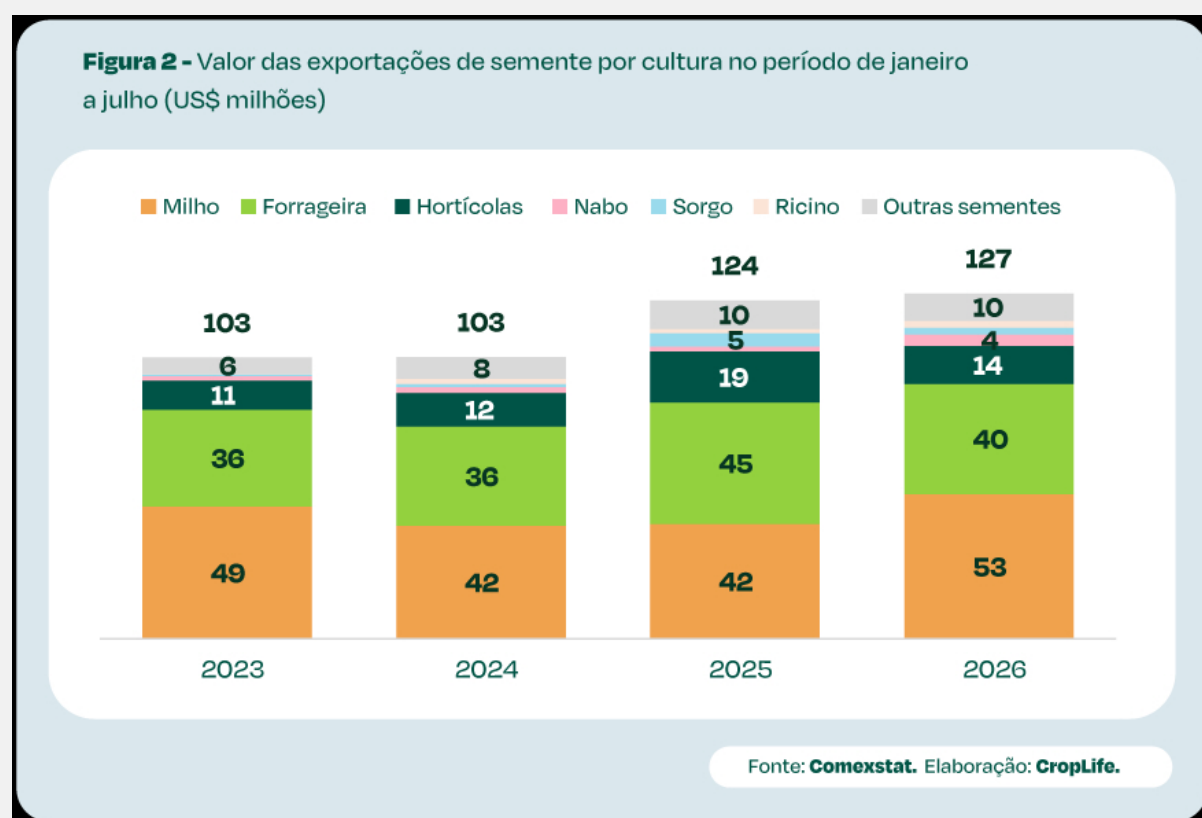
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Seed exports totaled US\$126,7 million through July

Corn leads the advance, with a 26,1% increase in external sales and strong growth in shipments to Venezuela

25.08.2026 | 14:01 (UTC -3)

Cultivar Magazine, based on information from Danilo Lysei



Brazilian seed exports totaled US\$126,7 million between January and July 2026, a

2,1% increase compared to US\$124,1 million in the same period of 2025. This result marks a new record for the period. Corn, forage, and vegetable seeds accounted for 85% of the exported value. The figures were released by CropLife Brasil.

Corn led the growth in value, with an increase of US\$11 million. Exports rose from US\$42,2 million to US\$53,2 million, an increase of 26,1%. Venezuela gained importance among destinations.

Shipments to the country increased from US\$4,2 million to US\$16,9 million.

Data from the United States Department of Agriculture (USDA) projects a 33,3% expansion in Venezuelan corn acreage, from 300 to 400 hectares. The expected increase in planting sustains the greater

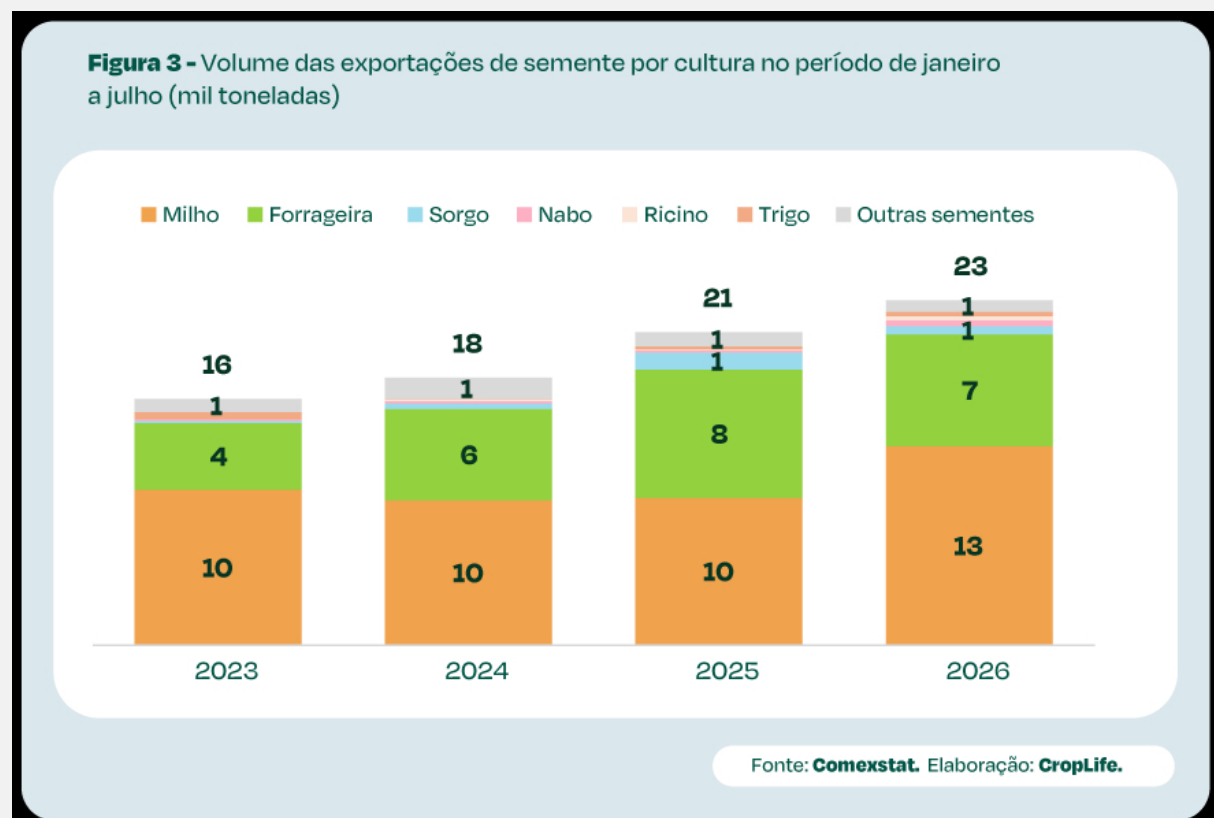
demand for Brazilian seeds.

Turnip seed sales increased by US\$2,3 million. The growth was concentrated in Uruguay, where purchases rose from US\$0,05 million to US\$3,2 million. In that country, forage turnip cultivation predominates, used for soil cover, green manure, and pasture. Sales to Paraguay decreased by US\$0,8 million.

Exports of castor seeds increased from US\$1,5 million to US\$2,5 million. African countries led the way in terms of destinations, with castor beans being used for oil extraction and initiatives related to biofuels.

In terms of volume, shipments grew 10,2%, from 20,6 tons to 22,7 tons. Corn increased by 3,4 tons, turnips by 250 tons,

and castor beans by 230 tons. Forage seeds decreased by 1,1 tons.



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New Holland brings new forage technologies to Farm Progress Show 2026

The brand will showcase machinery, automation, and precision agriculture solutions in Boone, United States

25.08.2026 | 10:43 (UTC -3)

Cultivar Magazine, based on information from Aimee Culbert



New Holland will showcase new equipment, connected technologies, and solutions for hay and forage production at the Farm Progress Show 2026, from September 1st to 3rd, in Boone, Iowa, USA. This participation reinforces the company's "First in Grassland Farming" strategy, aimed at livestock farmers and mixed-production farms.

Among the new releases is the Speedrower 1 Series line of self-propelled windrowers. The models feature increased power, new operator controls, improvements to the cooling system, and relative yield monitoring. This feature integrates with FieldOps connectivity.

The manufacturer will also showcase the Roll-Belt 1 Series roll balers, model year

2027. The machines incorporate durability improvements, a new net protection system, and factory-installed IntelliBale automation. The company has also updated operator-focused technology options.

In the FR Forage Cruiser forage harvesters, New Holland will highlight ForageCam, NutriSense, and CropSpeed. ForageCam uses image analysis with artificial intelligence to evaluate grain processing and automatically adjust processor settings. The system aims to maintain the defined parameters for forage quality.

The exhibit will also feature a Genesis 8970 tractor equipped with current precision agriculture technologies. The

demonstration will highlight possibilities for incorporating guidance, connectivity, and precision features into existing machines.

The booth will also showcase the Dynamic Blue visual identity and the expanded line of Workmaster compact tractors, with the 45C, 50C, and 55C models. The equipment features connectivity prepared for telemetry and the brand's new visual standard.

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John Deere launches system to automate baling

Hands-Free Baling integrates guidance, speed control, and automation into round bale balers

25.08.2026 | 09:35 (UTC -3)

Cultivar Magazine, based on information from Callie Kramer



John Deere announced in the United States the Hands-Free Baling, an

integrated automation system for baling corn and wheat straw. The solution combines guidance technologies and automatic functions of the tractor and baler. The goal is to reduce operator intervention and increase operational consistency.

According to the company, internal tests showed an increase of up to 8,4% in productivity, measured in bales per hour. Fuel consumption showed an efficiency gain of up to 4,4%, measured in tons per gallon. Operator activity decreased by up to 76%, considering steering commands and system controls.

The study took place in 2025 in central Iowa, United States. John Deere used a 6R 175 tractor and a 561R round baler.

The evaluation compared manual baling, with all automation disabled, to operation supported by Gate Automation, Speed Automation, Weave Automation, AutoTrac, and AutoTrac Turn Automation.

Corn and wheat

Hands-Free Baling was developed for working with corn and wheat straw. The system combines AutoTrac, AutoTrac Turn Automation, baler gate automation, automatic speed control, and Weave Automation on John Deere Series 1 round balers.

The integration allows the tractor to automatically follow the windrows. To do this, AutoTrac uses guide lines generated

by previous passes of the harvester. The system also moves the baler laterally using Weave Automation. This function aims to form uniform bales with regular sides.

The speed and gate automation systems operate during bale formation and unloading. The system manages tractor speed and controls the stopping, wrapping, and ejection stages. The AutoTrac Turn Automation performs repeatable maneuvers at the headlands.

According to Kaylene Ballesteros, marketing manager for hay and forage equipment at John Deere, the combination of technologies reduces repetitive tasks during baling. The company also aims to decrease the possibility of operational errors and make the system easier to use

for professionals with different levels of experience.

The solution leverages guidance lines created during previous operations in corn or wheat fields. With this, John Deere aims to connect steps performed in the same field and expand the use of precision agriculture technologies already installed on the machines.

John Deere Operations Center

The operational data can also be integrated into the John Deere Operations Center. This platform allows for the recording of work information and enhances the visibility of data generated

during field activities.

Hands-Free Baling will be available on select John Deere 1 Series baler models. Operation requires 6R, 7R, or 8R Series tractors equipped with the necessary precision farming technologies, including Weave Automation.

The new solution expands on features previously launched by the manufacturer. According to Ballesteros, gate and speed automation systems have been on the market for over ten years. The current integration adds guidance, maneuvering, and bale formation capabilities to the automated process.

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Vegetable nanoemulsion reduces nematode galls in tomatoes

The formulation with Nerium oleander achieved 85,33% efficacy in protected commercial cultivation

25.08.2026 | 07:10 (UTC -3)

Schubert Peter, Cultivar Magazine



Photo: Jean Tosti - CC BY-SA 3.0

A plant-based nanoemulsion reduced gall formation caused by nematodes of the genus *Meloidogyne* in tomatoes. The formulation achieved 85,33% efficacy at the highest dose evaluated in a commercial greenhouse. The performance was close to that obtained with a botanical nematicide used as a reference, which showed 89,35%. The study evaluated the product in pots and in a commercial production area.

The nanoemulsion combines furfural in the dispersed phase and aqueous extract of oleander leaves (*Nerium oleander*) in the continuous phase. Turkish researchers evaluated the formulation against *Meloidogyne incognita*, *Meloidogyne javanica*, and *Meloidogyne hapla* (doi

10.1002/ps.71233).

Tests in pots

In pot tests, researchers applied the nanoemulsion at concentrations of two, four, six, and ten milliliters per liter. The plants were inoculated with 500 second-stage juveniles per pot. The application occurred in the soil immediately after planting.

The increased concentration reduced the gall index in the three nematode species. At a dose of ten milliliters per liter, the average indices reached 3,40 for *Meloidogyne incognita*, 3,10 for *Meloidogyne javanica*, and 3,00 for *Meloidogyne hapla*. The untreated controls

showed indices of 8,00, 7,50, and 7,50, respectively.

The synthetic nematocide used as a reference in pot tests at a concentration of two milliliters per liter showed the lowest infection levels. The indices were 0,50 for *Meloidogyne incognita*, 0,70 for *Meloidogyne javanica*, and 0,40 for *Meloidogyne hapla*. Despite the difference, the nanoemulsion reduced gall formation in all species tested.

Greenhouse

The greenhouse phase took place in a commercial tomato production system in Mersin, Turkey. The area had an initial average gall index of 7,2. Researchers

tested doses of six, eight, and ten liters per hectare. Each treatment received two applications via drip irrigation. The first occurred at transplanting. The second occurred 15 days later.

Treatment with ten liters per hectare resulted in an average gall index of 0,97 and an efficacy of 85,33%. The dose of eight liters per hectare achieved an index of 2,30 and an efficacy of 68,29%. With six liters per hectare, the index reached 3,58 and the efficacy was 49,99%. The control without treatment showed an average index of 7,24.

The botanical product used as a reference contained *Quillaja saponaria* extract. Application was carried out at a dose of 20 liters per hectare, as per commercial

recommendations. The treatment resulted in an average gall index of 0,76 and an efficacy of 89,35%. Statistical analysis showed no difference between this result and the nanoemulsion applied at ten liters per hectare.

Greater suppression of nematodes

According to the researchers, the formulation showed greater nematode suppression per unit of product applied compared to the botanical reference. The nanoemulsion achieved similar performance with half the dose per hectare used by the commercial product. The results also indicated maintenance of

biological activity between the controlled trials and commercial protected cultivation conditions.

The formulation has an active ingredient load of 30%. The droplets have a diameter of less than 50 nanometers. The system uses biologically active components in both phases. The aqueous extract of Nerium oleander comprises the continuous phase. Furfural is part of the dispersed phase. Previous storage tests indicated physicochemical stability for three months at temperatures close to zero and 45 degrees Celsius.

The study did not directly investigate the mechanism of action. The researchers propose a combined action of the compounds in the plant extract and

furfural. The extract may contain cardiac glycosides, saponins, phenolic compounds, and flavonoids. According to the discussion presented in the work, these groups of substances may affect ion transport, membrane integrity, metabolism, feeding, development, reproduction, and hatching of nematodes.

No recommendation

The results do not yet support a recommendation for large-scale agricultural use. The commercial trial took place in a single location and during a single growing season. The researchers point to the need for studies in different locations, times, and field conditions.

The study also did not evaluate effects on plant growth, productivity, phytotoxicity, or duration of nematode suppression.

Furfural can cause phytotoxicity depending on the concentration. Nerium oleander contains toxic cardiac glycosides. The researchers consider further evaluations of crop safety, beneficial soil microorganisms, non-target organisms, and environmental impacts necessary before any eventual commercial-scale application.

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Cry1Ac reduces *Plutella xylostella* reproduction at low concentrations

Exposure alters sex pheromones, mating behavior, and population indicators of the pest

25.08.2026 | 06:23 (UTC -3)

Cultivar Magazine



Photo: Syngenta

Exposure to low concentrations of the Bt Cry1Ac protein reduced larval weight, pupation rate, and mating success of *Plutella xylostella*. Exposure also affected mechanisms linked to the synthesis of sex pheromones and caused transgenerational effects. The results are from a study by Chinese researchers (doi 10.1002/ps.71225).

Scientists observed alterations in messenger RNA levels of genes associated with the biosynthesis of sex pheromones. The treatment also modified levels of cyclic adenosine monophosphate (cAMP), calcium ions (Ca^{2+}), and the activity of enzymes involved in this pathway. The combination of factors reduced the production of sex pheromones and mating success.

Transgenerational effects impacted population indicators, including survival rates and reproductive output.

Plutella xylostella threatens cruciferous crops worldwide and has already developed resistance to several conventional insecticides. Scientists highlight the need to understand the broad effects of Bt proteins on pest species to support sustainable management strategies, paying attention to both immediate and long-term consequences.

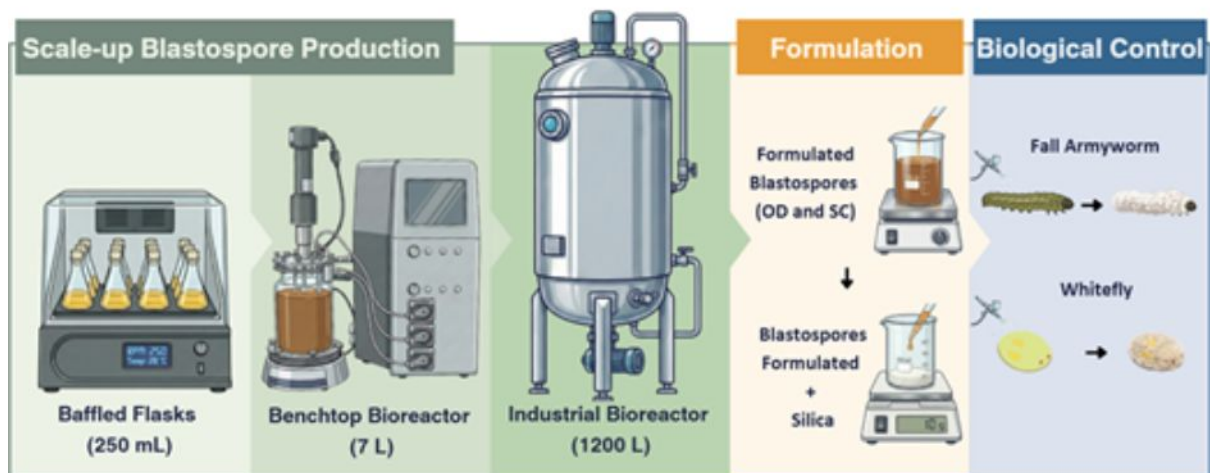
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Bioinsecticides are advancing towards industrial production.

Technology developed by Embrapa and Efense allows for the large-scale production of fungi and the control of whiteflies and fall armyworms.

24.08.2026 | 16:52 (UTC -3)

Cristina Tordin, Cultivar Magazine edition



Staggering of blastospore production

Researchers from Embrapa, in partnership with the company Efense, have developed a complete process for the industrial

production of bioinsecticides based on entomopathogenic fungi, which can expand the supply of sustainable alternatives for controlling important agricultural pests. The technology involves everything from optimizing large-scale liquid fermentation to the formulation, storage, and field validation of biological products (doi 10.1021/acsagscitech.6c00151).

The high production of fungal cells, known as blastospores, showed stability during storage and effectiveness in controlling whitefly (*Bemisia tabaci* biotype B) and fall armyworm (*Spodoptera frugiperda*).

According to Aline Lira, a scholarship recipient on the project at Embrapa Meio Ambiente during her doctoral studies

(Esalq-USP), the results represent an advance for the commercial production of fungal bioinsecticides, since they overcome two of the main challenges of this technology: large-scale manufacturing and the low stability of blastospores during storage.

“It has been demonstrated that it is possible to produce more than one billion blastospores per milliliter in just two days of fermentation, while maintaining the biological quality necessary for agricultural use. Furthermore, blastospores in oil formulations showed greater virulence when compared to non-formulated blastospores, creating a synergistic effect in the control of insect pests,” Lira points out.

Technology reduces costs and speeds up production.

Blastospores are cells naturally produced by entomopathogenic fungi during insect infection. For industry, the great advantage is that they can be rapidly multiplied through liquid fermentation. Compared to the traditional solid-state fermentation method for obtaining conidia, blastospore production makes the process faster, more uniform, and easier to automate.

In practice, this means more productive factories and better control of the bioprocess, which is reflected in the final quality of the propagules produced. However, their high sensitivity to

dehydration and adverse environmental conditions has always limited their commercial use.

“To overcome this problem, the team developed protocols that involved choosing the best carbon and nitrogen sources for fermentation, scaling up production in laboratory and industrial bioreactors, and developing formulations capable of preserving the viability of the fungi during storage and increasing their insecticidal activity,” explains Gabriel Mascarín, a researcher at Embrapa Meio Ambiente.

Production has been validated on an

industrial scale.

After the laboratory phase, the process was transferred to seven-liter bioreactors and, subsequently, to 1.200-liter industrial bioreactors.

“Even on a large scale,” Mascarin emphasizes, “production yields remained high. On average, the cultures reached between 1,8 and 2,8 billion colony-forming units per milliliter after 2 to 4 days of fermentation, demonstrating that the technology can be used in industrial processes without significant loss of performance.”

According to the researcher, this step represents one of the greatest advances in

the work, as it demonstrates that the industrial production of blastospores from these fungi is technically feasible and can meet the demands of the market for biological products for agriculture.

Formulation increases shelf life.

Another challenge faced by the researchers was prolonging the stability of blastospores after their production without prior convection drying, a method widely used for drying fungi in the manufacture of solid-dry formulations such as wettable powders and water-dispersible granules.

Stability during blastospore storage without convection drying is an industrial

bottleneck that limits the commercialization of these bioinsecticides. Furthermore, convection drying can increase the production costs of a fungal bioinsecticide. In practice, this reduces costs and simplifies the industrial process, opening the door to large-scale commercialization.

To this end, different formulations were evaluated using dispersion in vegetable oil and amorphous silica. The study showed that these combinations preserved the viability of the fungi for up to 90 days under refrigeration, a performance far superior to that observed with blastospores without an appropriate formulation.

Effective control of two important pests.

The researchers evaluated the effectiveness of the new bioinsecticides against two of the main pests in Brazilian agriculture.

According to Jeanne Marinho-Prado, a researcher at Embrapa Meio Ambiente, in laboratory and greenhouse tests, the formulated blastospores showed high virulence against *Spodoptera frugiperda* caterpillars and whitefly nymphs (*Bemisia tabaci* biotype B), reaching mortality rates between 70% and 93% when applied at a concentration of 10 million blastospores per milliliter.

"Experiments also showed that the blastospores of these fungi can quickly adhere to the bodies of insects, germinate, and initiate the infection process a few hours after application, consequently accelerating mortality within a few days, which is an important characteristic for the biological control of these pests," Marinho-Prado highlighted.

Results were confirmed in soybean crops. The technology was also tested under real-world growing conditions.

Marcus Santana, from Efense, the company that co-financed this research with Embrapa Meio Ambiente, explains that during two consecutive soybean harvests (2022/2023 and 2023/2024), successive applications of blastospore-

based bioinsecticides significantly reduced whitefly populations in the experimental areas.

"The trials compared the new products with commercial bioinsecticides registered in Brazil, demonstrating that blastospore-based formulations have high potential to integrate into integrated pest management programs and expand the biological control options available to farmers," Santana reported.

Path to new bioinsecticides

The researchers highlight that the study consolidates more than a decade of research focused on developing

technologies for the production of blastospores of entomopathogenic fungi, validating their patent under code BR112016 0066138 and PCT/US2015/049673 of inventors Gabriel Moura Mascarin and Mark Alan Jackson. The work demonstrates that it is possible to integrate all stages — production, industrial scaling, formulation, storage, and biological validation — into a single technically viable process.

The expectation is that the results will contribute to accelerating the development of new commercial bioinsecticides based on blastospores, strengthening integrated pest management and reducing dependence on chemical insecticides. In addition to environmental benefits, the technology can enhance the

competitiveness of the Brazilian bio-input industry, a sector experiencing continuous growth driven by the search for more sustainable agricultural systems.

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Herbivory leaves a legacy in the soil and increases the attraction of parasitoids

In a study, jasmonate remodeled the rhizosphere and increased the emission of an attractive volatile in untreated plants

24.08.2026 | 15:33 (UTC -3)

Schubert Peter, Cultivar Magazine



Herbivory on leaves can leave a defensive legacy in the soil capable of attracting parasitoids to plants cultivated after the attack. Researchers demonstrated this mechanism in *Vigna unguiculata* subjected to infestation by the leafminer *Liriomyza trifolii*. The process involves jasmonate signaling, flavonoid release by the roots, alteration of the rhizosphere microbiota, and increased emission of (Z)-3-hexenyl acetate by subsequent uninfested plants.

The study used a tritrophic system composed of *Vigna unguiculata*, *Liriomyza trifolii*, and the parasitoid *Neochrysocharis formosa*. In the first phase of the experiment, plants were either herbivored or remained uninfested. After removing these plants, the researchers cultivated new specimens of *Vigna unguiculata* in the

previously conditioned soils.

The new plants never had contact with the herbivore. Even so, specimens grown in soil from the herbivore treatment attracted more *Neochrysocharis formosa*. These plants also accumulated more biomass in the aerial part. The results indicated the persistence of a defensive effect in the soil after the removal of the attacked plant (doi 10.1016/j.celrep.2026.117869).

Systemic activation

The response began with systemic activation of the jasmonate pathway. Herbivory increased levels of jasmonic acid and the active conjugate jasmonic acid-isoleucine in leaves, stems, and roots. Application of methyl jasmonate to

uninfested plants reproduced the effect observed after herbivory. Conversely, inhibition of jasmonate biosynthesis with jarin-1 eliminated the increased attraction of parasitoids during the later phase.

Hormonal activation also modified root metabolism. Analysis of exudates showed an increase of 286 metabolites and a reduction of 68 after herbivory. Flavonoids stood out among the altered groups. The researchers focused their analysis on two isoflavones: daidzein and genistein.

Herbivory increased the concentration of these compounds in root exudates.

Treatment with methyl jasmonate also amplified the release of daidzein and genistein. Inhibition of jasmonate biosynthesis suppressed this increase.

Another treatment, aimed at inhibiting flavonoid biosynthesis, eliminated the herbivory-induced accumulation and also prevented the increased attraction of parasitoids.

Selection of the bacterial community

Daidzein and genistein acted in the selection of the rhizosphere bacterial community. Supplementation with flavonoids modified the microbial composition and reduced the diversity measured by the Shannon index. The treatment promoted enrichment of 32 bacterial sequence variants and a reduction in 205. Among the favored groups were bacteria of the genus

Bradyrhizobium and the genus Bacillus.

Researchers isolated 24 bacterial strains associated with the observed changes in the rhizosphere. Daidzein and genistein stimulated the growth of strains enriched by flavonoid treatment. Three strains of the genus Bradyrhizobium, identified as H4, H5, and H6, increased the attraction of parasitoids after individual inoculation in the soil.

Living microorganisms

Tests also confirmed the need for live microorganisms to maintain the effect. Soil sterilization eliminated the parasitoids' preference for plants grown in soil conditioned by herbivory. Reinoculation with a microbial suspension restored the

response. Similar results occurred in assays with methyl jasmonate and with flavonoid supplementation.

In the next phase, the H5 lineage served as a model to investigate the response of the new plants. Inoculation increased jasmonate levels in leaves and roots and elevated jasmonic acid-isoleucine in leaves, stems, and roots. The treatment also amplified the expression of genes linked to jasmonate signaling. Inhibition of this pathway blocked the effect of the bacterium on the attraction of *Neochrysocharis formosa*.

The response culminated in an alteration of the volatile compound profile. Plants without infestation, grown in soil previously conditioned by herbivory, emitted more (Z)-3-hexenyl acetate. Soil sterilization

suppressed this increase. Reinoculation of the microbiota restored the emission.

Inoculation with the H5 strain also increased the release of the compound.

Application of the jasmonate pathway inhibitor prevented this response.

Behavioral assays with synthetic (Z)-3-hexenyl acetate confirmed

Neochrysocharis formosa's preference for the volatile compound.

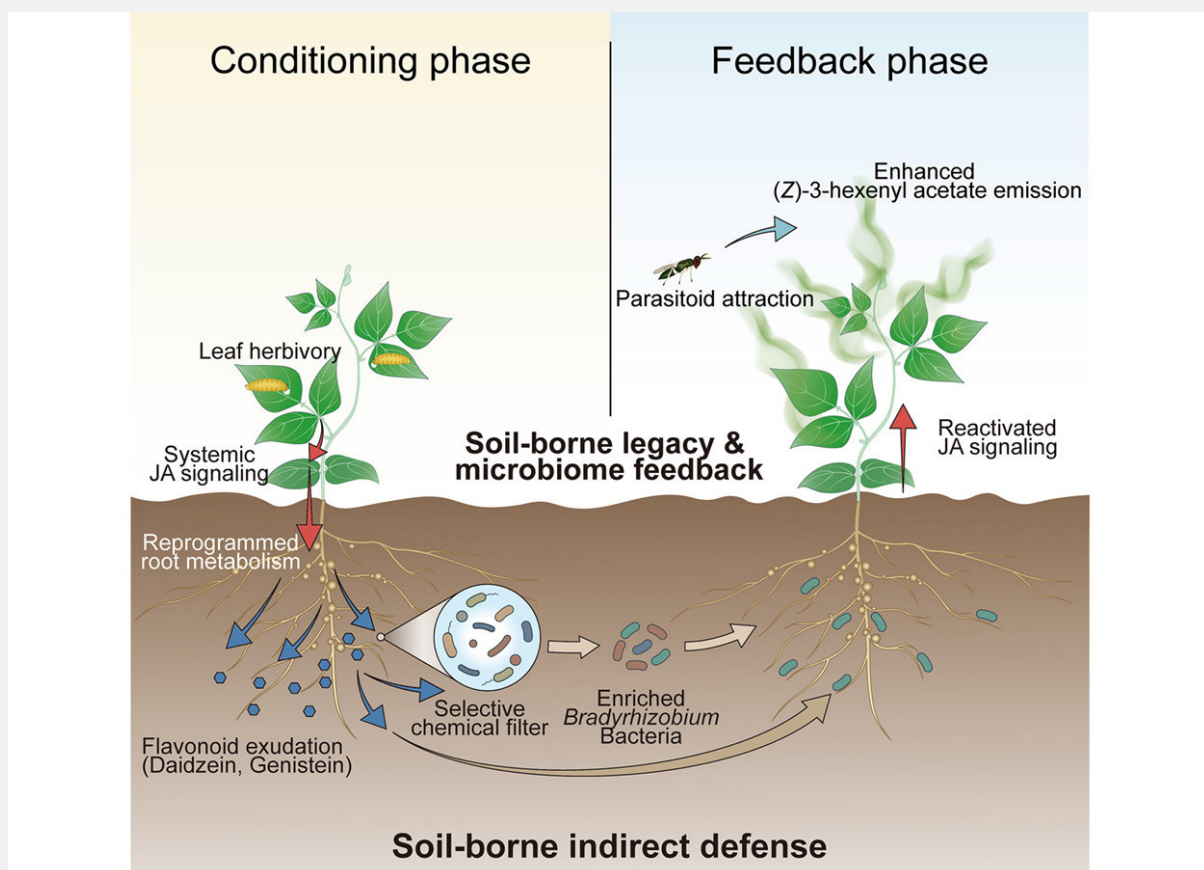
Integrated defense sequence

The results describe an integrated defense sequence. Attack by *Liriomyza trifolii* activates jasmonate signaling in *Vigna unguiculata*. This signaling increases the

release of daidzein and genistein by the roots. Flavonoids select components of the rhizosphere microbiota. The modified microbiome remains as a legacy in the soil and activates the jasmonate pathway in cultivated plants later. The new hormonal activation increases the emission of (Z)-3-hexenyl acetate and favors the recruitment of *Neochrysocharis formosa*.

Researchers point to implications for sustainable pest management. The work expands the concept of indirect plant defense, previously associated mainly with volatiles released during an ongoing attack. In the system studied, information about herbivory remained in the root environment and influenced a subsequent plant. The study also highlights experimental limitations. Validation

involved a restricted set of cultivable bacteria, while a significant portion of the rhizosphere microbiota does not allow cultivation by the methods used. Scientists also consider the possible participation of other root metabolites and other microbial groups in the same process.



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Silicon in wheat reaches the ceiling for defense against *Helicoverpa armigera*

The study indicates a reduction in larval growth of up to two millimoles per liter, with no additional gain at the highest dose

24.08.2026 | 09:11 (UTC -3)

Schubert Peter, Cultivar Magazine



Photo: feyza ?en - Pexels

Increasing the concentration of silicon in wheat plants reduces the growth of *Helicoverpa armigera* caterpillars, but the defensive effect reaches a limit. In an experiment with *Triticum aestivum*, supplementation with two millimoles of silicon per liter already promoted a significant reduction in the relative growth rate of the larvae. Increasing the dose to four millimoles per liter increased the accumulation of the element in the plant, without further suppressing insect growth.

The study evaluated five levels of silicon supply in a hydroponic system: zero, 0,25, 0,5, 2, and 4 millimoles per liter. The researchers used Sunflex cultivar plants and second-instar caterpillars of *Helicoverpa armigera*. The analysis showed a significant negative relationship

between the concentration of silicon in plant tissues and the relative growth rate of the insect.

Even so, the response did not maintain a linear behavior across the entire range evaluated. Plants subjected to four millimoles per liter accumulated about 21% more silicon compared to those treated with two millimoles per liter. This increase did not produce an additional reduction in the growth rate of the caterpillars. The researchers classify the result as evidence of a “defensive ceiling” for the action of silicon in wheat (doi 10.1111/een.70135).

Continuous absorption

Wheat continued to absorb silicon even at the highest concentration tested. The result is noteworthy because two millimoles per liter corresponds to the polymerization threshold of monosilicic acid cited in the study. Above this concentration, the compound can form insoluble silica. Even so, plants treated with four millimoles per liter showed a higher concentration of silicon in their tissues.

Supplementation also altered the plant's response to herbivory. The presence of *Helicoverpa armigera* reduced plant biomass. Silicon supplementation increased overall biomass and mitigated losses associated with caterpillar consumption. According to the

researchers, this pattern indicates a contribution of the element to the wheat's tolerance to herbivory damage.

Experiment data

The experiment began with *Triticum aestivum* seedlings transferred to hydroponic cultivation. Silicon was introduced into the nutrient solution in the form of potassium silicate. After six weeks, twelve plants from each supplementation level received a second-instar caterpillar. The other twelve plants from each treatment remained insect-free. The exposure lasted seven days.

After this period, the team calculated the relative growth rate of the caterpillars

based on mass gain relative to initial mass and feeding time. The researchers also determined the dry biomass of the plants and the concentration of silicon in the tissues by X-ray fluorescence.

Jaw wear

The team also evaluated the wear on the caterpillars' mandibles using scanning electron microscopy. The result diverged from the initial hypothesis. Caterpillars fed on silicon-deficient plants generally showed more worn mandibles compared to insects fed on supplemented plants.

Wear on the mouthparts did not correlate with silicon concentration in the airway tissues. There was also no direct

relationship between mandibular wear and a reduction in the relative growth rate.

These data indicate a lack of support, in this experiment, for attributing the decline in *Helicoverpa armigera* performance to mechanical damage to the mandibles.

Another hypothesis

The researchers discuss another possible explanation. The increase in silica in the tissues may reduce the palatability or nutritional quality of the leaves. With less consumption, the caterpillars would have less growth and, at the same time, less wear on their mandibles. The experiment did not directly measure palatability, therefore this interpretation remains a hypothesis discussed in the study.

The relationship between plant biomass and mandibular wear reinforced this interpretation. Caterpillars associated with greater biomass loss showed greater wear on their mouthparts. Silicon supplementation, in turn, reduced biomass losses related to herbivory.

The increasing supplementation also reduced the concentrations of several other elements in the wheat tissues. The study records this effect during the analysis of plant composition, although the main focus remained on the response to silicon and its interaction with *Helicoverpa armigera*.

According to the researchers, the results show behavior similar to that observed in other plant chemical defenses. Wheat can continue accumulating silicon after

reaching the level associated with the maximum response against herbivores, but this additional accumulation offers little defensive benefit against larval growth. In the assay, this level appeared at two millimoles per liter.

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Fungus alters sexual signaling and mate choice in sugarcane borer

Fusarium verticillioides infection increased male attraction and changed mating preferences

24.08.2026 | 08:00 (UTC -3)

Schubert Peter, Cultivar Magazine



Photo: William White / Bugwood

Infection of the sugarcane borer *Diatraea saccharalis* by the phytopathogenic fungus *Fusarium verticillioides* alters the insect's sexual communication and mate choice. Infected and uninfected males showed a preference for odors emitted by infected females. Females with the fungus also more frequently accepted infected males during mating.

The research combined behavioral assays, chemical analyses, and electrophysiological assessments. The work was carried out by Amanda C. Tuler, Arodi P. Favaris, Flávia P. Franco, and José Mauricio S. Bento, affiliated with the Department of Entomology and Acarology at the Luiz de Queiroz School of Agriculture, University of São Paulo (doi

10.1111/een.70140).

Wind tunnel

Wind tunnel tests showed a preference among males for the odors of females infected with *Fusarium verticillioides*. This pattern occurred among both infected and fungus-free males. In tests with an odor source and clean air, the odors of both infected and uninfected females increased male contact with the source. However, in direct comparison, the insects more frequently chose the odor of infected females.

The change did not result from alterations in the females' calling period. Infected and uninfected females initiated the behavior

approximately five hours after the start of the dark phase. After six hours, all exhibited calling activity. The infection also did not modify the latency or duration of this behavior.

Gland analysis

Analysis of pheromone-producing glands indicated a quantitative difference in a minor component of the sexual mix. Infected females showed a higher concentration of Z9-16. Researchers did not detect a significant difference for Z11-16 or for Z9,E11-16, the main component of the mix analyzed.

Electrophysiological tests also showed a response of the male antennae to the

three compounds, regardless of the presence of *Fusarium verticillioides*. According to the interpretation presented in the study, small changes in the proportion of minor components can influence sexual recognition and attraction in moths. The research did not determine the mechanism responsible for the alteration.

Partner selection

The infection also influenced the mate selection phase. In the bioassays, each female simultaneously received an infected male and an uninfected male. Females with *Fusarium verticillioides* mated more frequently with infected males.

Uninfected females did not show a preference between the two types of partners.

Researchers' hypotheses

Researchers consider two explanations for the observed mating pattern. The first involves a non-adaptive consequence of the alterations in sexual signaling caused by the infection. The second involves possible manipulation of host behavior to benefit the persistence and spread of the fungus. The study does not allow us to distinguish between these hypotheses.

The combination of increased attraction to infected females, preference of infected

females for infected males, and previous evidence of intergenerational fungal transmission suggests a possible role for reproductive behavior in the dissemination dynamics of *Fusarium verticillioides*. The researchers emphasize the need for further studies to test this possibility.

The results also raise a question for the integrated management of the sugarcane borer. Pheromone-based strategies depend on predictable insect responses to chemical signals. Infection-related changes can interfere with attraction and mate encounters. Scientists point to this interaction as a hypothesis capable of contributing to the understanding of variations recorded in the efficiency of synthetic mixtures of *Diatraea saccharalis* pheromones under field conditions.

However, the research did not evaluate this response in crops and recommends specific investigation on the subject.

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Electromagnetic field promotes tomato germination

Treatment increased germination after preconditioning with NaCl and PEG-6000 in a study with two varieties

24.08.2026 | 06:33 (UTC -3)

Cultivar Magazine



Photo: tom analogicus / pexels

An electromagnetic field of 5 milliteslas for three minutes increased the germination rate of Roma tomato seeds after pretreatment with sodium chloride. Germination reached 17%, compared to 6% in the control.

The researchers evaluated electromagnetic fields, nutri-priming with Spirulina, and a combination of the two methods. Before the treatments, some of the seeds received sodium chloride at 34,2 millimolars or PEG-6000 for one hour. The team monitored germination for seven days.

In the Roma variety, pretreatment with PEG-6000 also differentiated the responses. The control showed no germination. The electromagnetic field

reached 52% and nutri-priming with Spirulina reached 53%. The combination of treatments reached 30%.

The Cherry variety maintained germination rates above 92% under all evaluated conditions. However, under pretreatment with PEG-6000, the combination of Spirulina and an electromagnetic field increased the average germination time and reduced the speed of the process.

Statistical analysis indicated the influence of variety, pre-treatment, and treatment on germination percentage and speed. The researchers also highlight an interaction between the three factors (doi 10.3390/seeds5050051).

The experiment used only one electromagnetic field intensity, one

exposure period, and one concentration of Spirulina. The study also did not previously assess vigor, viability, and initial moisture content of the batches. The scientists recommend further trials with different combinations and independent batches before applying the results to agriculture.

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Vinícius Andrade takes over Supply Chain at Syngenta in Brazil

The executive has 19 years of experience with the company and expertise in seeds, production, research, and portfolio management

24.08.2026 | 06:15 (UTC -3)

Cultivar Magazine



Vinícius Andrade assumed the position of Brazil Head of Supply Chain Management at Syngenta in June 2026. The executive has been with the company for 19 years and has experience in different stages of the seed supply chain.

Prior to his new role, Andrade held the position of Director of Production Research, Purchasing, and Sustainability for Syngenta's seed operations in Brazil. He remained in that position between March 2024 and June 2026.

The executive's career path includes roles in research, production, planning, purchasing, logistics, and portfolio management. He has also worked with soybeans, corn, sweet corn, sorghum, and sunflowers.

Between 2021 and 2024, Andrade led the Seed Production Research area for Latin America. From 2018 to 2021, he led Syngenta's soybean portfolio in the region, with responsibility for seed strategies and technologies for the Nidera, NK, and Syngenta IBP Plus brands.

The executive also led soybean seed operations in Brazil and managed the crop's supply chain. Early in his career at the company, he worked in soybean research, parental seed production, and line purity processes.

Andrade holds a degree in agronomy from the Federal University of Lavras, a master's degree in plant breeding from the Federal University of Uberlândia, and a postgraduate degree in Supply Chain from the University of Warwick.

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Soybean architecture reduces brown stink bug parasitism

The increased complexity of the plants reduces the effectiveness of *Telenomus podisi* and may require adjustments in releases

23.08.2026 | 13:42 (UTC -3)

Schubert Peter, Cultivar Magazine



Photo: Jovenil Jose da Silva / Embrapa

The greater complexity of soybean plant architecture reduces the ability of *Telenomus podisi* to parasitize *Euschistus heros* eggs. This effect may require adjustments in the amount of parasitoids released as the crop develops and the level of infestation increases. Parasitism was halved in plants with more complex structures compared to simpler plants. This conclusion is part of a study conducted by researchers at the Luiz de Queiroz School of Agriculture.

Researchers evaluated three soybean plant architectures. Plants at the V5 stage represented the simple architecture. Plants at the V8 stage formed the intermediate treatment. Plants between R2 and R3 comprised the most complex condition. The experiment used the IAC Foscari

cultivar.

Each treatment consisted of 25 repetitions. The researchers infested each plant with 85 eggs of *Euschistus heros*, with a variation of ten eggs more or less. The eggs remained distributed on two leaves in the middle region of the canopy. Then, ten mated females of *Telenomus podisi* entered each cage from the base of the plant. The exposure lasted 24 hours.

Architecture and parasitism

The analysis revealed a significant effect of soybean architecture on parasitism. The rate decreased as plant height, number of leaves, and architectural complexity index

increased. Total leaf area also showed an association with parasitoid performance. Among the characteristics evaluated, number of leaves and total leaf area showed the greatest capacity to explain the variation in parasitism.

The result indicates a physical limitation for the movement and location of eggs on more developed plants. An architecture with more leaves and a larger surface area expands the search space. This condition increases the distance required to reach the host and may reduce the foraging efficiency of *Telenomus podisi*.

Population growth

The influence of architecture also appeared in the population growth projections of *Euschistus heros*. The researchers maintained the same initial pest population and the same number of parasitoids in the simulations. In plants with complex architecture, the stink bug population reached the action level about ten days earlier compared to the simple architecture scenario.

The finite population growth rate of *Euschistus heros* reached 1,033 in the complex plant scenario and 1,021 in the simple plant scenario. The net reproduction rate reached 2,77 in the complex architecture and 1,91 in the simple one. The average generation time showed little difference: 30,44 days in the complex scenario and 30,10 days in the

simple one.

The results reinforce the need to consider soybean phenology when planning flood releases. Recommendations based solely on a fixed amount of parasitoids can lead to underdosing or overuse. The risk increases as the cycle progresses, as the plant gains leaves, height, and leaf area.

Plants with eggs

The model developed in the study also incorporated the level of plants with *Euschistus heros* eggs. The demand for *Telenomus podisi* females increased with infestation and the number of leaves. In a field with 280 plants per hectare and an incidence of eggs in 0,5% of the plants, the

estimate ranged from 2.380 females per hectare in plants with eight leaves to 4.900 females per hectare in plants with 20 leaves.

With 1% of the plants infested, the estimate increased from 4.760 to 9.800 females per hectare between these two architectural levels. With 2% of plants infested, the model indicated 9.520 females per hectare in plants with eight leaves and 19.600 females per hectare in plants with 20 leaves.

The level of infestation had a greater influence on the calculated number of parasitoids compared to the architecture. For the researchers, the result highlights the importance of frequent monitoring of *Euschistus heros* eggs. Releases initiated

at low infestation levels tend to require fewer parasitoids to achieve the same parasitism target.

Protocols used

The study also discusses the current protocols used in Brazil. Previous modeling-based work recommends three to four releases, with at least five thousand adult female *Telenomus podisi* per hectare in each application. These recommendations consider the potential for parasitism, but do not incorporate variations in plant complexity and egg incidence.

The researchers highlight the relevance of the result for soybean cultivars with

indeterminate growth. These plants continue to form new leaves after the start of the reproductive period. The alteration of the architecture throughout the cycle can modify the performance of the parasitoid during the phase of greatest interest for stink bug management.

Estimates still depend on validation under field conditions. The experiment used individual plants in a controlled environment and egg densities higher than those frequently observed in crops. This strategy allowed isolating the effect of plant architecture on the parasitoid's search for food. According to the study, future field work could calibrate release rates based on soybean phenology, leaf number, and infestation by *Euschistus heros* (doi 10.1002/ps.71241).

The work was carried out by scientists
Nathália Graziele Falcão Fernandes,
Elianara Carvalho Cardoso, João Pedro
Benaci Ayusso, and Lessando Moreira
Gontijo.

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