

Strategic decisions
in challenging times



SUGAR CANE HARVESTER SHAKTIMAN 3737



Features



Engine Assembly:
173 HP water-cooled, six-cylinder diesel engine designed to deliver increased performance.



Fan Assembly:
The fan separates debris from the cane pieces, minimizing cane loss.



Self-Cleaning System:
Helps clean the radiator at regular intervals to remove dust that can clog the radiator fins. Prevents overheating, allowing the machine to run longer.



Stability: Features
16.9/28.12PR rear tires that offer maximum stability and low soil compaction for easier work in difficult conditions.



Visibility: The curved profile of the engine cover behind the operator allows the driver to better align with the field player or when turning.

Revolutionize your planting with efficient and cost-effective technology

In the field, every minute counts and every decision impacts the profitability of the harvest. That's why, today more than ever, agricultural producers are looking for solutions that allow them to plant faster, with greater precision, and while reducing operating costs. **In this scenario, the Shaktiman 3737 positions itself as an innovative alternative for those who want to take their production to the next level through mechanized and semi-mechanized planting systems.**

Designed to offer high performance and ease of operation, the Shaktiman 3737 combines robustness and technology to adapt to different terrain conditions. Its work capacity allows for optimizing planting times, improving uniformity in crop establishment, and significantly reducing dependence on intensive labor.

One of the greatest benefits of implementing mechanized solutions is the increase in productive efficiency. The 3737 Shaktiman allows for more precise and homogeneous work, promoting better seed distribution and soil utilization. This translates into more uniform crops, reduced waste, and greater yield potential per hectare.

For producers taking the step towards agricultural modernization, semi-mechanized systems represent an excellent transition. Thanks to its user-friendly and adaptable operation, this machine facilitates the gradual incorporation of technology in the field without the need to completely transform production processes from day one.

In addition to its technical performance, the 3737 Shaktiman stands out for its durability, low maintenance, and excellent cost-benefit ratio, making it a strategic investment for farmers seeking long-term competitiveness and sustainability.

Modern agriculture demands smart solutions, and mechanization is no longer a future option: it's a present necessity. With the 3737 Shaktiman, growers have a tool at their fingertips that can transform the way they sow, optimizing resources and sustainably increasing productivity.

Discover how technology can boost your field and learn about the full potential of the 3737 Shaktiman. The future of sowing is here



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MAQUINARIA





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The agroindustry is undergoing a profound transformation driven by technology, data, and innovation. Tools such as artificial intelligence, automation, and digital agriculture are reshaping the way we produce, manage, and strengthen the sector's competitiveness.

At Tecnicaña, we remain committed to promoting knowledge transfer as a means of connecting experiences, research, and practical solutions that contribute to the technical and strategic development of the sugarcane agroindustry.

This edition of Tecnicaña Magazine is published in conjunction with the Agrotech Colombia 2026 International Seminar, an event that brings together professionals, researchers, and companies from the sugarcane, coffee, oil palm, and floriculture sectors to exchange experiences and explore real-world technology applications in both the field and processing facilities through success stories and proven solutions that are already delivering measurable results.

We extend our sincere appreciation to the authors, partners, companies, and participants who made this edition possible. Their commitment to generating and sharing knowledge continues to strengthen an agroindustry that is increasingly innovative, sustainable, and well prepared to meet the challenges of the future.

Martha Caballero

Executive Director
Tecnicaña



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Being part of Tecnicaña means joining a community that promotes knowledge sharing, technical development, and professional growth within the sugarcane agro-industrial sector.

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Agrotech Colombia 2026 is made possible thanks to a committed team dedicated to creating an academic, commercial, and networking experience that connects innovation, technology, and knowledge for the development of the agro-industrial sector.

Every detail of the seminar has been carefully designed to create spaces for learning, connection, and new opportunities for all attendees and partners. **Thank you for being part of this experience with Tecnicaña!**



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Four AI Agents, One System Design, and the Two Words That Put COP 150 Million per Month at Risk

The breakthrough emerged from a simple combination: four AI agents with conflicting incentives, a system deliberately designed to force them to challenge one another's conclusions, and a human decision-maker who determines which argument holds up. The pattern they uncovered extends far beyond a single company—it applies across virtually every agroindustry.



Two Data Sources That Had Never Been Analyzed Together

We cross-analyzed the inventory records of a distribution company—nearly 1,000 SKUs, one month of sales, purchasing, and inventory data—along with more than 4,800 WhatsApp messages and approximately 750 voice notes exchanged with two of its customers. The inventory data revealed the first key finding: between January and April, approximately 3,600 units were purchased; in May, none; in June, none. The ten SKUs that accounted for nearly two-thirds of total revenue were never replenished, representing more than COP 150 million in monthly sales. The stockout that occurred in July was not the result of a supplier failure, but the mathematical consequence of a purchasing decision made in April.

A second contradiction then emerged. In the company's records, supplier lead times could not be determined: the fourteen SKUs in transit all shared the exact same expected delivery date, making the information effectively meaningless. Yet the WhatsApp voice notes contained around a dozen actual delivery dates, each associated with a specific product and SKU. The problem was not missing information—it was that the information had never been captured.



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A company executive walked into a management meeting with a straightforward question and left with far more troubling news: *Should we spend the next 90 days increasing inventory or reactivating inactive customers?*

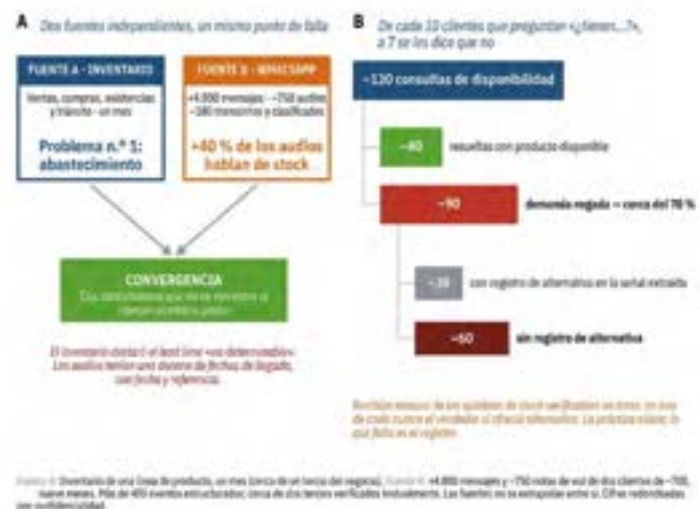


Figure 1. Cross-analysis of inventory records and commercial communications. (A) Convergence: two independent data sources identify the same operational failure. (B) Funnel of unmet demand. Values rounded.

The Two Words

Out of approximately **130 product availability** inquiries, nearly **90 ended with the same response: "out of stock."** That represents a denial rate of roughly 70%.

We then searched the entire communication dataset for the consequences one might expect to follow: "another supplier," "the competition," "I already found it elsewhere." There were **no matches**. Customers rarely complain when they are told a product is unavailable. They simply stop asking and quietly buy elsewhere. The only evidence left behind consists of two words that almost nobody records: **"Out of stock."**

It is like sugarcane left standing in the field. It is never weighed, never reaches the scale, never appears in productivity metrics. But it is still a loss.

The Real Issue Is System Design

An AI agent does not discover insights independently.

Every invocation starts from scratch. It has no memory, and it operates probabilistically by predicting the most likely next word.

Business operations, however, are deterministic: inventory either arrived or it did not.

Large language models cannot reliably correct their own reasoning without external feedback, and in some cases repeated self-correction actually degrades performance (Huang et al., 2024).

The correction must therefore be designed into the system.

This architecture is known as the **Supervisor Pattern**: an orchestrating AI agent that coordinates multiple specialist agents, deciding which one to activate—and when necessary, activating several within the same workflow (Infante, 2026).

The design consists of three key elements:

- **Roles with conflicting incentives.** Four specialized agents represent executive management, finance, operations, and commercial strategy. Their objectives intentionally conflict, forcing each to challenge the others. None may assert any figure that is not supported by the available data.
- **A mandatory second round of debate.** Whenever agents disagree, they must recalculate and defend their conclusions again.
- **Falsifiable predictions with defined time horizons.** Every recommendation must generate predictions that can be proven right or wrong using the following month's data. A performance score is maintained for each agent, making it possible to determine which agent is most reliable—and under which circumstances.

The approach worked.

Initially, the commercial agent recommended a customer reactivation campaign expected to generate nearly **COP 55 million per month**. The mandatory second review forced the agent to recalculate using only products that were actually in stock. The estimate dropped to approximately **COP 12 million**, and the original recommendation was withdrawn.

Without that challenge process, the agent would have confidently defended its first conclusion. A management committee that merely analyzes produces opinions. A committee that makes predictions, tests them, and learns from the outcomes develops judgment.

The entire exercise cost less than USD 10 in AI tokens and required only four hours of human validation. What scales is not the technology itself—it is the decision-making capability of the team you already have.

Where This Pattern Reappears

Procurement and commercial operations are fundamental processes across every agroindustry. Inventory is purchased in advance. Delivery dates are promised. Customers ask whether products are available.

An agricultural professional from this industry summarized the situation perfectly: "The field's most critical data ends up in pocket notebooks." The yield assessment discussed during a meeting. The delivery date a supplier mentioned over the phone. The reasoning behind a dosage adjustment made by the field manager.

All of that knowledge disappears when the person leaves. Yet the information already exists. It simply needs to be connected with the operational systems organizations already use. Two questions for next Monday:

- **How many times did your organization respond "out of stock" last month—and for which products?**
- **When was the last time you compared what your information systems report with what your operations team actually says?**

Technology has never been the real barrier.

The real challenge is designing how your team and your AI agents will work together—before someone else designs that process for you.

The company analyzed operates in a different industry; the operational pattern—not the specific product—is what is transferable.

Source A: Inventory records for one product line during one month in 2026, representing approximately one-third of the company's business. Source B: Communications from two customers selected from a portfolio of approximately 700 clients over a nine-month period. Voice messages were transcribed locally using speech recognition models. Of the more than 400 structured events identified, approximately two-thirds were directly verified against the original conversations. Figures have been rounded, and all organizations and individuals have been anonymized for confidentiality.

PalmaData: The Geospatial Information Hub for Colombia's Oil Palm Sector

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A Digital Pathway for Research and Technology Transfer

Oil palm cultivation in Colombia spans four production regions with highly diverse agroecological conditions. This diversity makes it essential for agronomic decision-making to be supported by timely, georeferenced technical information that is easy to interpret. In response to this need, Cenipalma developed and launched PalmaData (palmadata.cenipalma.org), a web-based geospatial information platform designed as a digital pathway for disseminating and transferring the research products developed by the Center and making them available to the oil palm sector.

PalmaData brings together, in a single open-access environment, results generated by Cenipalma's different research areas—including Geomatics, Plant Pathology, and Soils and Water, among others—along with information from national and international open-data sources considered relevant to oil palm production.

A Data Hub for Oil Palm Technical Professionals

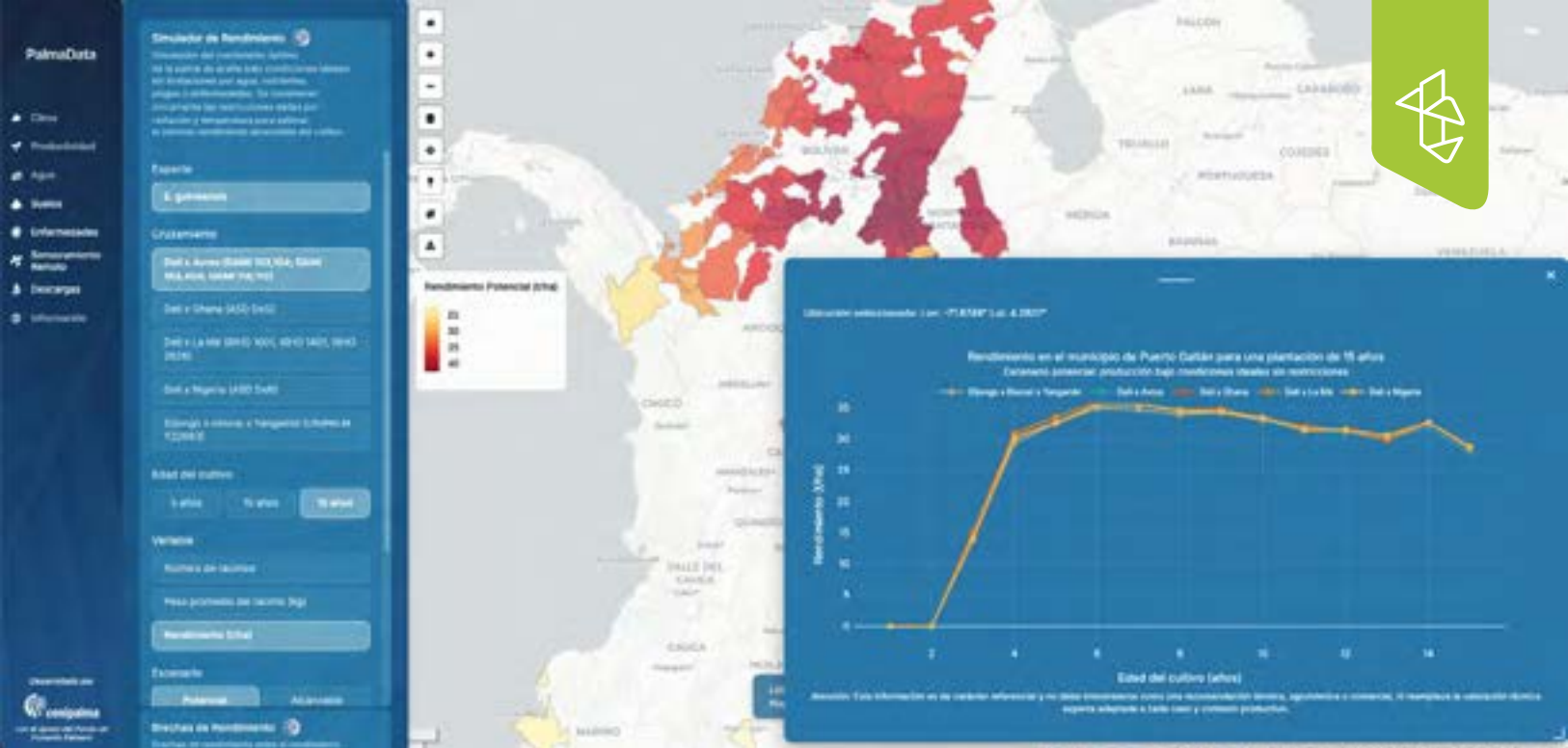
The platform was designed to become the data hub for oil palm technical professionals. Through an interactive mapping interface, growers, technical advisors, extension professionals, and researchers can explore production areas, query variables at specific locations, and access products derived from specialized models and analyses—all without the need to use geographic information system (GIS) software or download large volumes of data.

In this way, PalmaData democratizes access to information that was traditionally available only to users with advanced technical capabilities. By removing these barriers, the platform facilitates the efficient transfer of knowledge from research into field-level practice.

Information Integrated into Thematic Modules

PalmaData is organized into thematic modules that provide an integrated view of the different dimensions of oil palm production: climate, productivity, water, soils, diseases, pests, and remote sensing.

Each module brings together products developed by Cenipalma, such as historical climate datasets calibrated for Colombia's oil palm-growing regions, biophysical yield



simulators, disease favorability monitoring systems, and watershed hydrological models. These resources are complemented by reference information from institutions such as IGAC, IDEAM, ISRIC, NASA, ECMWF, and the University of California, Santa Barbara, among others.

This integration gives users access, in one place, to the information needed to support technical decision-making at multiple spatial scales, from the individual field to the watershed.

Dedicated Tools for Working with Growers' Own Data

One feature that sets PalmaData apart is its Downloads section, a repository of dedicated tools that extends the capabilities of the web platform by enabling users to conduct analyses with data from their own plantations.

Through this section, users can download Excel-based desktop applications such as the Yield Simulator, Water Balance, and Climate Favorability for Bud Rot tools. These applications run on Cenipalma's cloud infrastructure using the user's own local weather data.

The platform also provides QGIS plugins developed by Cenipalma, including the Palm Detector, Palm

Segmenter, and Harvest Collection Point Optimizer.

These tools apply machine-learning techniques to drone-captured orthomosaics to identify individual palms, delineate palm canopies, and optimize internal plantation logistics.

In this way, PalmaData goes beyond providing preprocessed regional information: it places in growers' hands the same tools used in research, while allowing them to be adapted to the specific conditions of each farm.

An Evolving Platform

PalmaData is an evolving initiative. Its modular, open-source software architecture is designed to progressively incorporate new research outputs, expand thematic coverage, and enrich the range of integrated data sources.

Beyond oil palm production, the PalmaData experience offers valuable insights for any agro-industrial sector seeking to integrate applied research, data science, and software development in order to provide growers with technical information that is ready to support decision-making.

The platform is available free of charge at palmadata.cenipalma.org.

Cobots: Collaborative Robotics Transforming Agribusiness

Automation is no longer limited to large-scale industries. Today, agribusinesses of all sizes are embracing technologies that streamline operations, increase productivity, and improve efficiency across both field and processing environments. Among the fastest-growing innovations is collaborative robotics, commonly known as **cobots**.

Unlike traditional industrial robots, cobots are specifically designed to work safely alongside people. Their flexibility and ease of deployment enable companies to automate repetitive, physically demanding, or highly precise tasks without requiring extensive modifications to existing production lines.

Across the agribusiness sector, cobots are already delivering value in applications such as:

- Product packaging and case packing
- Palletizing and depalletizing
- Crop sorting and material handling
- Quality inspection through machine vision
- Automation of repetitive plant-floor operations
- Labeling and internal logistics



One of the greatest advantages of collaborative robotics is its seamless integration. Many cobot solutions can be implemented modularly, allowing organizations to automate progressively while leveraging their existing infrastructure and minimizing operational disruptions.

The convergence of collaborative robotics, artificial intelligence, and machine vision is taking agribusiness automation to the next level. Advanced systems can now identify products, detect defects, classify crops, and support precision agriculture through smart sensors and real-time data analytics, enabling faster, more informed decision-making.

Safety is another key benefit. Equipped with intelligent sensors and advanced safety features, cobots are designed to operate collaboratively with human teams, helping reduce operational risks while minimizing injuries associated with repetitive movements and physically demanding tasks.

Global trends point toward an increasingly connected agribusiness ecosystem where automation, data analytics, connectivity, and artificial intelligence work together to drive operational excellence. As these technologies become more accessible, they are evolving into strategic tools that enhance competitiveness, improve efficiency, and support the long-term sustainability of modern agribusiness.

Increase profitability while reducing sugar losses

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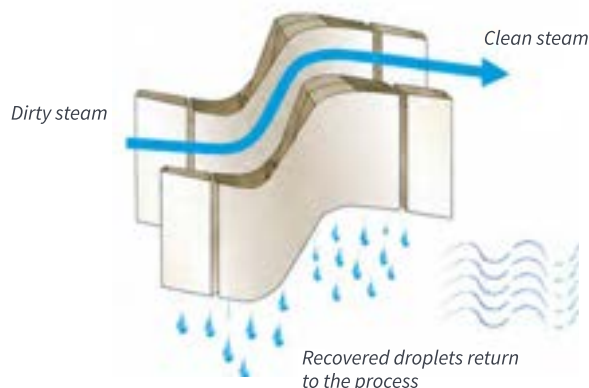
Munters
Your Perfect Climate



As global sugar demand continues to rise, producers are under increasing pressure to **improve process efficiency**. Product losses during production reduce profitability and increase downstream operating and treatment costs.



With rising energy costs and increasing pressure on profitability, the sugar industry continues to seek solutions that **reduce losses and improve process efficiency**.



Sugar recovery

increased more than double

following the
installation of Munters
mist eliminators.

CASE STUDY

A sugar mill operating pre-evaporators and two evaporation trains, with a total of eight evaporators and seven vacuum pans, was experiencing **significant sugar losses** in the barometric condenser.

After evaluating the existing separators (catchalls), the installation of **Munters mist eliminators was recommended**.

Following the trial period, **sugar recovery increased by more than double**.

KEY BENEFITS



+100%

Increase in sugar recovery.



Downstream protection

Reduces carryover and protects downstream equipment and piping.



Fast ROI

Fast return on investment.



Improved process efficiency

Stable operation, lower energy consumption, and improved profitability.

PROCESS OPTIMIZATION

Sugar losses in evaporators directly impact profitability due to energy consumption and associated operating costs.

Sugar refining presents viscosity challenges, making efficient mist eliminator design essential for recovering product without obstructions.

Munters systems provide high separation efficiency, easy maintenance, and fast return on investment.

MUNTERS SYSTEM ADVANTAGES

- Advanced plate geometry
- High separation efficiency
- Reduced sucrose losses
- Reduced carryover
- Improved energy performance
- Easy maintenance and cleaning

Munters mist eliminators installed in the evaporator train.

Interior of Munters mist eliminator: high-efficiency corrugated plates for maximum recovery.



GPS: The New Guide to Taking Sustainable Productivity to the Next Level

Over the past few years, Colombia's sugarcane agroindustry has strengthened the implementation of sustainable agricultural practices. Throughout this process, Cenicaña's Integra Program has become a key strategy for supporting growers in adopting technologies and practices aimed at improving both sustainability and field productivity.

The results achieved demonstrate the impact of this collaborative effort with producers. Integra reached more than 67,000 hectares and 773 production units. Within the agro-environmental pillar, 1,266 actions were implemented with 336 growers, focusing on practices such as efficient water use through irrigation management, Gotas automated rain gauges, and irrigation scheduling tools such as water balance. The program also promoted the efficient use of fertilizers by updating soil analyses and implementing tools such as the Expert Fertilization System (SEF), enabling more precise crop nutrition.

Contact us and become part of GPS.

gps@cenicana.org

WhatsApp: 322 6746944



Likewise, under the social and economic pillars, 624 actions were implemented with 193 growers, strengthening management, planning, and decision-making capabilities within production units. This comprehensive approach to sustainability encompasses both the well-being of farming families and the profitability of their operations.





Building on this progress, Cenicaña has developed the Sustainable Productivity Guide (GPS), a new tool designed to support growers and technical advisors in making strategic field decisions. GPS brings together technical knowledge, monitoring tools, and recommendations derived from research and extensive field experience. Its approach is based on identifying productivity gaps by comparing actual field performance with each farm's productive potential, making it possible to identify improvement opportunities throughout every stage of crop production, from field design to crop ripening and harvest.

More than a data platform, GPS is a practical guide that facilitates action tracking, field activity records, and the monitoring of critical crop variables through an accessible interface tailored to different grower profiles. Its digital dashboards provide clear visualization of the main factors limiting productivity and the affected areas at both the individual farm level and across groups of interest.



If you are a grower or a technical advisor, this invitation is for you. GPS is designed to support your work, and Cenicaña is ready to assist you every step of the way through training, technical support, and personalized guidance, helping you maximize the benefits of the platform from day one.

The next level of your crop begins with a decision.



Juan Sebastián
Gardeazabal Collazos

The Link That Defines Crystallization: Slurry Dosing, Crystallographic Control, and Process Standardization

In the operational chain of a sugar mill, few technical decisions carry as much responsibility as slurry dosing. This suspension of seed microcrystals is not just another input: it is the trigger for crystal morphological behavior. The seeding moment determines, from its very origin, the morphological evolution, particle size distribution, and final strike yield. And yet, in a large proportion of mills across the industry, this stage is

managed empirically, based on subjective criteria and undocumented operational experience.

The consequences are predictable: batch-to-batch variability, instability in mean crystal aperture (MA), and deterioration of the coefficient of variation (CV). Comparative particle size distributions from two slurry batches produced under the same nominal conditions but without a Standard Operating Pro-

cedure (SOP) illustrate this clearly: the distribution curves diverge significantly in the 7–12 micron range, with MA shifts exceeding 5 μm between batches.

In a process where a difference of just 2 microns in the MA can require up to 70% more or less dosing to achieve the same effective nucleation, such variability is unacceptable.

Cálculo Cantidad de Semilla para Templas de doble magma					
Ti μm	10 μm	11 μm	12 μm	13 μm	14 μm
Ft3/Templa	1900	1900	1900	1900	1900
Bx masa (%)	94	94	94	94	94
Nº templas	4	4	4	4	4
% cristales	35	35	35	35	35
Tamaño final polv.	280	280	280	280	280
Peso slurry en gr. azúcar	4949.43	6587.691	8552.615	10873.9	13581.24
Peso slurry en kr. azúcar	4.94943	6.587691	8.552615	10.8739	13.58124
Azúcar en fabricación de slurry (Kgr)	1	1	1	1	1
Alcohol en fabricación de slurry (Ltr)	2	2	2	2	2
Dosis Slurry (Ltr)	9.89886	13.17538	17.10523	21.7478	27.16247
Densidad Slurry	0.9	0.9	0.9	0.9	0.9
Dosis Slurry (KGR)	8.908974	11.85784	15.39471	19.57302	24.44622

Figure 1. Comparative particle size distribution of two slurry batches produced without an SOP. The curves reveal divergence in MA and CV between nominally identical batches.

“A difference of just 2 microns in the slurry MA can require up to 70% more or less dosing to achieve the same effective nucleation.”

This extreme system sensitivity reveals that slurry cannot be managed approximately. Its behavior is non-linear: small, unquantified deviations are amplified downstream in the crystallization process, compromising the crystal structure of the entire massecuite. Both overdosing—which generates excessive nuclei density and suboptimal crystal size—and underdosing—which produces uncontrolled secondary nucleation—result in a direct impact on MA, CV, and the system’s energy efficiency.

The Crystallography Laboratory: From Analytical Service to Strategic Process Control Unit

The crystallography laboratory must redefine its role within the mill's organizational structure. It is not a periodic measurement service: it is a real-time process control unit. Its functions include verifying slurry conditions prior to use—population distribution, crystal morphology, and degree of conglomeration—, determining the precise dose per pan based on massecuite type, and supplying

data to the pan floor for corrective decisions during the strike.

Crystallographic images reveal precisely this distinction: a properly characterized slurry shows a narrow monomodal distribution with crystals of uniform morphology and low conglomeration, whereas slurry produced without rigorous control shows broad population dispersion, the presence of agglomerates, and irregular morphologies that negatively

condition nucleation. The difference between the two is not visible to the naked eye in the pan: only crystallographic analysis detects it in time.

The physical location of the laboratory is also an operational condition, not a logistical preference. Positioning it adjacent to the pan floor reduces the sample-to-analysis-to-decision cycle and ensures direct communication between the crystallographic analyst and the pan operator. A remote laboratory is an outdated laboratory.



Figure 2. Comparative crystallographic analysis: slurry with rigorous control (monomodal distribution, uniform morphology) vs. slurry without standardization (broad dispersion, presence of agglomerates).

The SOP as an Instrument of Technical Process Sovereignty.

Even in mills that have already incorporated crystallography systems, the absence of an SOP for slurry production and dosing results in high batch-to-batch variability. Available technology is a necessary condition, but not sufficient: without documented, validated, and disciplined executed protocols, crystallographic data loses its guiding capacity.

A robust SOP must address the following components

- **Base sugar selection and preparation:** purity specifications, input particle size, and moisture conditions.
- **Controlled milling:** speed, temperature, and process time parameters to achieve the target particle size distribution.
- **Characterization of the resulting slurry:** verification of MA, CV, and morphology before authorizing its use.

- **Storage protocols:** temperature, agitation, and maximum batch shelf-life conditions.
- **Equipment cleaning and verification:** sanitization procedures and calibration of measurement instruments.
- **Batch traceability and control:** documentary record of each production run, including input data, process conditions, and analytical results.
- **Training and execution control:** training protocols, competency assessment, and periodic compliance auditing.

Disciplined implementation allows achieving variations of less than 2 µm in mean particle size, with demonstrable repeatability from batch to batch. A process that depends on individual judgment is, by definition, a fragile process. The SOP converts accumulated technical knowledge into organizational assets: repeatable, auditable, and improvable.

Crystallography Is Not Auxiliary: It Is the Core of the Process

Ignoring or downplaying the role of crystallographic control is equivalent to abandoning scientific mastery of the process and relegating it to operational variability. Slurry dosing, backed by a competent crystallography laboratory and governed by a validated SOP, is not an operating cost: it is the investment that guarantees process stability, product quality, and the competitiveness of the mill in an industrial environment that does not tolerate improvisation.



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A vertical decorative border on the left side of the page, featuring a close-up of various colorful flowers including red, pink, yellow, and white daisies.

Data-Driven Floriculture: The Next Competitive Leap for Colombia's Flower Industry

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Established Leadership in a New Competitive Landscape

Colombia's floriculture industry has built its global leadership on quality, technical excellence, and adaptability. Today, the country exports flowers to more than 100 destinations, generates nearly 240,000 jobs, and remains one of the world's leading players in the international flower trade. However, the current global landscape presents a challenge that goes beyond producing exceptional flowers: future competitiveness will depend on the industry's ability to transform the spatiotemporal variability of its production factors into technically sound, timely, and traceable decisions.

Biotic and abiotic factors—including rainfall, temperature, relative humidity, pathogen pressure, and crop phenology—create dynamic disturbances that reactive management models are unable to anticipate. The solution is not simply to collect more data, but to structure its continuous flow (data streams) from microclimate IoT sensors, hyperspectral imagery, and georeferenced phytosanitary records, integrating these data into formal decision-making frameworks and artificial intelligence agents capable of operating under quantified uncertainty. Data streams are not an end in themselves; they are the foundation that enables the transition from empirical observation to rigorous inference.

The Silent Threat to Machine Learning and Precision Agriculture

Deploying highly predictive machine learning models without accounting for dataset shift is one of the most costly mistakes in precision agriculture. Dataset shift occurs when the statistical distribution of production data differs from the distribution on which the model was originally trained, whether due to seasonal changes, variations in agronomic practices, the emergence of new pathogens, or shifts in climatic conditions (Quionero-Candela et al., 2009).

Under these circumstances, even highly accurate data captured through hyperspectral sensors or UAV platforms may feed a model whose predictions are systematically biased, without providing any warning to the operator. Timely detection of dataset shift requires continuous monitoring of the divergence between the training data distribution and the current data



distribution using specialized metrics (Calin, 2020). When a significant shift is detected, the model must be recalibrated or retrained before its recommendations translate into economic losses. Ignoring this step transforms technological sophistication from a risk-mitigation tool into an additional source of risk.

Decision Theory: From Data to Evidence-Based Action

Transforming data into decisions is far more than interpreting performance indicators. Scientific decision theory provides the formal framework for this process. In its classical formulation (Von Neumann & Morgenstern, 1944), an optimal decision maximizes expected utility given a set of alternatives and a utility function that reflects the decision-maker's preferences. In floriculture, this means quantifying the economic consequences of each possible action—such as applying a phytosanitary treatment or advancing harvest timing—under different climatic and biotic scenarios.

The Bayesian extension (Matthews, 2026) introduces the ability to incorporate prior knowledge, which is continuously updated with new observations from the data stream. A Bayesian pest management model combines the prior probability distribution of an outbreak with the likelihood of current observations to produce a posterior distribution that quantifies the remaining uncertainty before a decision is made. Dataset shift detection fits naturally into this framework: when the distribution of the data-generating process changes, the prior distribution must be revised and posterior inference recalculated, thereby integrating data quality control with the formal decision-making process.

Spatiotemporal Modeling, Industry Evidence, and the Social Dimension

The heterogeneity generated by greenhouse microclimates and environmental gradients introduces significant spatial variability in stem density, phytosanitary quality, and crop phenology. Spatial data

processing techniques, combined with Transformer architectures such as BERT and SciBERT for the semantic representation of unstructured agronomic data, make it possible to integrate sensor time series and multispectral imagery into a vector space in which AI agents can operate. The recommendations generated by these agents, combined with calibrated utility functions, produce traceable decisions that go far beyond simply interpreting alerts (van Maarseveen, 2024).

A recent technology foresight initiative led by CENIFLORES identified 20 success stories, 28 peer-reviewed scientific publications, 32 active patents, and 61 technologies at different stages of maturity that are applicable to floriculture production and postharvest processes. The economic impact of this transition extends beyond agronomic performance: digital traceability enables access to premium markets with ESG standards while strengthening the industry's international negotiating position. From a social perspective, it also creates demand for specialized professionals—including agricultural data scientists and machine learning engineers—thereby improving employment quality in regions that depend heavily on the floriculture sector.

Foresight and Rigorous Decision-Making as a Sustainable Competitive Advantage

The future competitiveness of the sector will not be defined by those who adopt the most technology, but by those who develop the institutional capability to transform uncertainty into a managed variable, to anticipate rather than react, and to base every decision on scientifically sound evidence.

The floriculture industry of the future will not simply be more digital—it will be more intelligent, more resilient, and fairer to the people who work within it. That is the leap worth making.

References

- Matthews, C. (2026). Bayesian modelling and decision making: A practical framework for reasoning under uncertainty, statistical inference, and data-driven decisions.
- Quionero-Candela, J., Sugiyama, M., Schwaighofer, A., & Lawrence, N. D. (2009). Dataset shift in machine learning. MIT Press.
- van Maarseveen, H. (2024, mayo 12). BERT: Pre-training of deep bidirectional transformers for language understanding. Kindle Edition.
- Von Neumann, J., & Morgenstern, O. (1944). Theory of games and economic behavior. Princeton University Press.
- Calin, O. (2020). Deep learning architectures: A mathematical approach (Springer Series in the Data Sciences). Springer.

Improving Soil Health and Sugarcane Productivity in Colombia's Cauca Valley with Humic Substances

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Abstract

The sustainability of sugarcane (*Saccharum* spp.) production in Colombia's Cauca Valley depends largely on soil health and nutrient-use efficiency. Challenges such as soil compaction, declining organic matter, and reduced fertilizer efficiency are common in highly mechanized production systems.

Humic substances, which are chemically active components of humus, have received increasing attention as agronomic tools capable of improving soil structure, biological activity, and nutrient uptake efficiency. This article reviews the role of humic acids in improving soil-plant functionality in sugarcane and their potential to enhance fertilizer efficiency, mitigate abiotic stress, and support biomass production and sugar accumulation.

Humic Substances and Soil Functionality

Humic substances are relatively stable fractions of soil organic matter formed through humification processes. They originate from the microbial and chemical decomposition of plant lignin, cellulose, and polyphenols.

Humic acids are characterized by a high density of reactive functional groups, including carboxylic,

phenolic, quinone, amine, and hydroxyl groups. These functional groups allow humic molecules to interact with soil minerals, nutrients, and microorganisms within the rhizosphere.

As a result, several key soil processes can be enhanced, including soil aggregation, increased cation exchange capacity, improved nutrient availability, and greater microbial activity. In the sugarcane production systems of the Cauca Valley, these processes can contribute to improved soil structure and greater overall efficiency within the soil-plant system.

Biostimulation and Root Development

In addition to their effects on soil properties, humic substances can act as plant biostimulants. Research has shown that humic acids can stimulate H⁺-ATPase activity in root cell membranes, enhancing nutrient uptake and root development.

In sugarcane production systems, these mechanisms may translate into stronger root system development, greater soil exploration, and improved nutrient uptake efficiency. These biostimulant effects can often result in positive agronomic responses beginning in the early stages of the sugarcane crop cycle.

Progressive Improvement of Soil Structure

Soil compaction is one of the major challenges in highly mechanized sugarcane production systems. Repeated machinery traffic can increase soil bulk density and restrict root growth.

Humic substances can help improve soil structure by promoting the formation of stable aggregates, stimulating microbial activity, and increasing the formation of root-generated micropores.

Importantly, improvements in soil compaction associated with humic substances should be viewed as a cumulative process that develops progressively with continued applications over time.

Mitigation of Abiotic Stress

Humic substances also play a role in mitigating abiotic stress conditions such as water deficit, soil compaction, salinity, sodicity, and nutrient imbalances.

By improving root development and overall plant physiological efficiency, humic substances can help sustain photosynthetic activity and vegetative growth under challenging conditions.

In sugarcane production, these responses may contribute to greater biomass accumulation and create favorable physiological conditions for sucrose synthesis and storage.

Integration with Fertilization Programs

The engineered properties of humic acid-based products allow them to be easily blended with NPK fertilizers. This compatibility makes it possible to incorporate humic substances into standard fertilization practices for both plant cane and ratoon crops.

In addition, the physical properties of properly formulated humic acid products allow them to dissolve in the soil along with the fertilizer, helping ensure their availability as nutrients are released.

The functional groups contained in humic acid-based products interact with mineral nutrients and can improve fertilizer-use efficiency, with documented

improvements of up to 15% in nitrogen-use efficiency and up to 20% in phosphorus- and potassium-use efficiency.

Indicators of Agronomic Impact in Sugarcane Systems

Integrating humic acids into fertilization programs can positively influence several agronomic indicators associated with soil-plant system productivity. These include improved root development, greater nutrient uptake efficiency, increased tolerance to abiotic stress, and greater plant biomass production. These conditions can also support physiological processes associated with sucrose accumulation in sugarcane stalks.

Highly concentrated humic products provide a practical tool for incorporating these benefits into modern nutrient management strategies.

Conclusions

Agronomic technologies that incorporate humic acids represent an important tool for improving soil health and nutrient-use efficiency in sugarcane production systems. High-quality humic acid-derived products have been shown to positively influence the physical, chemical, and biological processes that take place in the soil.

Their biostimulant effects can promote measurable responses from the first year of application, while improvements in soil structure and functionality develop progressively over time.

Humic acid technologies have demonstrated the potential to improve both productivity and sustainability in sugarcane production systems. The physical characteristics of humic products allow them to be applied as part of fertilizer blends and to dissolve at a similar rate, helping reduce nutrient losses while improving nutrient uptake.

In the Cauca Valley, where sugarcane growers are pushing yields to historically high levels, humic substances can play an important role in sustaining productivity while promoting environmentally responsible production practices.

FAVS Advances Climate Adaptation Actions to Strengthen Regional Water Sustainability.

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Climate variability is one of the greatest challenges facing water resource management in Colombia's Valle del Cauca and neighboring regions. Extreme weather events, such as the El Niño phenomenon, reduce river flows, increase pressure on water supply sources, affect rural water systems, and intensify conflicts over access to water. In response, the Water for Life and Sustainability Fund (FAVS), working in partnership with water user associations, rural water utilities, community organizations, environmental authorities, and strategic partners, has developed a regional adaptation strategy that goes beyond emergency response and focuses on building long-term water resilience.

Over the past several years, FAVS has implemented integrated interventions across multiple watersheds within its area of influence to strengthen the capacity of local communities to cope with drought and climate variability. These efforts combine ecological restoration, the protection of strategic ecosystems, improvements to rural water infrastructure, community-based hydrological monitoring, and participatory water governance.

One of the most significant achievements in 2025 was the strengthening of 16 rural water supply systems through initiatives aimed at reducing water losses and optimizing conveyance and storage infrastructure. These interventions reduced water losses by nearly 70%, resulting in estimated water savings of 1,680 liters per second.

In addition, during the 2024–2025 period, 654 hectares of strategically important land for water retention and regulation were protected, enhancing the natural

capacity of ecosystems to store and gradually release water during dry seasons. These interventions included spring protection, ecological restoration, forest enrichment, and voluntary conservation agreements with landowners and local communities. Complemented by community-based hydrological monitoring and streamflow measurement campaigns, these efforts have generated valuable information to support informed decision-making and sustainable water resource management. Together, these results demonstrate that climate adaptation also depends on improving the efficiency of available water resources.

For 2026, the strategy continues to evolve. Through the Water with a Future initiative, FAVS will launch a new phase focused on promoting ecological restoration and community-based water management as key adaptation measures to address climate variability and water scarcity.



Fondo Agua
Por la Vida y la
Sostenibilidad





The initiative will mobilize approximately COP 800 million, contributed by FAVS and its partner organizations, to implement adaptation actions across multiple watersheds and strengthen field interventions. This investment will support 13 projects in 16 watersheds, directly benefiting nearly 7,800 people through ecological restoration and landscape management across 27 priority hectares, strengthening 16 community-managed water systems, installing 10 water storage tanks, and facilitating 36 dialogue forums on rural water management.

These actions are designed to reduce pressure on water sources, improve water-use efficiency, and strengthen community water governance, thereby building long-term adaptive capacity to address climate variability and future water-related challenges.

More than a temporary response to extreme weather events, the strategy led by FAVS represents a long-term commitment to regional water security. Its approach integrates ecosystem conservation, efficient water use, local capacity building, and collaborative governance, demonstrating that effective adaptation is achieved when communities, institutions, and productive sectors work together toward a shared goal: ensuring water for life and the sustainable development of their territories.

“Less pressure on water sources, greater access to water for everyone.”

This vision continues to guide the actions of FAVS and its partners as they work to build more resilient territories capable of facing climate variability and the water challenges of the future.

THE FUTURE OF AGRICULTURE IS NOT GROWN ONLY IN THE SOIL.

IT IS ALSO GROWN IN DATA.

Artificial Intelligence is redefining how **agribusinesses** make decisions, **optimize operations**, and anticipate the market.

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FROM DATA COLLECTION TO INTELLIGENT DECISION-MAKING

The Mayagüez Sugar Mill Experience

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Modern agriculture has undergone a profound transformation over the past several years. Twenty years ago, the focus was on adopting GPS technology, generating descriptive maps, and understanding the spatial variability of soils and crops. Today, the challenge has evolved toward integrating these data sources to generate actionable information that supports real-time decision-making, improves productivity, optimizes costs, and advances more sustainable operations with a lower environmental footprint.

At Mayagüez, this transformation has meant moving beyond the independent use of technologies such as positioning systems, auto-steering, and electronically controlled input application equipment. Instead, we have built a connected technological ecosystem that integrates field operations, satellite imagery, agricultural machinery, and office-based analytics. Most importantly, this ecosystem places people at its core, enabling the transformation of data into more efficient, timely, and reliable agronomic decisions.

From Technology to Field Results

Agricultural innovation only becomes meaningful when it delivers measurable benefits in the field. At Mayagüez, we did not implement precision agriculture simply to produce maps. We adopted these technologies to answer operational questions that would have been impossible to address using traditional methods.

PRECISION AGRICULTURE



CASE 1

How Can We Apply Fewer Inputs While Achieving Better Results?

Our georeferenced soil sampling strategy, based on management zones and supported by technical expertise and advances in geostatistical modeling, has provided a detailed understanding of the spatial variability of soil chemical and physical properties. Combined with varietal knowledge developed by Cenicaña, this information enabled the implementation of a variable-rate fertilization methodology tailored to each field. As a result, we have managed nearly 3,000 hectares while reducing nitrogen fertilizer use by an average of 13%.



CASE 2

How Can We Improve Mechanical Harvest Quality While Reducing Its Impact on the Crop?

The adoption of auto-steering systems for mechanical harvesting has become one of the most impactful technologies for improving harvest quality. Supported by the georeferencing of more than 20,000 hectares using drones connected to Cenicaña's RTK correction network, harvesting operations are now performed with centimeter-level accuracy along planting rows, reducing crop traffic damage by up to 30%.

However, precision is not achieved through technology alone. It is the result of integrating high-quality data, advanced positioning systems, and the expertise and commitment of field operators. This integrated approach has not only improved crop and soil conservation but has also enhanced the safety, efficiency, and working conditions of operational personnel.



CASE 3

How Can We Turn Millions of Data Points into Better Decisions?

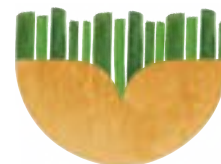
For many years, each operational area managed its own information independently. Soil data, weather records, telematics, satellite imagery, and field operation data remained isolated in separate platforms. With the consolidation of software solutions and the creation of a dedicated Digital Transformation department, Mayagüez successfully integrated these data sources into a unified system that enables a deeper understanding of the interactions among soil, climate, and crop performance, ultimately supporting more informed and timely management decisions.

The development of a Data Lake-based ecosystem has made it possible to integrate these diverse information sources while incorporating predictive models developed by Cenicaña, including water balance, field trafficability, and weather forecasting models. Together, these tools generate automated performance indicators, interactive dashboards, and advanced analytics that support faster and better-informed decision-making across every level of the organization.

After several years of implementation—a process that continues to evolve—we have learned that technology only creates value when it addresses real operational needs. Every innovation introduced at Mayagüez began with a specific production challenge: How can we use less fertilizer? How can we optimize irrigation? How can we make better decisions?

This practical approach to innovation has enabled us to transform Precision Agriculture into a management model that helps close productivity gaps, optimize production systems, and generate lasting value for both our people and our organization.

MORE THAN 3,600 SERVICES PROVIDED DURING "LA CAÑA NOS UNE" COMMUNITY OUTREACH EVENT IN FLORIDA, VALLE DEL CAUCA



CORAZÓN
DE CAÑA

More than 900 residents of the municipality of Florida, Valle del Cauca, participated on July 4, 2026, in a new edition of "La Caña Nos Une" ("Sugarcane Brings Us Together"), a free community outreach initiative focused on health, well-being, and recreation. The program is led by Asocaña and its affiliated sugar mills in partnership with the Colombian Aerospace Force, the Florida Municipal Government, and several public and private organizations.

Held at the Absalón Torres Camacho Educational Institution, the event delivered more than 3,600 services to the community through specialized medical care, health promotion and disease prevention programs, institutional guidance, and recreational activities for children, youth, and families.

Participants had access to consultations in general medicine, internal medicine, pediatrics, gynecology, nutrition, psychology, physiotherapy, dentistry, optometry, and speech-language pathology. Additional services included cervical cancer screening (Pap smears), electrocardiograms, blood glucose testing, vaccination, hearing screenings, ear irrigation, family planning, HIV and serological testing, clinical breast examinations, and deworming.

This edition of "La Caña Nos Une" was made possible through the joint efforts of Asocaña and the Colombian Aerospace Force, with the participation of Riopaila Castilla, Mayagüez, and Incauca sugar mills, and the support of the Florida Municipal Government, the Colombian National Army, the National Police, the Institute for Blind and Deaf Children, Comfandi, Good Vision, Fundación 180, Corporación Organización El Minuto de Dios, Benjamín Barney Gasca Hospital, Asmet Salud, Salud Total, and Fundación Corazón de Caña.

Through initiatives such as this, Asocaña and its partner organizations continue to strengthen their commitment to community well-being by expanding access to healthcare services, promoting disease prevention, and supporting programs that contribute to stronger social cohesion in the regions where Colombia's sugarcane agro-industrial sector operates.



Maximizing Yield: The Challenge of Strategic Nutrition in the Sugarcane Industry

Do You Know What Percentage of Your Nitrogen Investment Is Lost Before the Crop Can Use It?

For Alejandro, walking through **Field Block 4** of his sugarcane operation in Colombia's Cauca Valley had become a financial puzzle. Despite rigorously following his fertilization program, yields per hectare remained stagnant. *"It feels as though the investment evaporates into the soil before the crop delivers any measurable return,"* says Alejandro.

His concern is supported by a troubling technical reality: under our climatic conditions, conventional urea can achieve nitrogen-use efficiencies below 30%. From a financial perspective, this means that a significant portion of invested capital never reaches the root zone where it is intended to generate value.



Critical Insight: If you rely on conventional urea, up to seven out of every ten dollars invested may end up in the air or in the water—not in your sugarcane crop.

Where Does the Nitrogen Go?

Alejandro's challenge was not a lack of effort—it was the impact of three natural chemical processes acting as invisible threats to his profitability:

- **Volatilization:** High temperatures and soil pH conditions can cause nitrogen to escape into the atmosphere as ammonia gas before it can be incorporated into the soil.
- **Leaching:** Heavy rainfall or intensive irrigation can wash fertilizer beyond the effective rooting zone, placing nutrients out of reach of the crop.
- **Denitrification:** In poorly drained soils, nitrogen can be lost as gaseous nitrogen oxides, reducing nutrient availability and fertilizer efficiency.

The Science Behind 4R Nutrient Stewardship: Moving Beyond "Blind" Fertilization

Through the technical guidance of CIAMSA Agrícola, Alejandro adopted a new paradigm based on the globally recognized **4R Nutrient Stewardship framework: Right Source, Right Rate, Right Tim, Right Place.**

This approach revealed a fundamental truth: success is not about applying more fertilizer—it is about protecting the nutrients you apply. By implementing precision nutrition technologies, Alejandro optimized production costs and achieved a yield.



The NAXTROM Family: Advanced Nitrogen Protection for Your Crop
CIAMSA's stabilized urea technologies are engineered to function as a protective shield for nitrogen, safeguarding nutrient availability and maximizing fertilizer performance:



A stabilized nitrogen source featuring **triple protection technology**, designed to minimize losses caused by volatilization, leaching, and denitrification. Through the use of urease and nitrification inhibitors, NAXTROM keeps nitrogen protected in the soil for longer periods, improving nutrient availability and enhancing fertilizer-use efficiency.



A stabilized nitrogen-and-sulfur source featuring **triple protection technology**, designed to reduce losses from volatilization, leaching, and denitrification through advanced urease and nitrification inhibitors. The sulfur included in its formulation enhances nitrogen assimilation, contributing to improved factory performance indicators while promoting vigorous and uniform ratoon regrowth.

A Future Defined by Precision and Confidence From Uncertainty to Profitability: Alejandro's Success Story

For Alejandro, success is no longer a financial riddle—it is reflected in stronger bottom-line results. Thanks to stabilized nitrogen technology, the investment that once seemed to "evaporate" has been transformed into a vigorous and uniform crop, where every granule of fertilizer contributes to protecting the profitability of the operation from day one.

Today, Alejandro's management approach demonstrates how technology-driven agriculture can transform economic performance. By adopting stabilized nitrogen solutions, he safeguards his investment while advancing a more technical and efficient production model. His confidence comes from knowing he is supported by solutions specifically designed to address the real-world challenges faced by Colombian sugarcane producers.

Is Your Investment Evaporating?

Protect your profitability and transform your results with CIAMSA's specialized technical advisory services.

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DNS THREAT LANDSCAPE 2025 - 2026



TECHNICAL ANALYSIS AND ATTACK TECHNIQUES

A global analysis of Domain Name System (DNS) traffic reveals a critical transformation in the cybercriminal infrastructure. Over the past year, 100.8 million Newly Observed Domains (NODs) were registered, 25.1% of which have been associated with malicious activity. Traditional signature-based defenses are no longer sufficient against highly volatile and automated attack infrastructures.

1. Key Market Insights (July 2024 – July 2025)

- **Campaign Isolation:** 95% of malicious domains were observed within a single network environment, highlighting the highly targeted nature of modern attacks.
- **Passive Exposure:** 82% of monitored enterprise networks generated active queries to Traffic Distribution Systems (TDSs).
- **Deployment Speed:** A critical TDS domain now reaches peak traffic in just 19 days—2.3 times faster than in 2024 and 39 times faster than in 2020.

2. Attack Lifecycle: WordPress Hackers and the Vextrio Viper TDS

Cybercriminal organizations have established a symbiotic supply chain with commercial AdTech networks:

[Victim] → [Compromised WordPress Site] → [TDS / Vextrio Viper] → [Commercial AdTech Networks] → [Malware / Infostealer]

1. **Compromise:** Malicious JavaScript is injected into vulnerable WordPress websites.
2. **Profiling (TDS):** User traffic is redirected to assess the victim's browser, language, and geolocation.
3. **Monetization:** Traffic is routed through advertising platforms (e.g., Los Pollos, BroPush, RichAds).
4. **Impact:** Automated delivery of fake CAPTCHA challenges, financial scams, or Infostealer malware.

3. DNS Malicious Techniques Taxonomy

- **Domain Generation Algorithms (54.7%):** Predominant use of RDGA, DDGA, and DGA techniques for large-scale domain generation.
- **Traffic Redirection (11.0%):** Diversion of legitimate web traffic to malicious destinations.
- **Deceptive Identities (10.2%):** Evenly split between lookalike domains (5.1%) and domain hijacking (5.1%).
- **CNAME Abuse (5.8%):** Exploitation of orphaned DNS records and dangling CNAME configurations.

4. Profile of Key Threat Actors

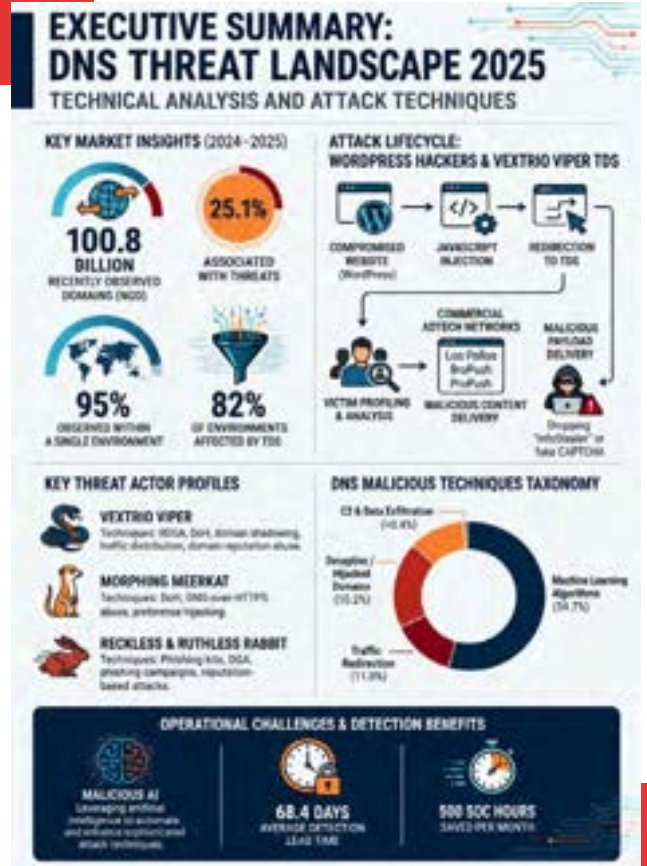
- **Vextrio Viper:** Responsible for 72.8% of the analyzed TDS connections, primarily leveraging compromised WordPress sites.
- **Morphing Meerkat:** Abuses DNS over HTTPS (DoH) and MX records through open resolvers to deploy multilingual phishing kits in 12 languages.
- **Reckless & Ruthless Rabbit:** Uses RDGA-based algorithms to power automated investment fraud campaigns.

OPERATIONAL CHALLENGES AND DETECTION BENEFITS

Approximately 88% of AI-generated or AI-obfuscated malware successfully evades traditional endpoint detection technologies. To close this gap, pure DNS telemetry intelligence provides:

- 68.4 days of advance protection before threats become publicly available through Open-Source Intelligence (OSINT).
- An extremely low false-positive rate of 0.0002%.
- Operational efficiency gains by saving more than 500 SOC analyst hours per month.

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Applied Crystallography: massecuite boiling as a measurable and standardizable system

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For decades, the massecuite boiling process has been evaluated from the standpoint of molasses exhaustion, leaving the structural behavior of the crystal in the background. Today, however, the demands placed on the sector—higher recovery, purging efficiency, standardization between materials—call for a layer of information that exhaustion figures alone cannot reveal: the **crystal structure**. Applied crystallography fills that gap and turns crystallization into a measurable, comparable and standardizable system.

Why measuring crystals through crystallography

Applied crystallography rests on the systematic measurement of four variables: mean aperture size (**MA**), coefficient of variation (**CV**), population distribution and crystal morphology. These variables provide an objective verification of every crystallization, identify secondary nucleation, quantify purging performance and enable comparison between strikes, days and harvests. Without this layer, many operational issues—purity rises, conglomerates, excessive fines—can only be diagnosed in qualitative terms.

The four pillars of crystallographic control

Plant-level intervention is structured around four interconnected pillars. The first is **slurry control and dosing**: the cubic relationship $N \propto 1/d^3$ means that a $\pm 2 \mu\text{m}$ variation in seed mean size produces dosing deviations close to 65 %, making direct measurement and batch-to-batch traceability non-negotiable. The second is control during crystallization, which verifies seeding and operation within the metastable zone according to the system purities.

The third is monitoring during massecuite boiling, where the evolution of MA, CV and population distribution between stations enables early detection of deviations before they affect the process. The fourth is **control in centrifugation**, which links crystal quality to purging efficiency (separation velocity $\propto m^2/\eta$) and feeds back to the boiling stage through the loss of mean size between massecuite and magma.

Case study: a Brazilian sugar mill with a two-massecuite scheme and attached distillery

Crystallographic control covering the four pillars was implemented at a Brazilian sugar mill. The initial diagnosis revealed high heterogeneity in the A massecuite, low purging efficiency and difficulty in keeping color below the 180 IU specification. Interventions focused on slurry standardization, securing operation within the metastable range and systematic recording of growth between stations.

Results that transform plant operation

The structural improvement of the crystal was clear: the

MA of the A massecuite increased from 440 μm to 480–510 μm ; the **CV** decreased from 59–60 % to 42–45 %; fines dropped from 40–35 % to 10–5 %; and the optimum fraction grew from 17–23 % to 25–35 %. A more open granular structure allowed a reduction in centrifuge wash water and times, going from 24 s to a minimum wash time of 14 s while keeping final color below 150 IU against the 180 IU requirement, with a sugar production increase close to **5 %**.

Toward measurable and standardizable crystallization

The case shows that applied crystallography does not compete with the conventional industrial laboratory; it complements it by providing the diagnostic layer that explains phenomena previously attributed to operator skill. Standardization is progressive and consolidates through operational discipline, systematic recording and a team trained to read the information contained in the crystal. Its adoption at plant level is the path toward a process less dependent on subjectivity and closer to the systematic boiling control the sector demands to be more efficient.



TECNICAÑA será anfitriona del gran encuentro latinoamericano del sector agroindustrial de la caña de azúcar. En 2029, Colombia recibirá a expertos y líderes de América Latina y el Caribe para compartir conocimiento, innovación y construir juntos el futuro de nuestra agroindustria.

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agrotech COLOMBIA 2026



REAL-WORLD INNOVATION EXPERIENCES FOR THE AGRIBUSINESS SECTOR

The third edition of the International AGROTECH Colombia Seminar represents a new step forward in how innovation is experienced across the agribusiness sector. This year's event has evolved into a hands-on, demonstration-driven platform where technology is no longer just a concept—it is a practical, measurable reality delivering tangible results.

AGROTECH 2026 brings together industry professionals, companies, researchers, technology providers, and representatives from a wide range of productive sectors in an environment designed to accelerate knowledge transfer and showcase the practical solutions that are transforming modern agriculture.

One of the event's defining strengths is its experiential approach. Rather than focusing solely on future trends, AGROTECH 2026 demonstrates how innovation is already creating measurable value across farming operations, harvesting processes, and industrial production. Technical sessions and presentations highlight real-world applications, performance indicators, implementation lessons, and operational success stories from organizations and agricultural systems that are already embracing digital transformation.

Renowned national and international speakers—recognized for leading innovation, research, and technological transformation initiatives across diverse agribusiness industries—will share practical knowledge, successful case studies, and first-hand experiences that are driving improvements

in productivity, sustainability, and data-driven decision-making.

While the sugarcane agroindustry remains at the heart of the event, this edition also incorporates perspectives and experiences from coffee, oil palm, floriculture, and animal protein production. This cross-sector approach fosters meaningful dialogue around the shared challenges and opportunities shaping the technological transformation of agriculture.

The academic program explores key topics including precision agriculture, applied artificial intelligence, predictive maintenance, industrial automation, IT/OT convergence, advanced data analytics, circular economy, and digital transformation. Together, these themes create a forward-looking agenda aligned with the current priorities and emerging challenges facing today's agribusiness sector.

Complementing the technical program, the commercial exhibition and networking spaces provide valuable opportunities for companies and professionals to connect, exchange ideas, and build strategic partnerships that foster innovation, competitiveness, and long-term growth throughout the agribusiness industry.

With its third edition, the International AGROTECH Colombia Seminar further strengthens its position as a leading platform connecting agribusiness professionals with the technologies, expertise, and real-world experiences that are redefining competitiveness and sustainability across modern agriculture.



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Recognition | Dr. José Orive



*A Lifetime Dedicated
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of the Global Sugar
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Tecnicaña proudly recognizes the distinguished career of Dr. José Orive, Executive Director of the International Sugar Organization (ISO), for his outstanding contributions to the advancement and transformation of the global sugar industry. With extensive experience in industry representation, sustainability, and international trade, Dr. Orive has championed the transition toward a sugarcane-based bioeconomy, promoting the integration of emerging sugarcane applications with the challenges of energy production and sustainability. During his 19 years as Executive Director of the Central American Sugar Association (AICA), he established himself as a leading figure in fostering collaboration and advancing the regional sugar agroindustry. His leadership and vision have left a lasting legacy in building a more competitive and sustainable sector.

IN MEMORIAM

Dr. Óscar Almazán del Olmo

*A Legacy of
Knowledge and
Commitment to
Sugarcane*



Tecnicaña honors the memory of **Dr. Oscar Almazán del Olmo**, Honorary Member of the Cuban Association of Sugar Technologists (ATAC), who devoted his life to the scientific and technological advancement of sugarcane by-products. During his terms as President of ATAC (1979–1984 and 1989–2002), and later as an advisor to the Cuban Research Institute for Sugarcane By-products (ICIDCA), he made invaluable contributions to research, the education of new generations of professionals, and the development of the sugar industry. His distinguished career, unwavering commitment, and dedication to sharing knowledge will continue to inspire the international sugar community for years to come.

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PREMIOS Y RECONOCIMIENTOS

en la Agroindustria de la Caña en Colombia



Was recognized by Camilo Torres Educational Institution for its contribution to regional education through initiatives aimed at improving learning conditions and supporting teacher development.



Received the **Farm Sustainability Assessment (FSA)** Silver Level certification, an international recognition that validates the company's performance in sustainability and environmental, social and governance (ESG) best practices.



Was recognized by ICONTEC in celebration of its **60 years** of membership, honoring six decades of commitment to quality, the adoption of excellence standards, and the advancement of competitiveness and sustainability in Colombia's sugarcane agroindustry.



Received the Order of Democracy Simón Bolívar, awarded by the Congress of the Republic of Colombia, in recognition of its distinguished track record, growth in the legal sector, and contribution to innovation and business development in the country.



We congratulate **María del Pilar Rodríguez Caicedo** on her appointment as President of Grupo Mayagüez, a position she assumed on July 1, 2026. We wish her every success as she leads this new chapter, focused on strengthening sustainability, innovation, and the continued development of Colombia's sugarcane agroindustry.

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