



Editing the Future: Public - Private Collaborations in Gene Editing

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Who is Pairwise?

Partnering to build a healthier world by making plants easier to grow and eat.

- We are the **world leader in deploying CRISPR** technologies to **create agriculture products**.
- We're **solving the most pressing challenges** in our global food and agriculture system.
- We create products in **markets worth \$600B+** in total value.
- We **commercialize** in conjunction **with other world agriculture leaders**, including Bayer and Corteva.



Our world is changing fast. We help plants keep up

Agriculture sits at the crossroads of climate change, global competitiveness, and human health. We're accelerating plant adaptation to address these challenges with science-based solutions. **Pairwise is CRISPR in agriculture.**

We apply our industry-leading gene editing platform across a range of crops to drive:



By increasing and protecting crop yields and mitigating food waste

By creating fresh produce varieties that are more appealing to consumers

By changing plant architecture to make picking faster and safer

By adapting plants to grow in new geographies and climates

Plants contain all the genetic information they need to adapt to our changing world. It's up to us to deploy it



We have a 7-year track record of delivering value to partners and customers

That's why Pairwise is supported by preeminent collaborators in food & ag and blue-chip investors...



...and industry-leading scientific and commercial advisors



We are transforming the food system from multiple angles, one collaboration at a time

Diverse Product Portfolio with Demonstrated Commercial Traction

Examples of our Collaboration work include:

- **Traits and Traited Seeds / Germplasm:**



Large Acre Row Crops: achieved 27 novel phenotypes to-date, including improved yield and disease resistance, across 3 crops that are in field trials



Fruit & Vegetables: created 12 novel phenotypes to-date (e.g. seedless / pitless, enhanced flavor profile, early flowering, compact plants) across 9 crops



Developed and commercialized 1st gene-edited produce in North America in < 5 years; demonstrated consumer acceptance and food service and retailer uptake, and executed product licensing agreement

- **Tools / IP** – License technology platform for other parties to directly edit their/their clients' products
- Established regulatory groundwork and freedom to operate in many countries

Leading, Proprietary Gene-Editing Platform

Our Fulcrum™ Platform is the most comprehensive in food and agriculture:

- Custom delivery and transformation tools in combination with deep knowledge of plant genetics **unlock features of commercial value**
- Ability to **multiplex and tune**, with hundreds of gene edits already achieved across crop families
- **~100 patent families** covering traits and technologies
- Extensive computational capabilities with **data science, AI and machine-learning tools**



Collaborations

Editing the Future



Collaboration Model for Pairwise Partnership



Aligned incentives, shared success, faster innovation.





Collaborations

Directly license our gene editing toolkit to grow from bold hypothesis to fully-realized product quickly and with confidence.



Two exclusive 5-year deals with Bayer:

2018 - 2023

- Included work in Corn, Soybean, Cotton, Canola, & Wheat
- Produced 27 novel traits for Bayer's Pipeline
- Phenotypes include:
 - Corn yield increases
 - Asian soybean rust resistance

2023 - 2028

- A new 5-year deal with Bayer focused on innovations in short-stature corn



Multi-year Caneberry collaboration with PSI:

- Includes work in blackberry, and red and black raspberry
- Seedless & thornless blackberries growing in greenhouses

An exclusive 5-year deal with Corteva:

Joint venture to accelerate and expand the delivery of advanced gene edited technologies aimed at increasing crop yield for food, fuel, and fiber production

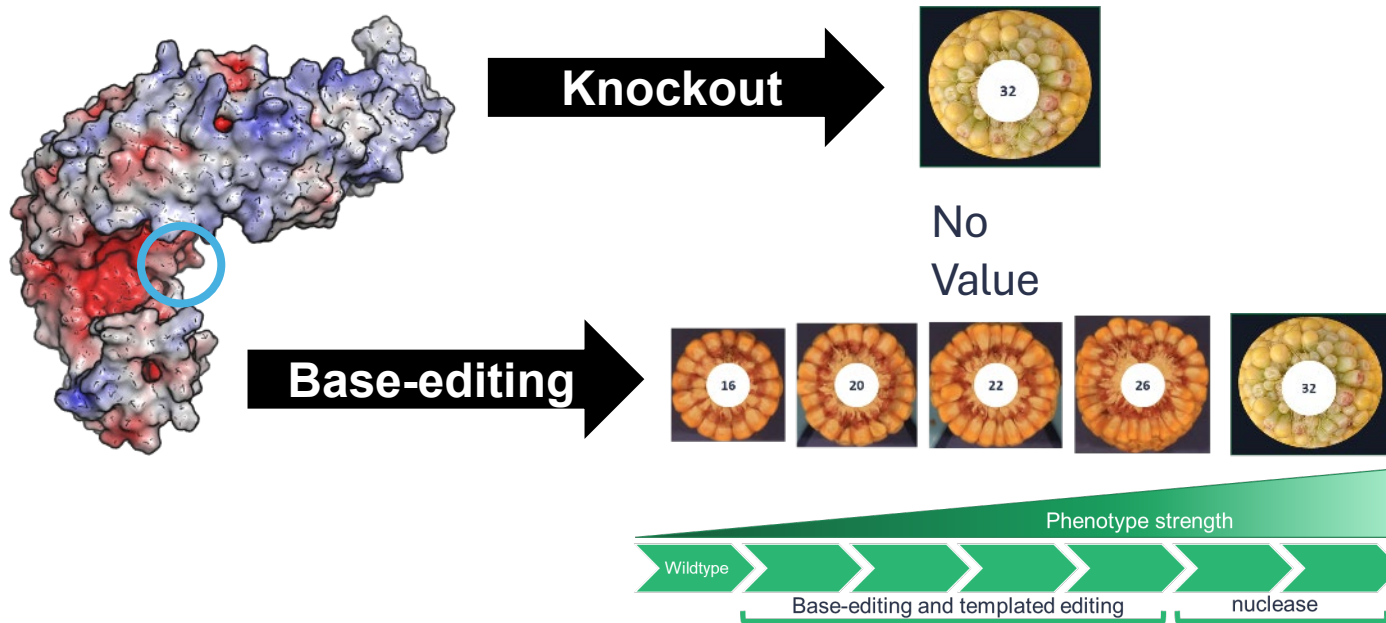
Additional Collaborations

- Beginning in 2023, a multiyear, proprietary collaboration with a large CPG company in a vegetable crop



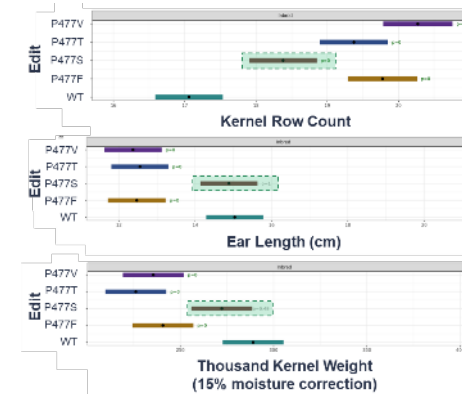
ALLELIC DIVERSITY TO OPTIMIZE BENEFIT

- High value traits typically have a “sweet spot” for best trait performance that is somewhere between “on” and “off”
- Fulcrum creates targeted diversity to determine the best edit
- Creating a range of phenotypes enables selection of an optimized variety quickly



Identifying the key part of the gene to change

Creating diversity in a single generation



↑ 10%
in Yield



Picking the winner based on real performance

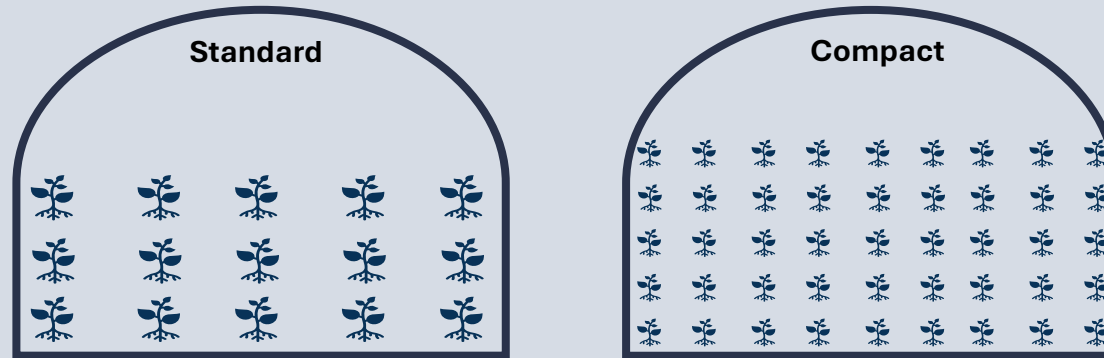
Asian Soy Rust: Solving for a multi-billion-dollar disease problem



Compact plants & production system - higher density, reduced input cost per crate, and higher yield per acre.

Currently have a grower trial in the field in Colombia, and we are in discussions with several caneberry Grower-Packer-Shippers for grower trials in 2026-2027 in California

How It Works



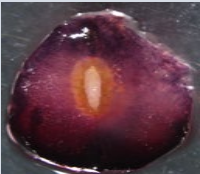
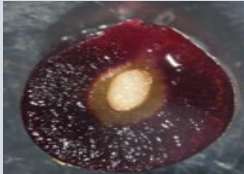
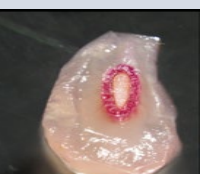
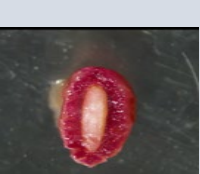
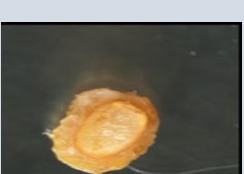
Potential for:

- ~3x density
- 1.5-2x yield per acre potential¹
- Reduced cost per crate of fruit
- Earlier flowering and fruiting window, which may increase cycles per year in certain growing regions
- More efficient management of crop

In the Field in CA & COL



Seedless/Pitless trait in blackberry is distinctive, valuable, and extendable to other fruit.

First Seedless/Pitless Blackberry		
	Unedited	Edited
Ripe Drupelet		
Remove Anthocyanins		
Stain the Pit Tissue		
Zoom in on Endocarp and Seed After Stain		

Pairwise Seedless/Pitless Projects

 **Blackberry**

 **Cherry**

- We have the seedless blackberry edits confirmed in controlled environment and are moving to field trials
- Broad IP protection strategy with patent granted and broad claims allowed
- Application of thesis is not limited to cherry (see next slide)—many crop opportunities apply

Other Applications for Seedless/Pitless

 **Red Raspberry**

 **Black Raspberry**

 **Peach/Nectarine/
Plum/Apricot**

 **Avocado**

 **Mango**

 **Dates**

Rubus diversity project

Pairwise designed a unique public-private collaboration. Field studies of diverse Rubus material (wild and cultivated) was conducted to quantify the natural diversity and develop associated genomic resources for association analysis to drive gene discovery efforts.



Phenotyping Infrastructure

- Quantitative & reproducible data on a comprehensive set of traits

Genomics Infrastructure

- Detailed understanding of genome structure and composition, genetic diversity and relationships
- Annotation and expression of target genes
- Functional genomics

Gene Discovery and Breeding Tools

- Phenotype and Genotype Associations
- Next-gen editing and Breeding Targets
- Marker Assisted Breeding

Publications

- Lust-Moore, K., et al. "Anecdote of homozygosity in black raspberry (*Rubus occidentalis*)." *XIII International Rubus and Ribes Symposium 1388*. 2023.
- Perkins-Veazie, P., et al. "Anthocyanin profiles in fruit from seminal primocane and floricanes-fruiting *Rubus* cultivars." *XIII International Rubus and Ribes Symposium 1388*. 2023.
- Clare, Shaun J., et al. "Development of KASP fingerprinting panel for clonal identification in red raspberry (*Rubus idaeus* L.)." *Plant Breeding* 142.6 (2023): 798-808.
- Fister, A., et al. "Application of gene editing technologies in *Rubus* to introduce beneficial consumer and agronomic traits." *XIII International Rubus and Ribes Symposium 1388*. 2023.
- Perkins-Veazie, P., et al. "Anthocyanin profiles among *Rubus* species." *XIII International Rubus and Ribes Symposium 1388*. 2023.

5 Check Varieties and 320 Test Entries

5 Collaboration Locations
(CA, NC, AK, NY, OR)

2 years of phenotype data
(2020-2021)

Material

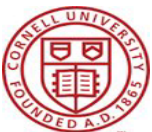
- USDA Rubus Repository Lines (78%)
- Publicly available genetics (3%)
- PSI breeding material (19%)
- ~3240 plants in 504 plots in PSG trial
- 568 Lines Genome Sequenced
- 15 Lines for Reference Genomes

Phenotypes Collected

- 15 Architecture Traits
- 32 Yield/Berry Traits
- 14 Drupelet Traits
- 5 Seed Traits
- 15 Biochemical/Flavor
- Root Tip and Red Berry Mite

Innovation in Phenotyping

- 2,950,317 Bob Cart Plot Images
- 48,074 Berry Beauty Station Images
- 5,064 Clamshell Images
- 661 Thirty Seed Images



LATEST COLLABORATION!!

MULTIYEAR COLLABORATION IN CHERRIES

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Business of Food

After Seedless Grapes, Now for the Pitless Cherry

Cherries with no pits are set to (eventually) hit grocery shelves thanks to gene-editing technology.



Fresh cherries are close to being an \$800 million business in the US. *Photographer: SeongJoon Cho/Bloomberg*

By [Ilena Peng](#)
September 19, 2025 at 7:00 AM EDT

Gift this article



- Global fruit genetics and licensing company
- Known for pioneering seedless grape development
- Develops and licenses varieties of table grapes, stone fruit, citrus, and mangoes



Applying blackberry trait analogs to cherry and other fruit could significantly expand the market

R&D Progress



Proof of concept of seedless/pitless in blackberry



Stable transformation for cherry



Rapid flowering with transgenic plant to accelerate pitless fruit testing



Plant architecture edits for improved management



Editing observed in cherry targets

Flowering and plant architecture edits **drive yield per acre and speed to value**



IITA and Pairwise secure \$3.8M from BMGF to boost yam production through gene editing

Goal: Develop dwarf bushy varieties of White Guinea Yam (*Dioscorea rotundata*)
“Yam Optimized Architecture through Gene Editing (YOAGE)” project

Impact for West Africa: Reduce labor and environmental impact associated with traditional plant staking & enable mechanized farming.

- Yam is the second most important root and tuber crop in sub-Saharan Africa after cassava
- Serves as a key traditional crop vital to social and religious customs.
- Plant staking can represent up to 40% production cost.

Significance for Pairwise

- Boosts our dwarfing franchise trait
- Aligns with our positioning goals
- Empowers us to explain our technology’s impact on underserved communities.

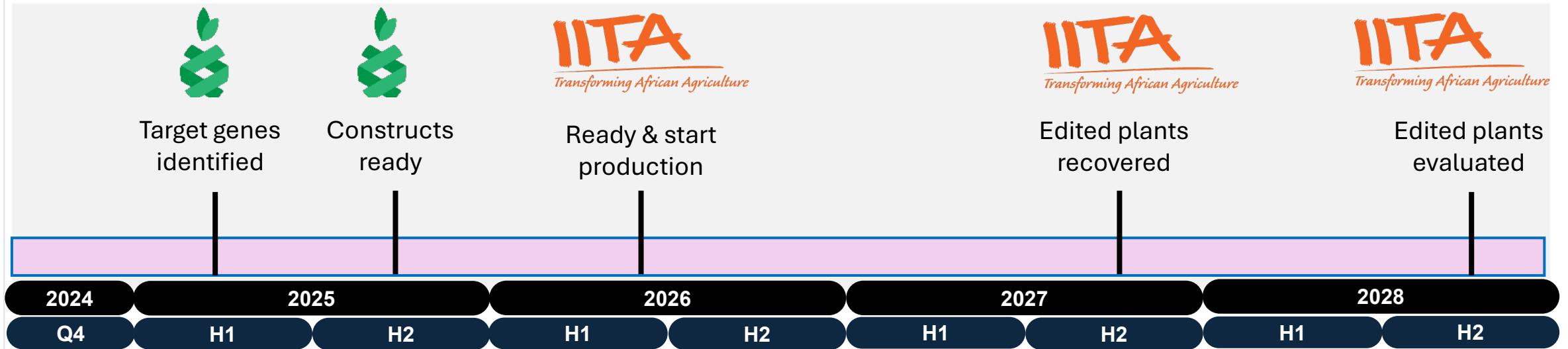


Kick-off in Nigeria, November 21-22

IITA: International Institute of Tropical Agriculture



YOAGE project–key milestones 2024 -2028



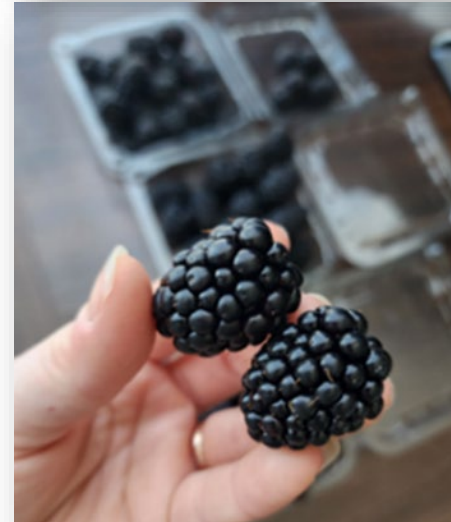
Social Objectives

1. Conduct gender intentional scoping and foresight analysis on the gendered trait preferences and impact of labor requirements in yam cultivation
2. Enhance visibility for yam genome editing project



Collaboration with Growers that leads to the best berries!

- Since 2021, Pairwise has partnered with growers across the USA and Latin America to test and commercialize its edited varieties
- Colombia is rapidly emerging as a regional powerhouse in berry production, with high-quality edited berries now being grown and sold in the local market



Collaborations through licensing





Pairwise Licenses Gene Editing Tools to CIMMYT to Fast-Track Smallholder Farming Systems' Transformation

Global Fulcrum™ license spans 20 countries for trait development in maize, wheat, sorghum, millets, pigeon pea, and groundnut



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Mars and Pairwise Collaborate to Accelerate Cacao Research and Development

August 06, 2025 09:15 ET | Source: [Pairwise](#) [Follow](#)

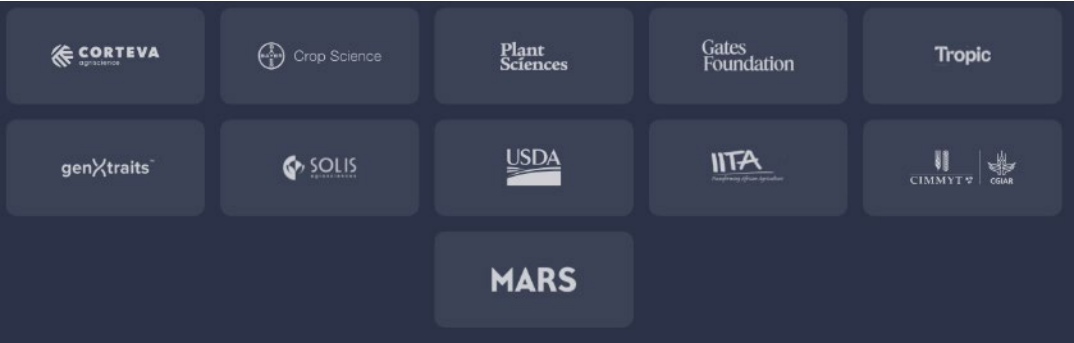
Additional Licensing

- Over 20 other public organizations that we are working on licensing



Gene Editing Momentum: Strong Signals from Partners, Regulators, and Consumers

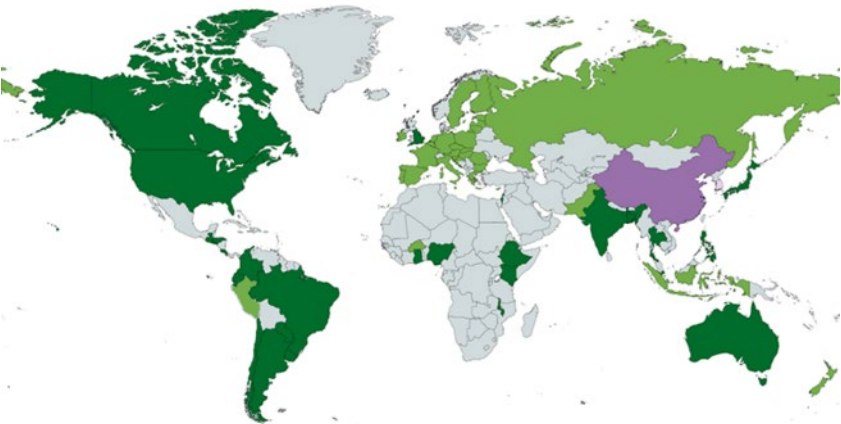
Broad and increasing partnerships signal momentum



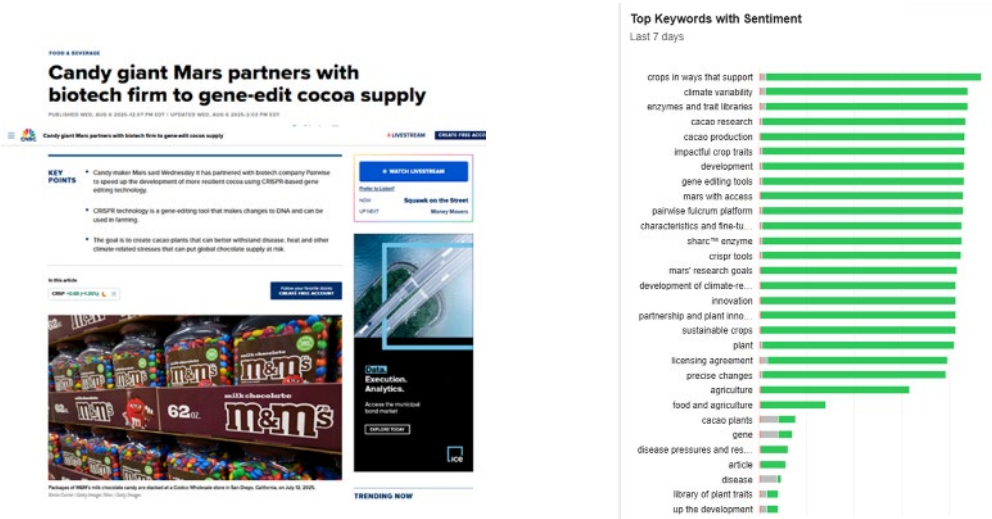
Real world examples are positive indicators of acceptance



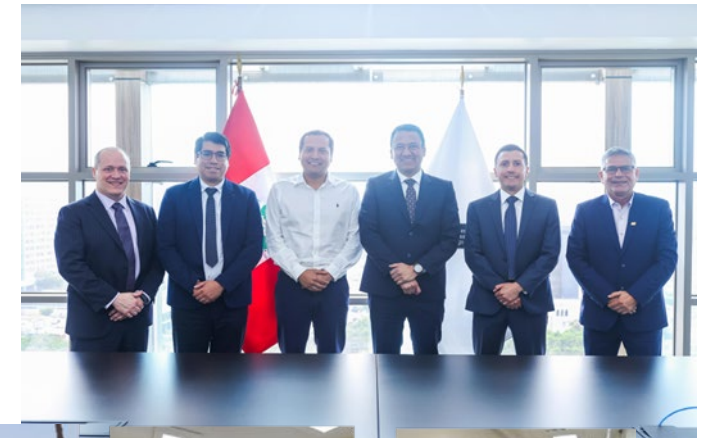
Global regulatory policy continues to declare GE is not GMO with major markets such as the EU expected to come online soon



Mars Pairwise Fulcrum Platform License Announcement in a consumer crop had a reach of 340 MM with no negative sentiment



Latin America is investing!





Thank you!

Jorge Venegas
Latin America Berry Operations
Director at Pairwise Plants



- www.pairwise.com
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