



AGRI^{THORITY}[®]

Science without Borders



AN INDEPENDENT GLOBAL AGRICULTURAL CONSULTANCY

ACCELERATING PRODUCT DEVELOPMENT AND MARKET ACCESS WITH KNOWLEDGE TRANSFER TO ENHANCE SUSTAINABILITY OF TOMORROW'S FOOD, FEED, FIBER & FUELS.

WHO WE ARE: RESPECTED AUTHORITIES FILLING GAPS IN YOUR R&D OR MARKET DEVELOPMENT EFFORTS SINCE 2008



Serving Crop & Animal Agriculture, Horticulture & Allied Industries

19 

highly skilled agricultural experts with 6 PhDs leading the research efforts

100+

clients from multi-national to start-up

200+

network of local specialists



Presence in
25+
global industry conferences

800+
projects globally



Crop technology **67%**
Seed companies **15%**
Crop chemicals **12%**



900+

locations with more than 100 CROs around the world



30+

years seed treatment experience

WHAT WE CAN HELP YOU DO | IDENTIFY & BRIDGE GAPS TO ACCELERATE DEVELOPMENT

PUT MORE "D" IN R&D

Proof of Concept



Commercialization



EXPLORE



EXPAND



EVOLVE

ACCELERATE PRODUCT DEVELOPMENT
from proof-of-concept through regulatory approval to commercialization by identifying and filling gaps in product or field capabilities

ACCESS MARKETS TO SPEED COMMERCIALIZATION OR GROWTH
of your products and technology in target markets around the globe

ASSIMILATE KNOWLEDGE
from experts with broad and deep understanding of local ag markets



Overcoming Field Experiment Challenges of Biostimulants & Biofertilizers

Ignacio Colonna, Research Manager –
LATAM, AgriThORITY



Overcoming Field Experiment Challenges of Biostimulants & Biofertilizers

Goals

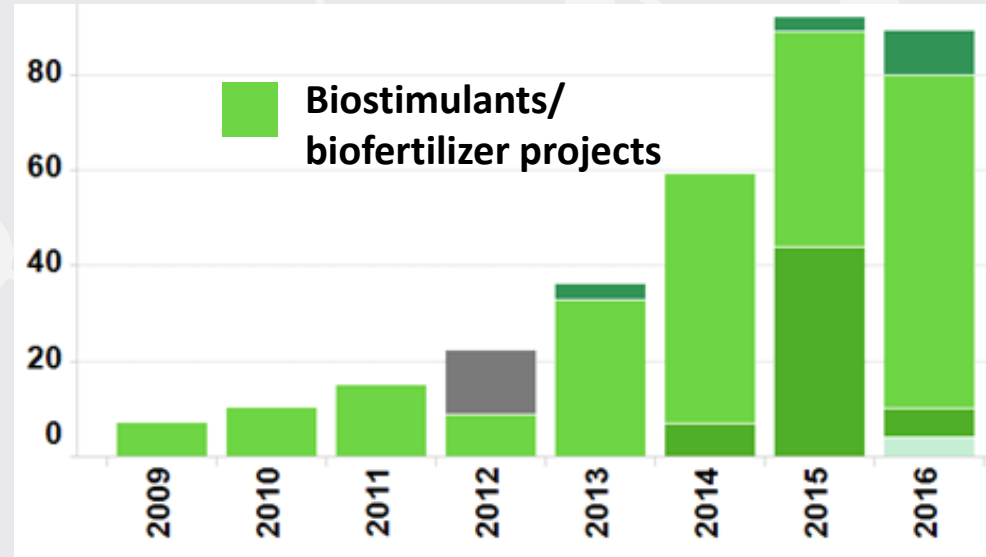
- Analyze the impact of key decisions throughout the biostimulant/fertilizer product development process.
- Address specific needs for LATAM as counter season or market target.
- Provide examples of biostimulant efficacy data analysis based on AgriThORITY historical trial database.
- Review usefulness of state-of-the-art phenotyping tools

Worldwide Trials & CRO network



Over 900 locations with more than 200 CROs around the world

AgriThORITY® LATAM field trials 2009-2016





Accelerating product development,
market access & knowledge transfer
to enhance sustainability of tomorrow's
Food, Feed, Fiber & Fuel



Accelerating product development

R&D timeline for biofertilizers – LATAM

Operational stages

Phase 1:



Regulatory &
importation
planning

Phase 2:



Efficacy trials

Phase 3:

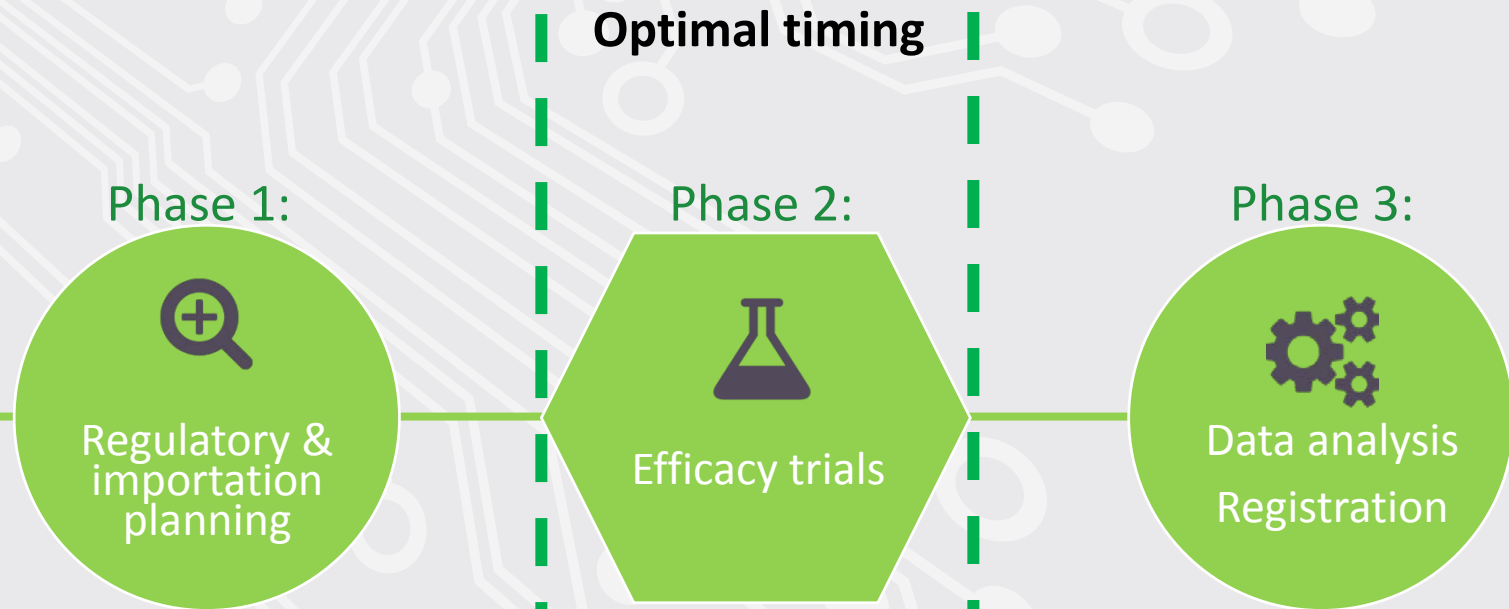


Data analysis
Registration

Accelerating product development

R&D timeline for biofertilizers – LATAM

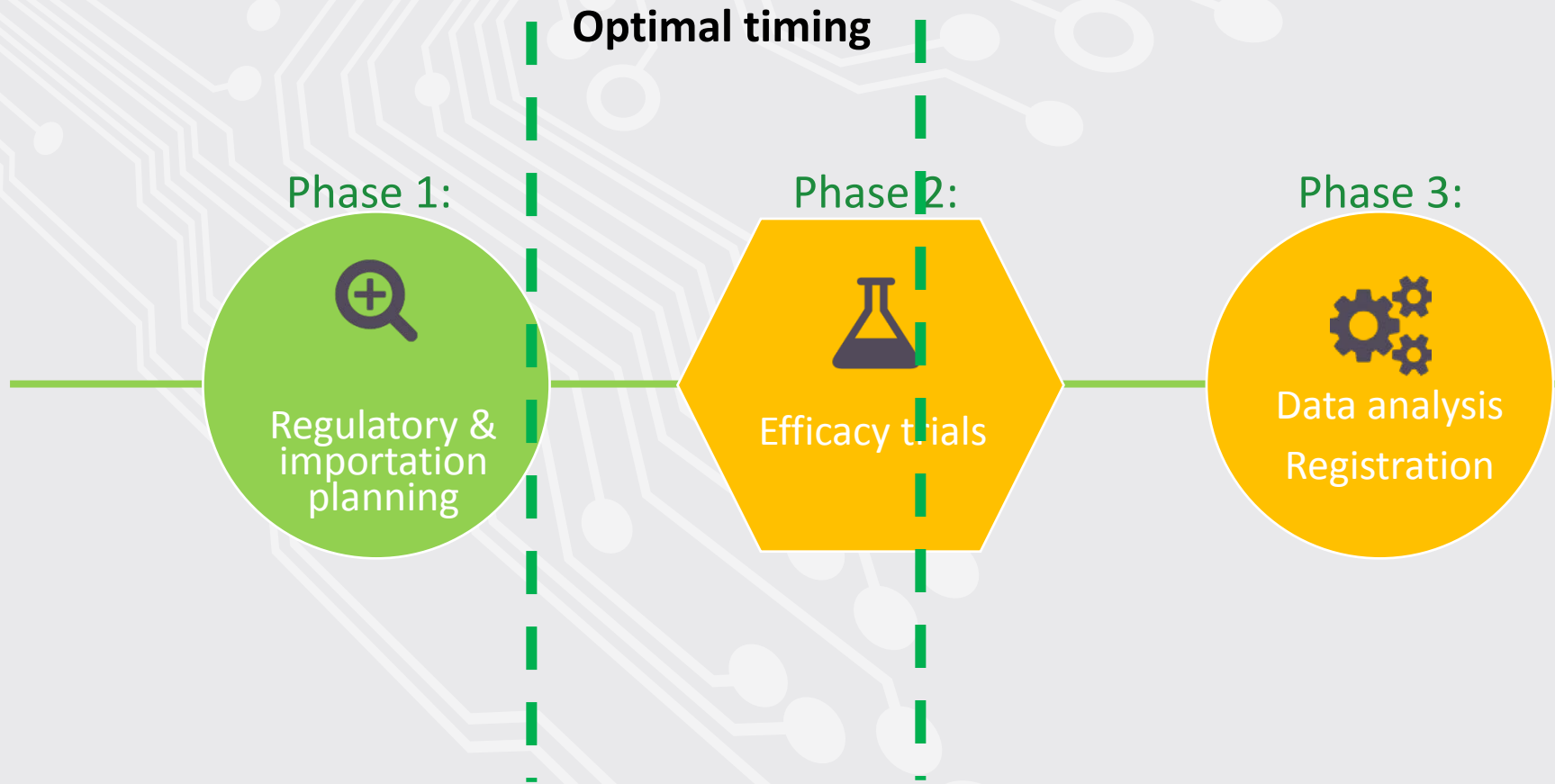
Operational stages



Accelerating product development

R&D timeline for biofertilizers – LATAM

Operational stages

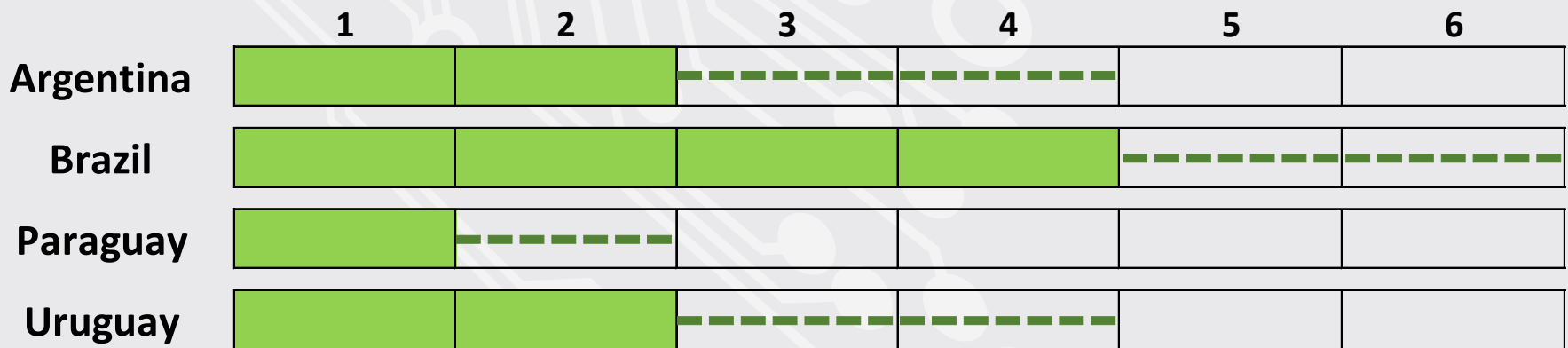




Regulatory & importation planning

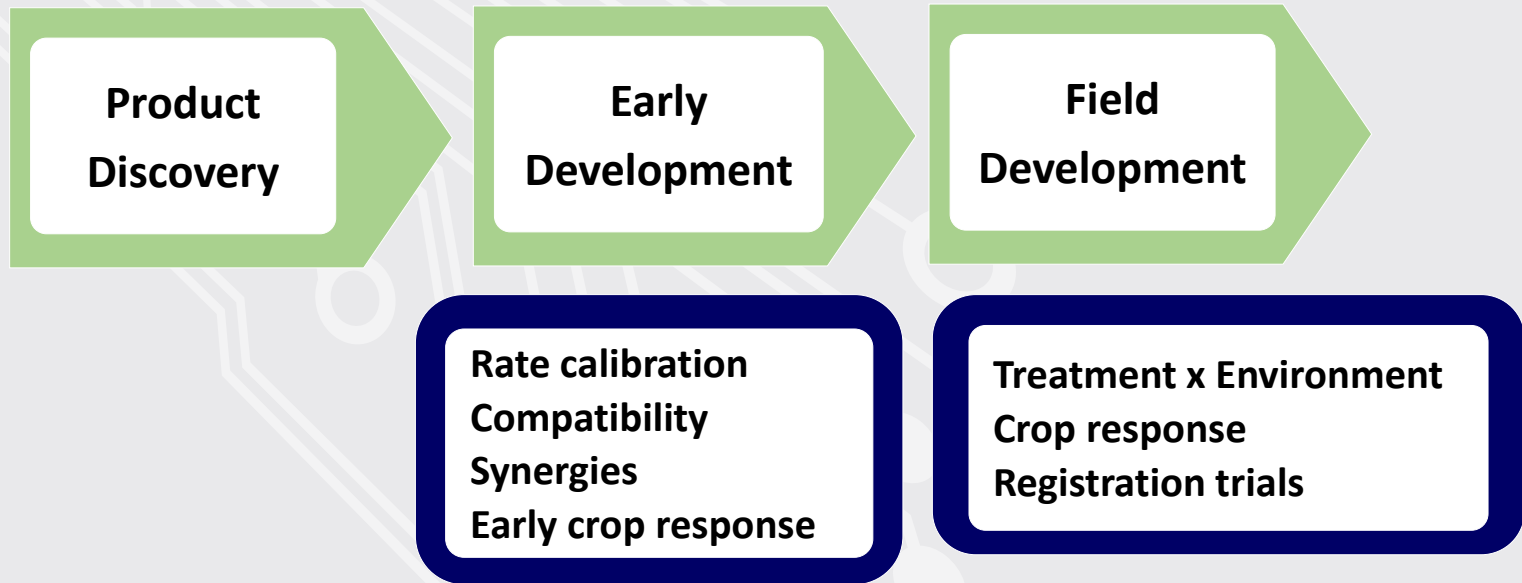
- Regulatory requirements and timing highly dependent on product properties.
- Legislation may not be well defined for new generation biostimulants
- Limited resources and experience in government institutions to review new experimental products.

Months for importation approval (overall estimates)





- Choosing the right experiment for product type and stage



**Early
Development**



**Efficacy
trials**

**Rate calibration
Compatibility
Synergies
Early crop response**

Example: early detection of negative effect of Biostimulant + Fungicide mix



Use of WinRhizo to quantify root growth daily

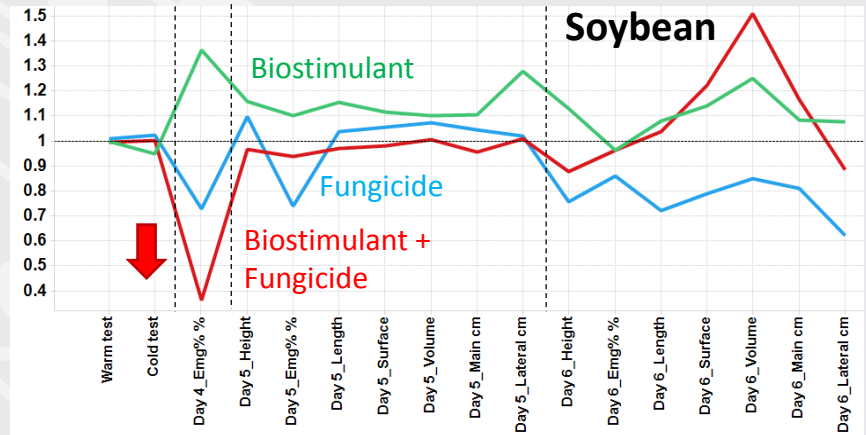
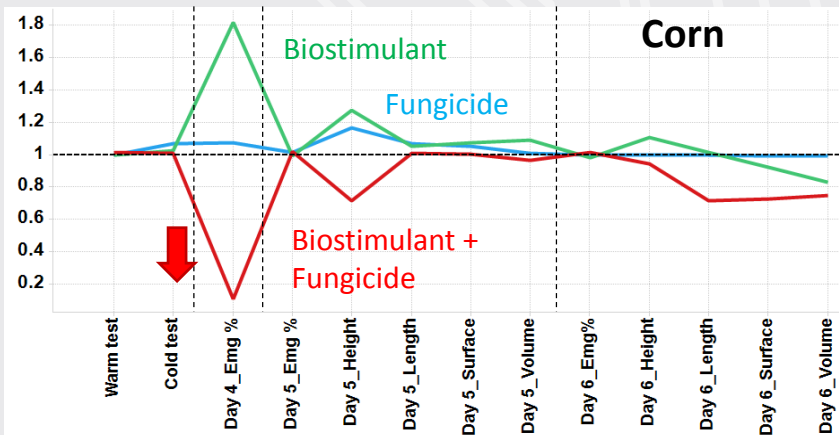
Early
Development



Efficacy
trials

Rate calibration
Compatibility
Synergies
Early crop response

Example: early detection of negative effect of Biostimulant + Fungicide mix



Investment in early development increases effectiveness of field experiments at later stages!



**Field
Development**



**Efficacy
trials**



**Treatment x Environment
Crop response
Registration trials**

Challenges:

- Target the right environmental range for project.
- Maximize information collected from a (typically) low number of sites.
- Design experiments to fit product development AND registration needs.
- Quantify crop response objectively



**Field
Development**



**Efficacy
trials**



**Treatment x Environment
Crop response
Registration trials**

Challenges: Target the right **environmental range** for project.

Field
Development

Efficacy
trials

Treatment x Environment
Crop response
Registration trials

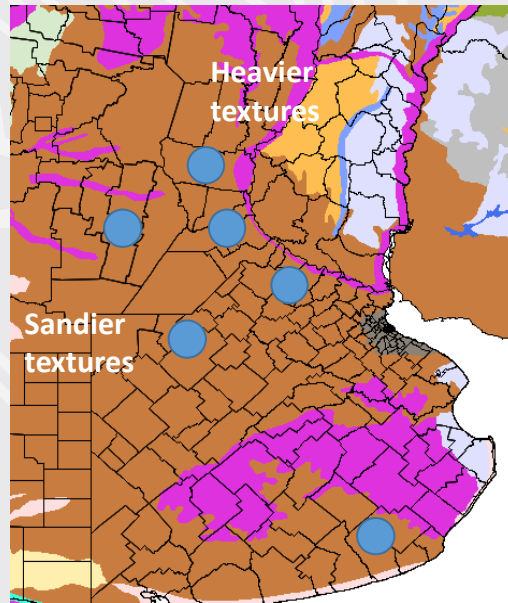
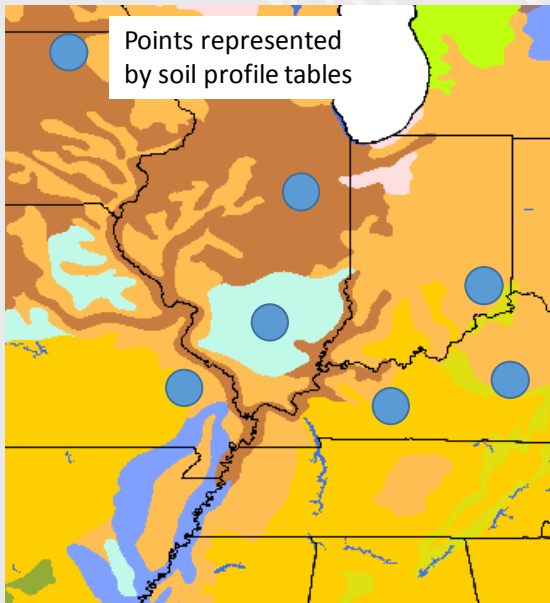
Challenges: Target the right **environmental range** for project.

Counter season experiments: Correlation between target and testing environments

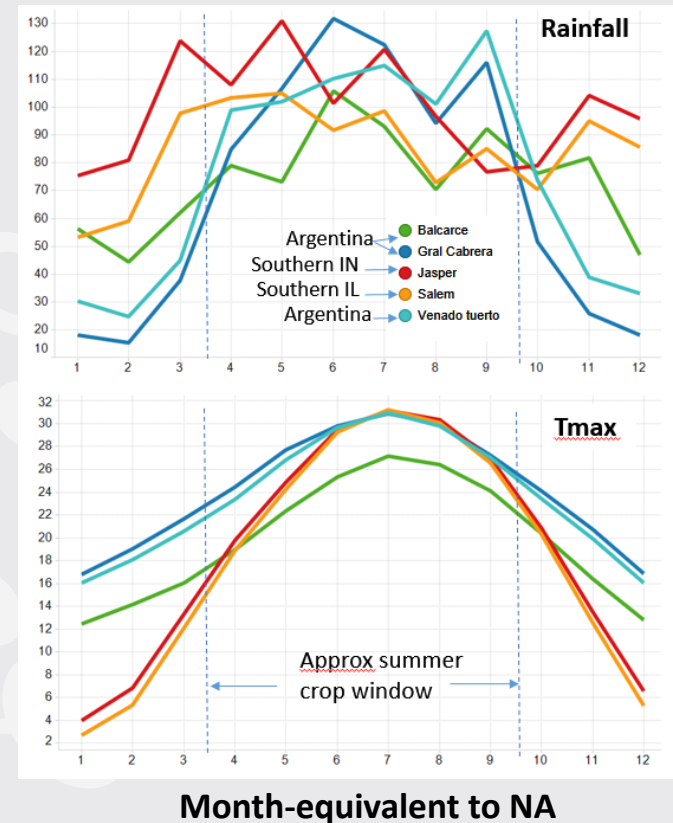
Soil type comparison

Target product environment

Testing environment



Climate comparison



Field
Development

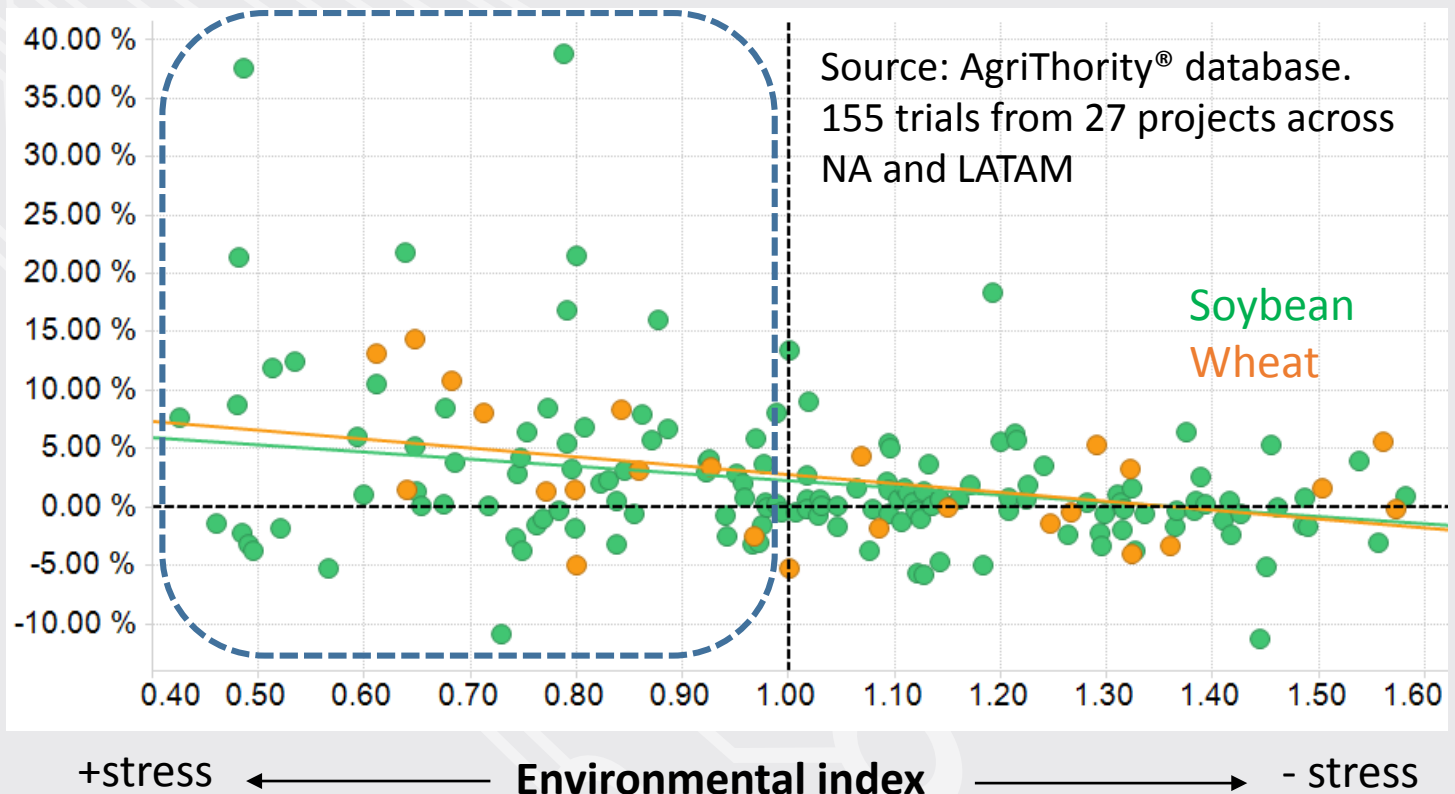
Efficacy
trials

Treatment x Environment
Crop response
Registration trials

Challenges: Target the right **environmental range** for project.

Treatment x Environment : higher relative response under stressful environments

Treatment
**relative
response vs
control**



**Field
Development**

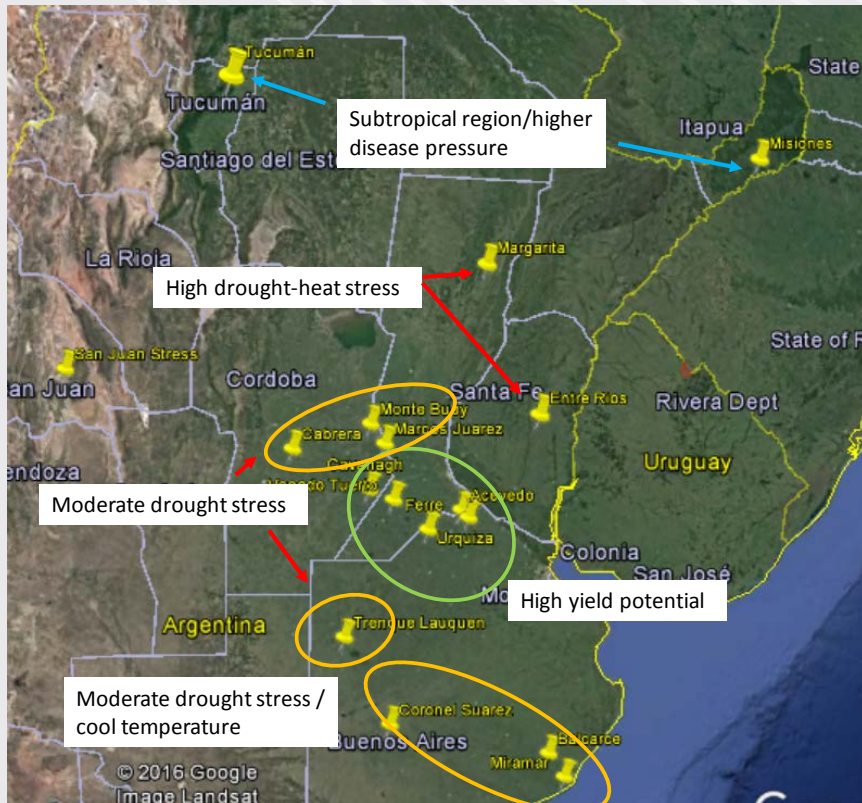
**Efficacy
trials**

**Treatment x Environment
Crop response
Registration trials**

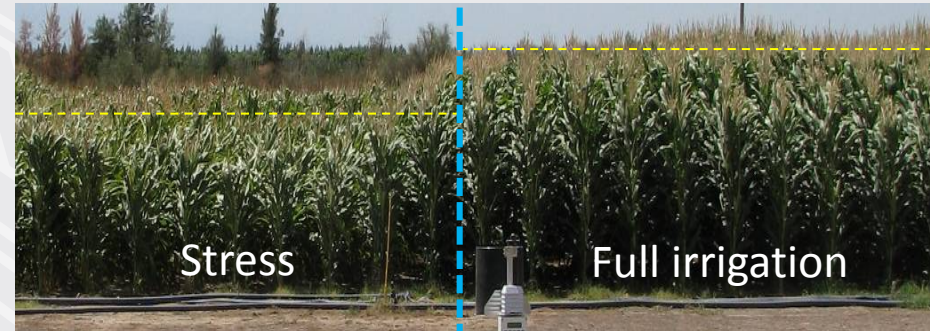
Challenges: Target the right **environmental range** for project.

Testing in stressful environments: Abiotic stress in rainfed and managed stress sites

Select rainfed environments



Managed stress environments





**Field
Development**



**Efficacy
trials**



**Treatment x Environment
Crop response
Registration trials**

Challenges: Maximize information collected from a (typically) low number of sites.

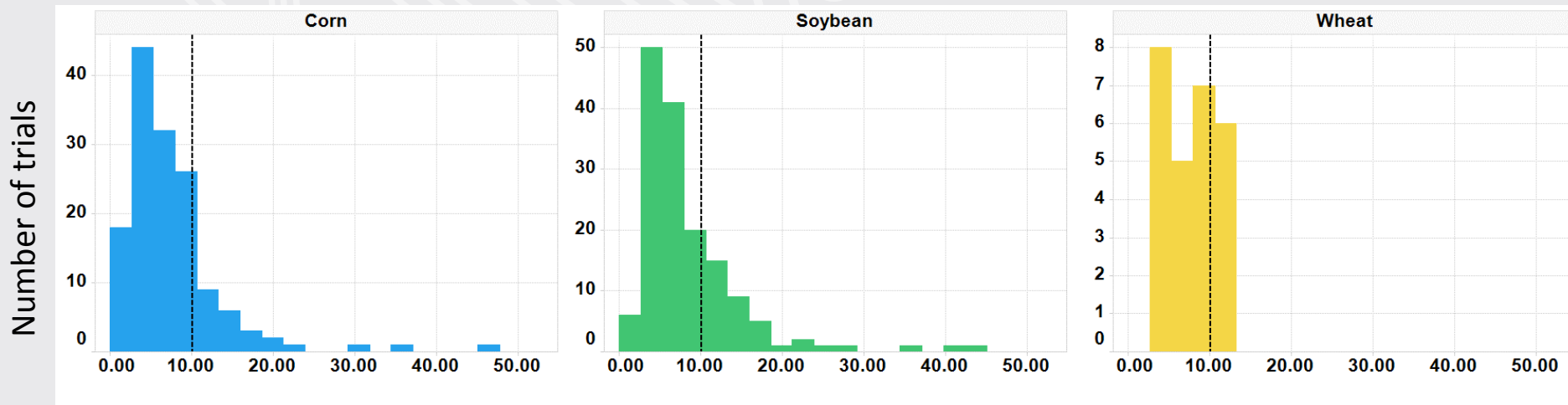
- Minimize experimental error without restricting environmental range



Challenges: Maximize information collected from a (typically) low number of sites.

- Minimize experimental error without restricting environmental range

Distribution of the Coefficient of variation (CV) across multiple trials



Coefficient of variation (CV)

$$\text{Coefficient of variation (CV)} = \frac{\text{Experimental error Std.dev}}{\text{Trial mean}}$$

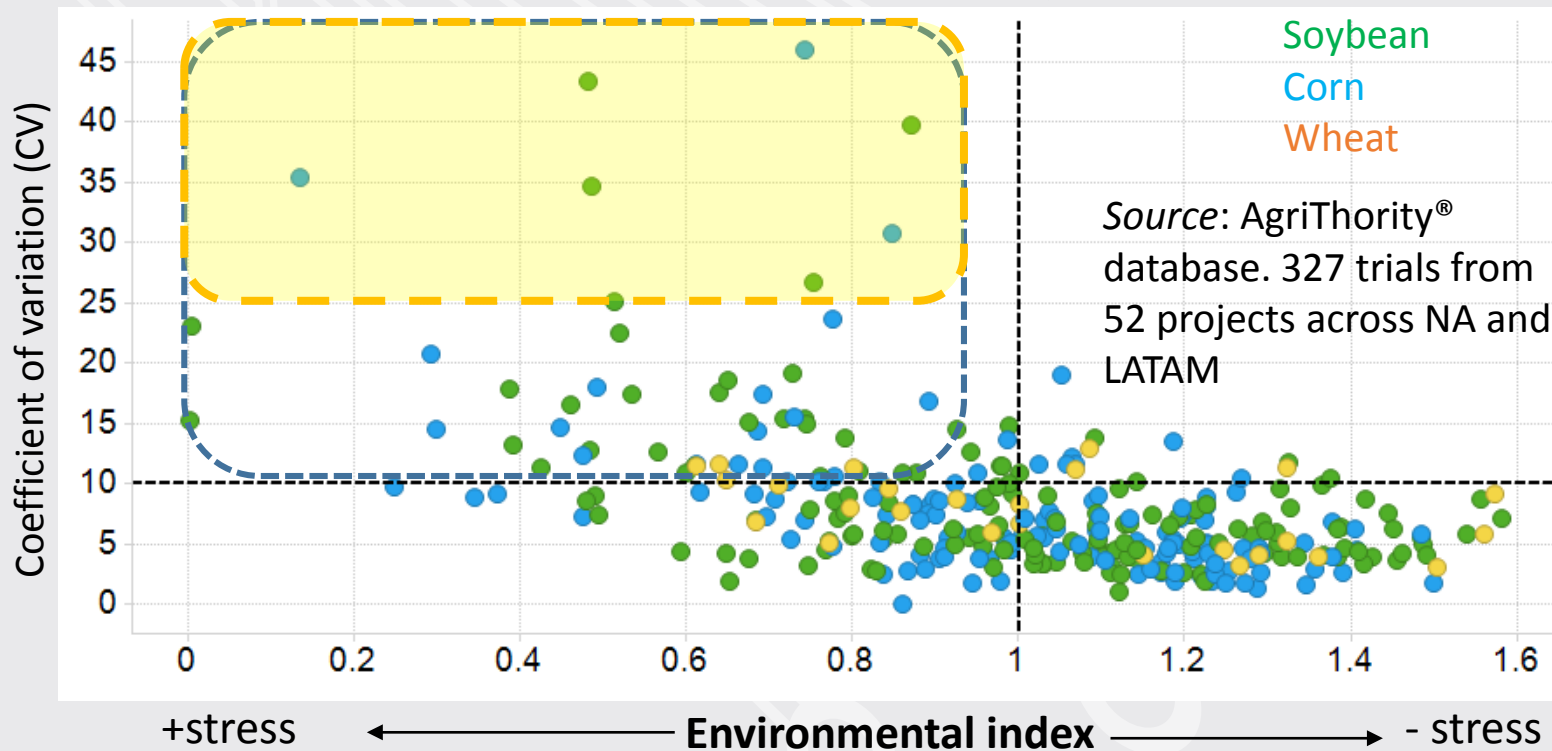
Source: AgriThORITY® database.
327 trials from 52 projects across
NA and LATAM



Challenges: Maximize information collected from a (typically) low number of sites.

- Minimize experimental error without restricting environmental range

Coefficient of variation (CV) across an environmental range



**Field
Development**



**Efficacy
trials**

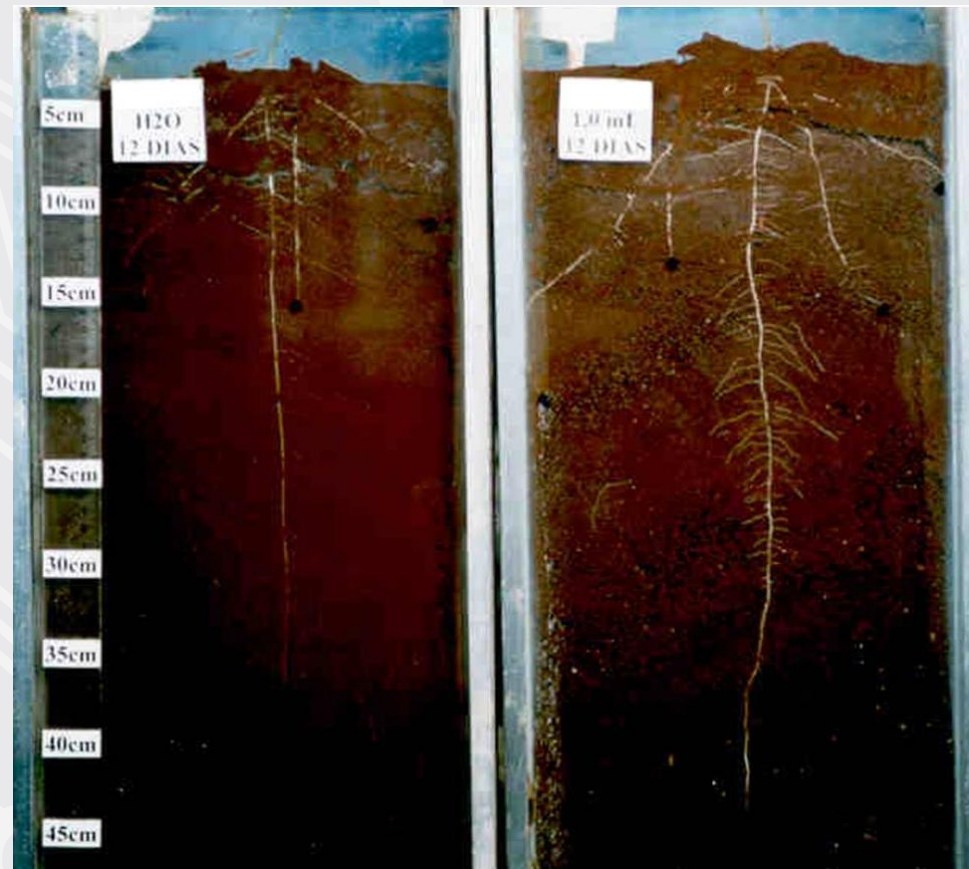
**Treatment x Environment
Crop response
Registration trials**

Challenges: Design experiments to fit product development AND registration needs.

Example: Rhizotron study designed to support biostimulant root growth claims in registration dossier

Control

Biostimulant



**Field
Development**



**Efficacy
trials**

**Treatment x Environment
Crop response
Registration trials**

Challenges: Quantify crop response objectively

Supplementing visual vigor scores with objective crop health indicators

Ground-based NDVI sensors

NDVI = (NIR-VIS)/(NIR+VIS). -1 to 1 indicator of crop canopy size and activity



Field
Development

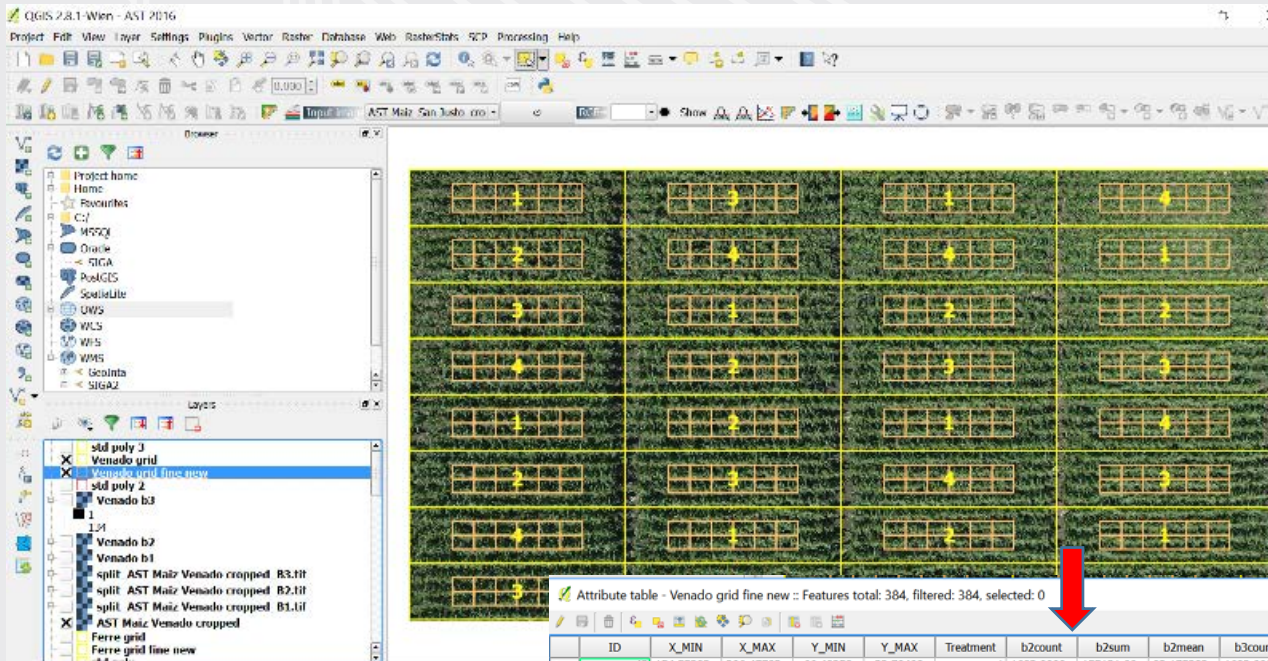
Efficacy
trials

Treatment x Environment
Crop response
Registration trials

Challenges: Quantify crop response objectively

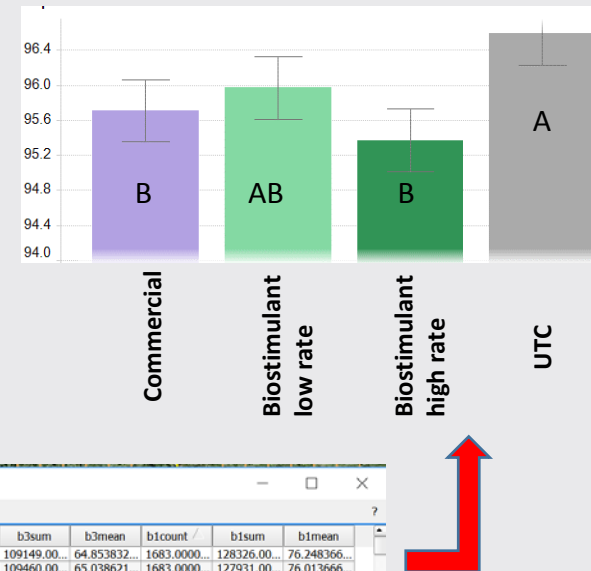
Converting drone imagery into numbers

“Greenness” value
(lower is better)



Attribute table - Venado grid fine new :: Features total: 384, filtered: 384, selected: 0

ID	X_MIN	X_MAX	Y_MIN	Y_MAX	Treatment	b2count	b2sum	b2mean	b3count	b3sum	b3mean	b1count	b1sum	b1mean	
1	43	154.55383...	206.47783...	-66.48258...	-32.70408...	1	1683.0000...	155131.00...	92.175282...	1683.0000...	109149.00...	64.853832...	1683.0000...	128326.00...	76.248366...
101	56	829.56583...	881.48983...	-66.48258...	-32.70408...	3	1683.0000...	159803.00...	94.951277...	1683.0000...	109460.00...	65.038621...	1683.0000...	127931.00...	76.013666...
104	243	154.55383...	206.47783...	-235.3750...	-201.5965...	2	1683.0000...	148739.00...	88.377302...	1683.0000...	102445.00...	60.870469...	1683.0000...	117149.00...	69.607248...
107	256	829.56583...	881.48983...	-235.3750...	-201.5965...	4	1683.0000...	158618.00...	94.247177...	1683.0000...	107306.00...	63.758764...	1683.0000...	129780.00...	77.112299...
121	403	154.55383...	206.47783...	-370.4890...	-336.7105...	3	1683.0000...	139126.00...	82.665478...	1683.0000...	93269.0000...	55.418300...	1683.0000...	108216.00...	64.299465...
100	416	829.56583...	881.48983...	-370.4890...	-336.7105...	1	1683.0000...	158915.00...	94.423648...	1683.0000...	107504.00...	63.876411...	1683.0000...	128810.00...	76.535947...
144	1163	154.55383...	206.47783...	-1012.280...	-978.5020...	3	1683.0000...	119244.00...	70.899584...	1683.0000...	80029.0000...	47.551396...	1683.0000...	92279.0000...	54.830665...
140	1176	829.56583...	881.48983...	-1012.280...	-978.5020...	4	1683.0000...	133223.00...	79.163992...	1683.0000...	90115.0000...	53.544266...	1683.0000...	103327.00...	61.394533...
10	42	102.62983...	154.55383...	-66.48258...	-32.70408...	1	1716.0000...	159265.00...	92.811771...	1716.0000...	106489.00...	62.056526...	1716.0000...	134781.00...	78.543706...
1	44	206.47783...	258.40183...	-66.48258...	-32.70408...	1	1716.0000...	142898.00...	83.273892...	1716.0000...	100175.00...	58.377039...	1716.0000...	120251.00...	70.076340...
4	45	258.40183...	310.32583...	-66.48258...	-32.70408...	1	1716.0000...	149553.00...	87.152097...	1716.0000...	106057.00...	61.804778...	1716.0000...	128467.00...	74.864219...



**Field
Development**

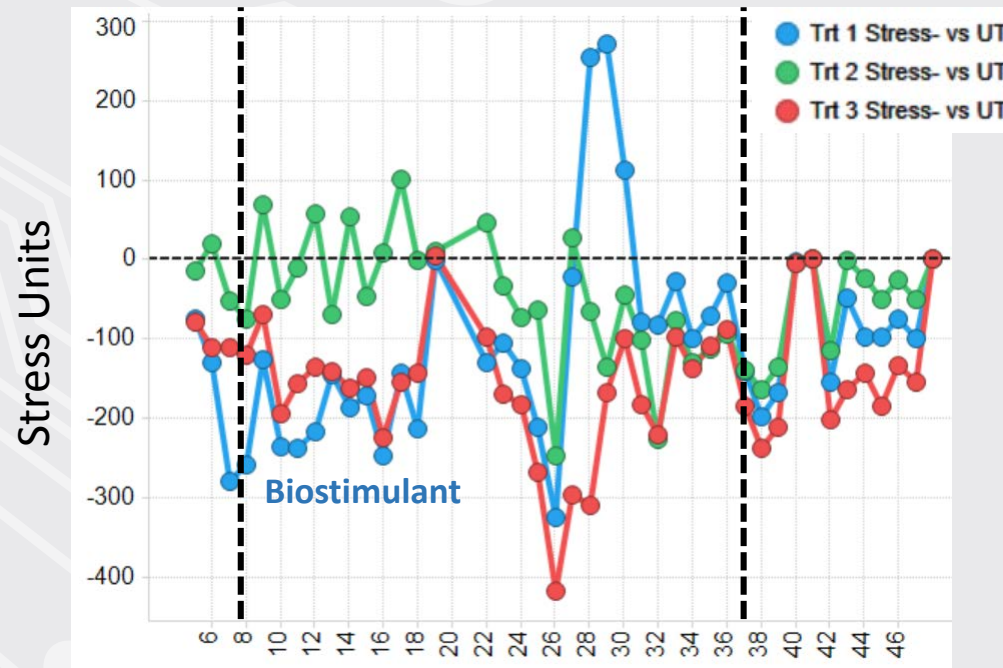


**Efficacy
trials**

**Treatment x Environment
Crop response
Registration trials**

Challenges: Quantify crop response objectively

**Remote thermal sensing in stress
environments**



Overcoming Field Experiment Challenges of Biostimulants & Biofertilizers

Key messages

Genuine “acceleration” of biofertilizer/biostimulant development requires

- Early planning for regulatory/importation process.
- Careful design of early development experiments.
- Understanding of product efficacy across environments.
- Choice of adequate environmental range in testing.
- Testing in stressful environments carries a higher relative experimental error: higher number of sites
- Relying on objective assessments of crop vigor/health.

Thank you

Latin America Research Manager
Ignacio Colonna records



You create it.
We prove it.

