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From Breeding to Market Launch:

Digitalizing Alfalfa Product Development for Agroecology

2025 world alfalfa congress
FRANCE REIMS-CHÂLONS

Alfalfa
to get back
into planetary
boundaries

November 6th 2025

Doriane : Key figures

40
Years of experience

12
Expert Agronomists

18
Pers. in Tech/Data

20+
Countries

5
Alfalfa breeding organization

3 - 700
Users per team

450K
Trials handled each year

2024
Information Security ISO

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Agenda

- Introduction
- Particularities in Alfalfa breeding and Product Development
- Digitalization as a Business, Scientific and Operational Enabler
- Three Key Insights from Digitalizing Alfalfa R&D
- Conclusion

Context

Why alfalfa matters : biodiversity, nitrogen fixation, soil health, and farmer sustainability

- ***Increased demand from the animal feed industry and the growing livestock population*** *are estimated to drive the expansion of forage cultivation.*
- *The* ***total forage cultivation area in Europe reached 9.1 million ha in 2022****, which increased by 4.6% between 2017 and 2022.* ***Forage alfalfa have the 2nd largest area under cultivation****, accounting for 35.4% of the overall European forage cultivation area in 2022.*

Biodiversity

Sustainable rotations

Soil quality

Moving **from** Research **to** Market **:** to support both **Productivity** and **ecological goals**

→ breeders and developers need a new way to manage data, traits, and feedback across the pipeline.

How to Breed Alfalfa ?

*"As an **alfalfa breeder** in France, I want to develop new varieties that respond to the needs of **the European livestock farmers**"*

*"As an **alfalfa breeder**, I need to know what **alfalfa phenotypic traits** will be valued by the livestock farmers in Europe."*

*"As an **alfalfa breeder**, I also need to know **the strength and weaknesses of the competing varieties** in the market in order to compare my material to them and decide which one to advance as a candidate for sales launch"*

*As an **alfalfa breeder**, I want to develop a breeding program that will produce a **succession of new varieties matching with Product Design** in order to satisfy the European livestock farmers"*

Traits	Priority	Benchmark	Target	value
Crude protein content %	Niche	Variety A	>	45
Yield T/ha	Must have	Variety B	>	1.5
Verticillium wilt resistance (Rating 1-9)	Added value	Variety C	>	2

Beneficiaries: Livestock farmers in Europe who use alfalfa as fresh feed for cows

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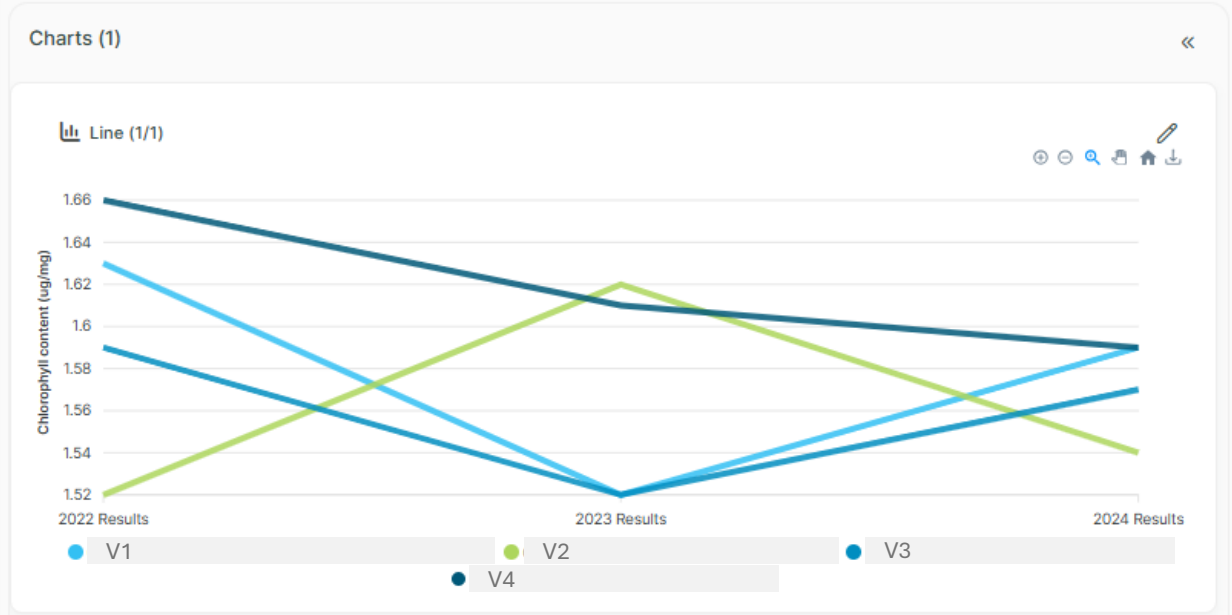
The Complexity of Alfalfa Breeding and Mix Development

1. Breeding perennial crop

- Evaluate performances over several years.
  - to study the homogeneity of harvests depending on the period of harvest and the differences of performance among the different harvests
  - Each harvest will come with a list of observations (yield wet and dry, digestibility, biomass etc) that will be then compared among the different harvests for the different varieties
  - With all the data collected over years (e.g. 3 years, with 5 harvests each) the breeder wants to : Compare the **general performance** of the varieties (during all the trial duration) ; Compare the **seasonal performance** of the varieties (early and late cuts) ; Compare the **stability of performances** (e.g. by excluding one or several trial years)



		1.3 Chlorophyll content			Kinetic
		Aggregated	2022 Results	2023 Results	2024 Results
☐	CABE	1.62	1.63	1.65	1.57
☑	CABE	1.58	1.63	1.52	1.59
☐	CARIC	1.63	1.54	1.65	1.7
☑	CARIC	1.56	1.52	1.62	1.54
☐	MALB	1.57	1.56	1.59	1.54
☑	MALB	1.56	1.59	1.52	1.57
☐	NEBB	1.62	1.63	1.6	1.63
☑	NEBB	1.62	1.66	1.61	1.59
☐	PINOT	1.6	1.61	1.59	1.62
☐	PINOT	1.6	1.61	1.65	1.54
☐	SYRA	1.61	1.65	1.61	1.57

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The Complexity of Alfalfa Breeding and Mix Development

2. Breeding populations

- Set up a breeding scheme to increase genetic variability (polycrosses) and stabilize improved populations
  - no possibility to have pure lines → increase genetic variability with "populations" (Polycrosses and Synthetics).
  - Set up in field : cages isolated from outside pollen.
  - The seeds harvested can be bulked (population) or harvested as half-sibs → Define codification rules

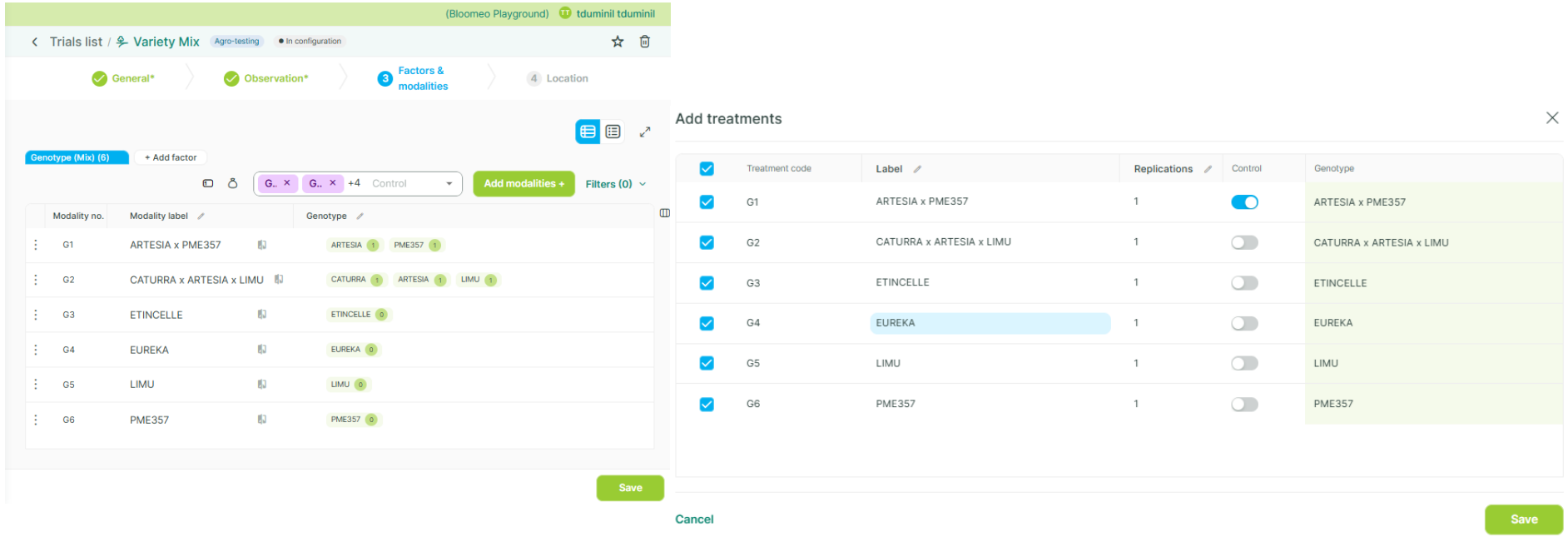
Cage1		Cage2	
1	6	11	16
2	7	12	17
3	8	13	18
4	9	14	19
5	10	15	20

Polycross		Harvested on each plant – with or without aut pollinisation	**Synthétique**	Harvested on all the plants of the cage – with or without autopollinisation	
	F	M		F	M
PY01	1	0,1*1 / 0,1*2 / 0,1*3 / 0,1*4 / 0,1*5 / 0,1*6 / 0,1*7 / 0,1*8 / 0,1*9 / 0,1*10	SY01	0,1*1 / 0,1*2 / 0,1*3 / 0,1*4 / 0,1*5 / 0,1*6 / 0,1*7 / 0,1*8 / 0,1*9 / 0,1*10	-
PY02	2	0,1*1 / 0,1*2 / 0,1*3 / 0,1*4 / 0,1*5 / 0,1*6 / 0,1*7 / 0,1*8 / 0,1*9 / 0,1*10	SY02	0,1*11 / 0,1*12 / 0,1*13 / 0,1*14 / 0,1*15 / 0,1*16 / 0,1*17 / 0,1*18 / 0,1*19 / 0,1*20	-
....					
PY10	10	0,1*1 / 0,1*2 / 0,1*3 / 0,1*4 / 0,1*5 / 0,1*6 / 0,1*7 / 0,1*8 / 0,1*9 / 0,1*10			

The Complexity of Alfalfa Breeding and Mix Development

3. Commercializing mixes

- Forages are also “services crops” that can be planted in groups of varieties.
- Product development department can study the effect of **different crop mixes**.
- How to decide which mix you would like to do ?
- How to qualify each component of mix?
  - The Mix is evaluated like **a new product** (with specific protocols as less variables can be evaluated together e.g. biomass, digestibility, yield, nb of plants)
  - The result is reverted to the **components of the mix** (e.g. Clover 1 – High capacity to combine with alfalfa)



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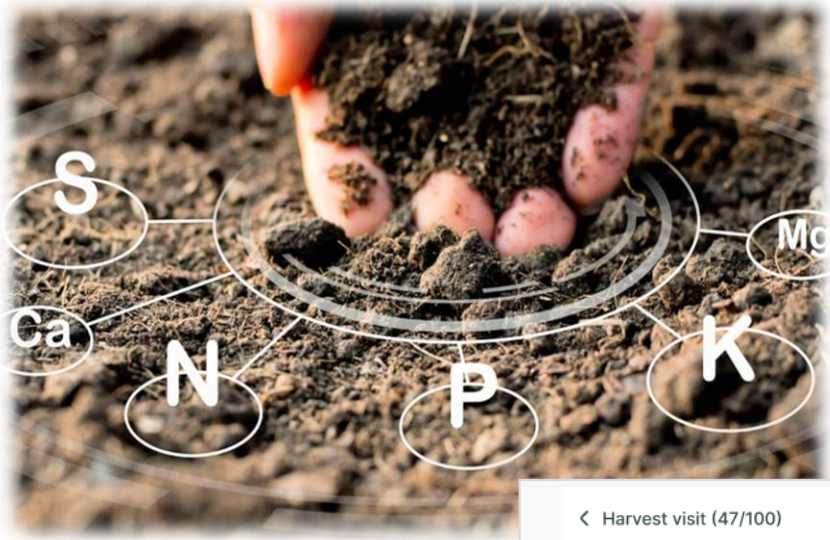
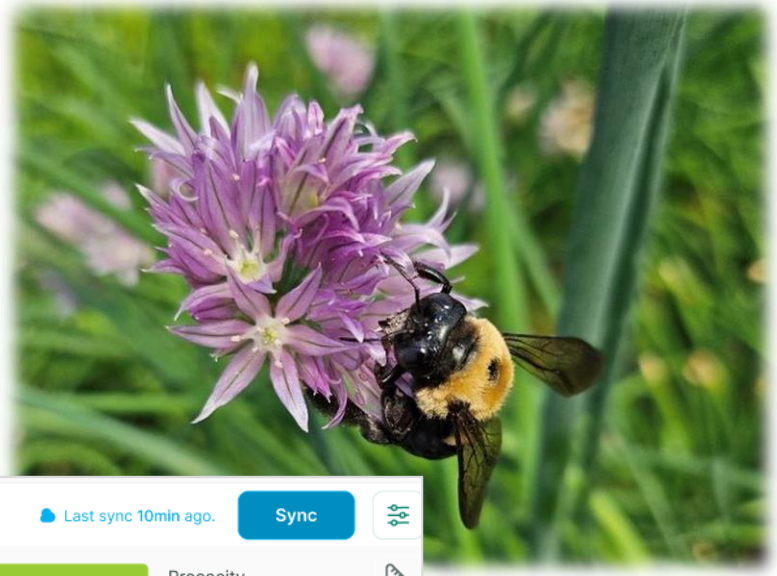
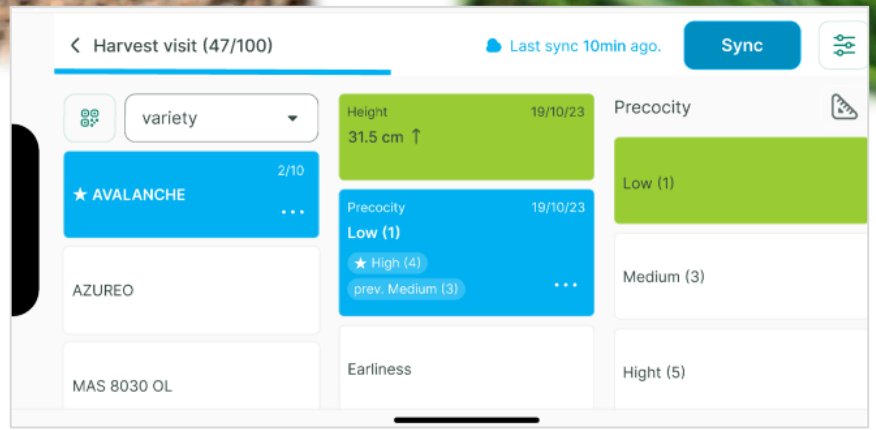
The Complexity of Alfalfa Breeding and Mix Development

4. Identifying new traits for agroecology

- Alfalfa are also services crops that can be planted into a rotation and in cover crop.
- New breeding and testing strategies should measure the effect of varieties and mixes on new agroecological factors (water use, soil quality, biodiversity)







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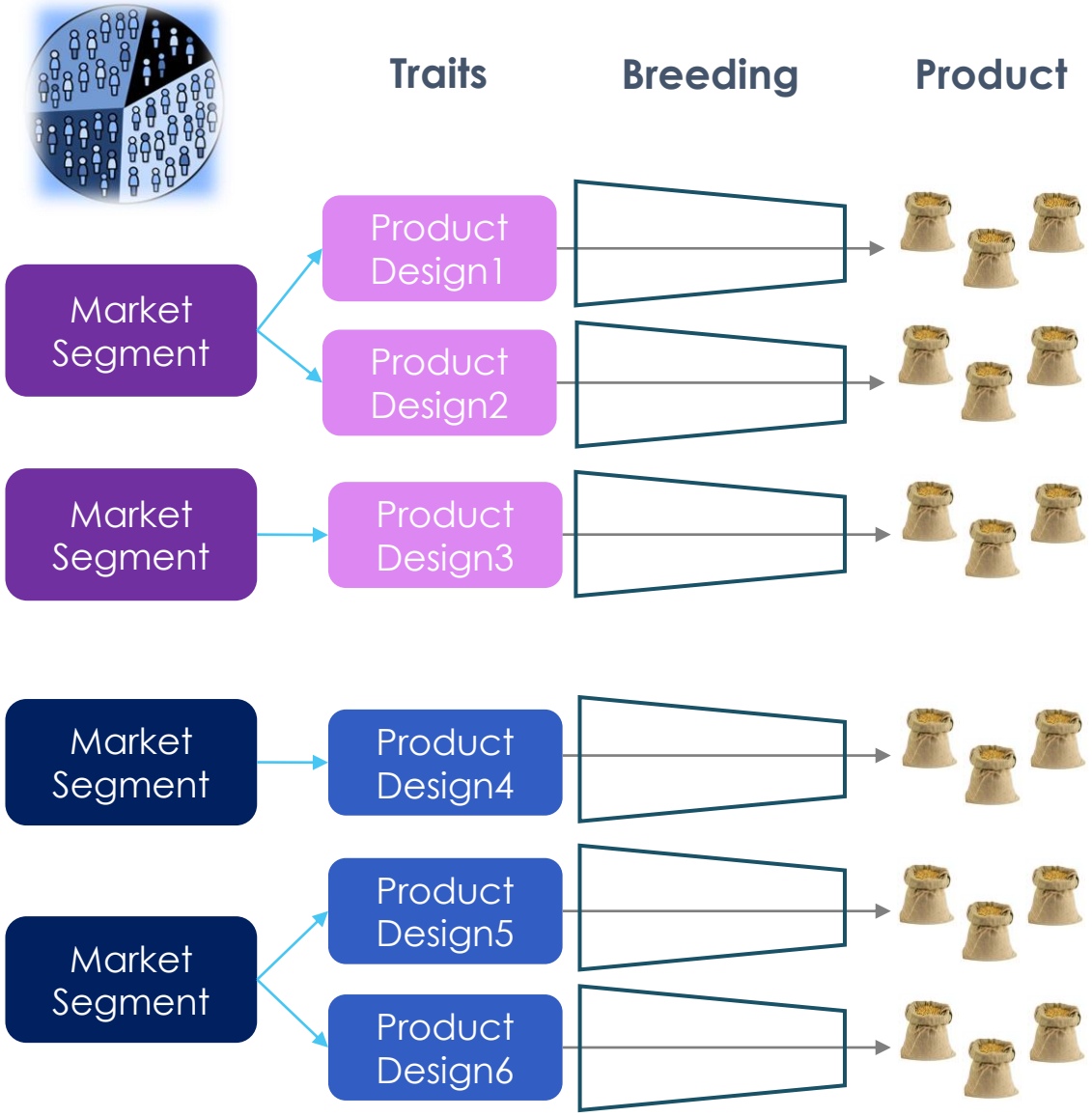
Structuring the breeding program with Market Segment and Product Design



- → *Market segmentation is the **process of defining the criteria spliting the different customers and opportunities***
- → *It is a **powerful tool to align all the strategy** : each market segment need to get a **prioritization**, based on the potential or on the historic profitability.*
- → *For one market segment, there is a **unique value proposition : products**, marketing support and sales approach.*
- → *A **Product Design** is created for a defined set of beneficiaries who represent the **market segment***
- → *A **Product design** is a technical specification of a new variety using a detailed set of technical attributes with quantitative measures and qualitative descriptions*
- → *The Product Designs are translated into **breeding objectives**.*
- → *The Product Design should be a **communication tool** for technical and non-technical audiences to win their support*

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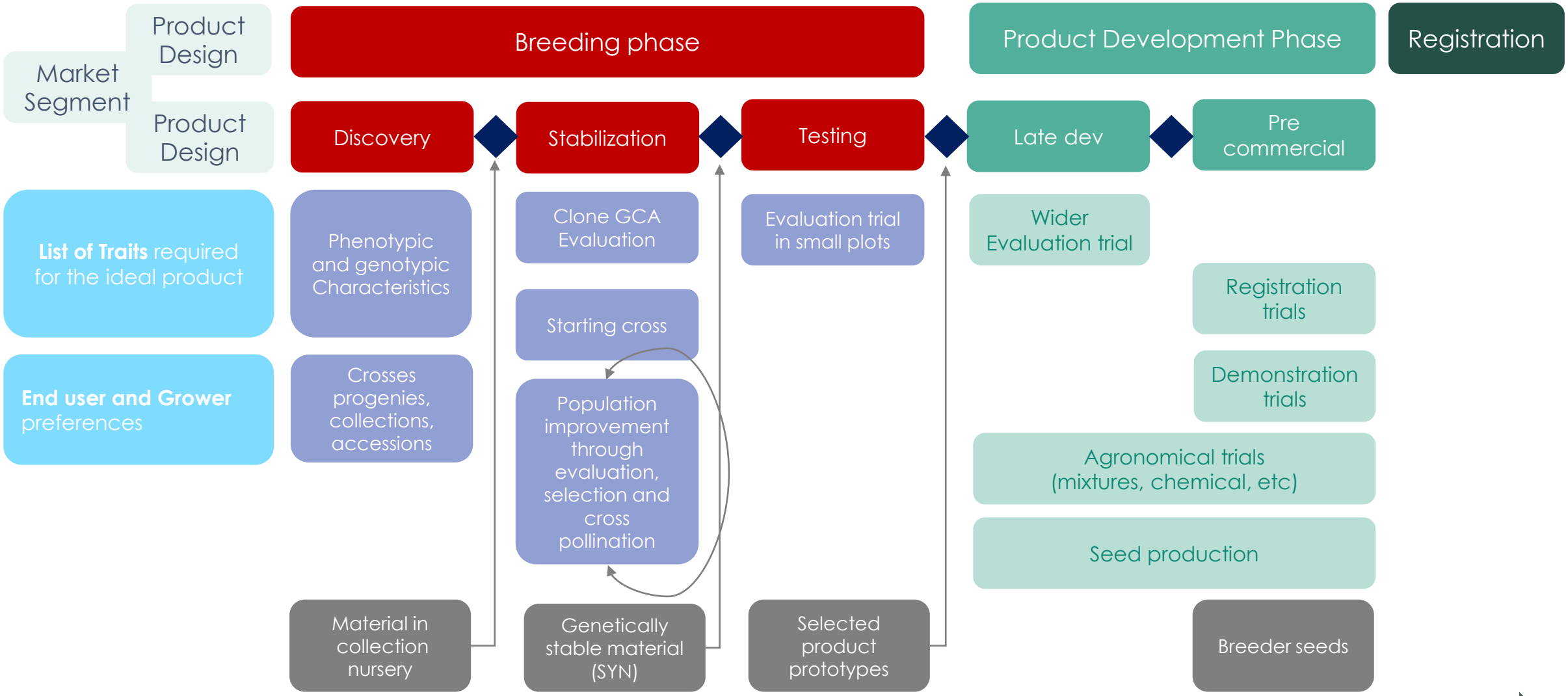
Digitalizing Product Developement pipeline



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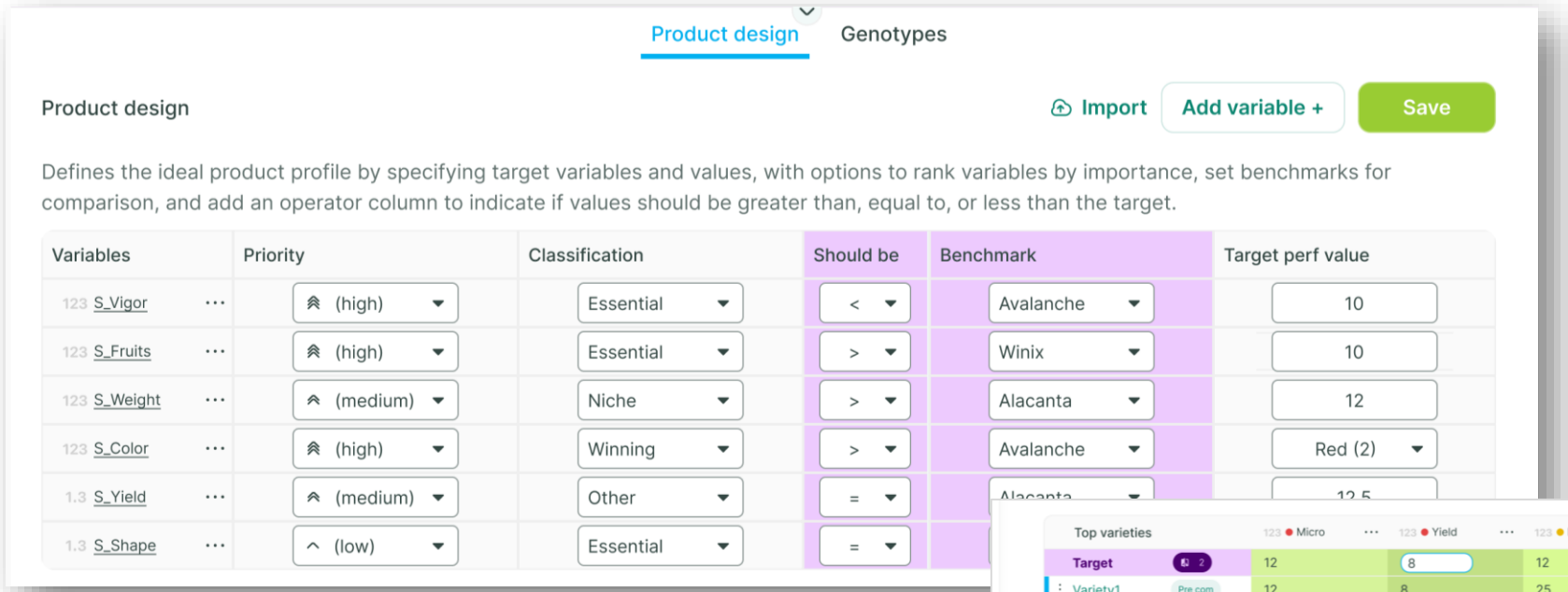
Tracking KPIs along the Product Developement Pipeline

1. Product market fit



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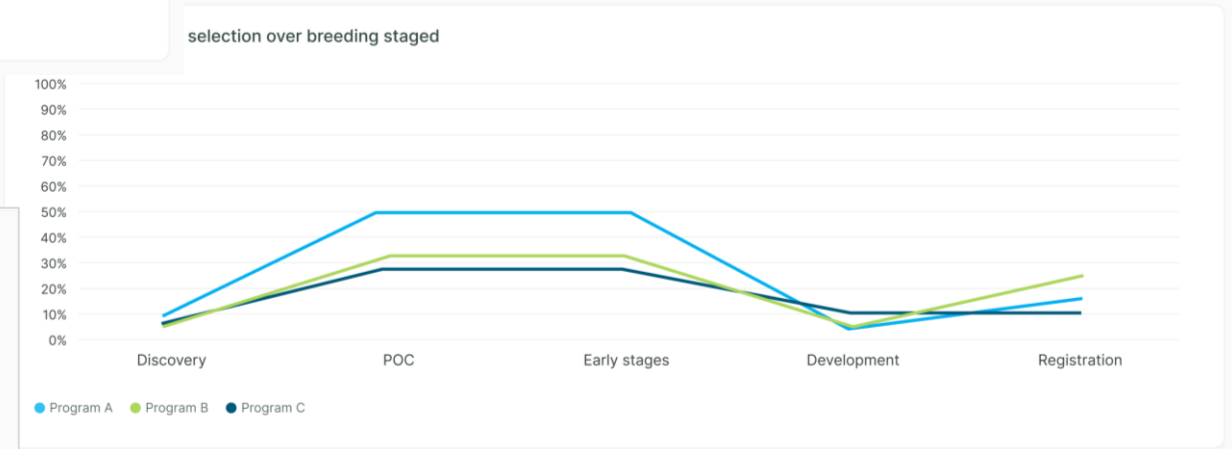
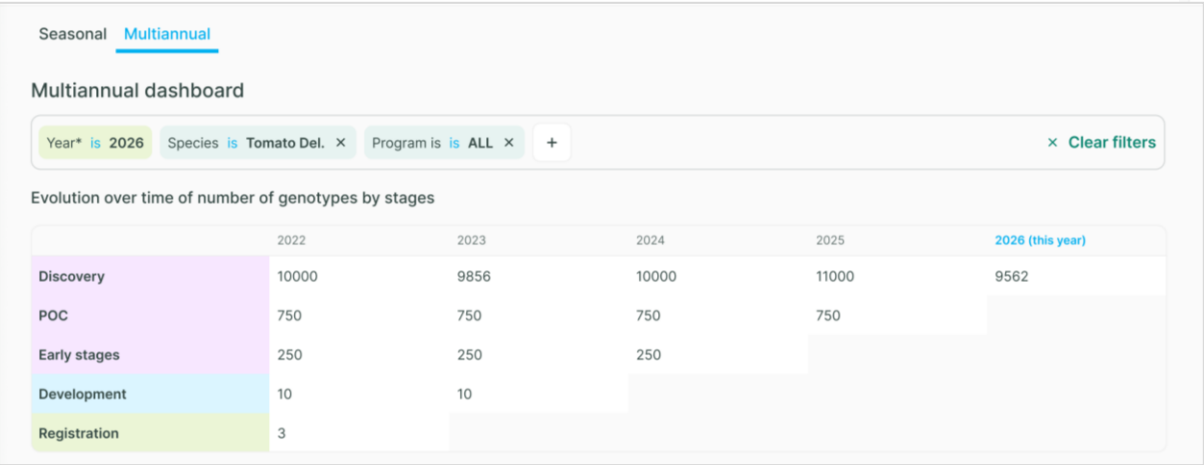
Tracking KPIs along the Product Developement Pipeline

2. Breeding Program efficiency





	2022	2023	2024	2025	2026 (this year)
Discovery	10000	9856	10000	11000	9562
POC	750	750	750	750	
Early stages	250	250	250		
Development	10	10			
Registration	3				

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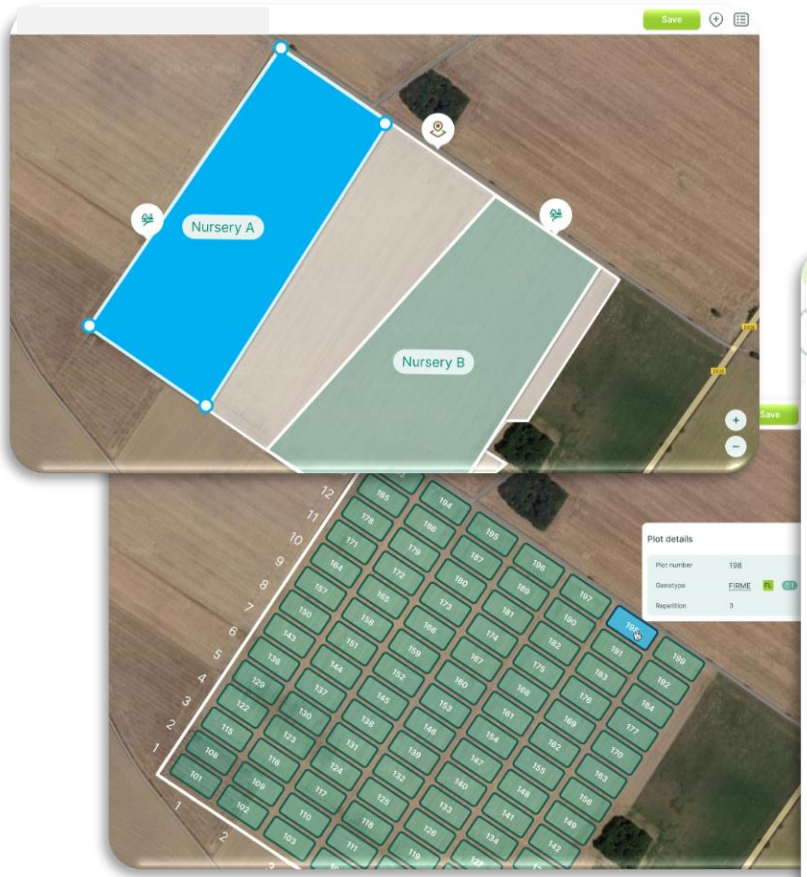
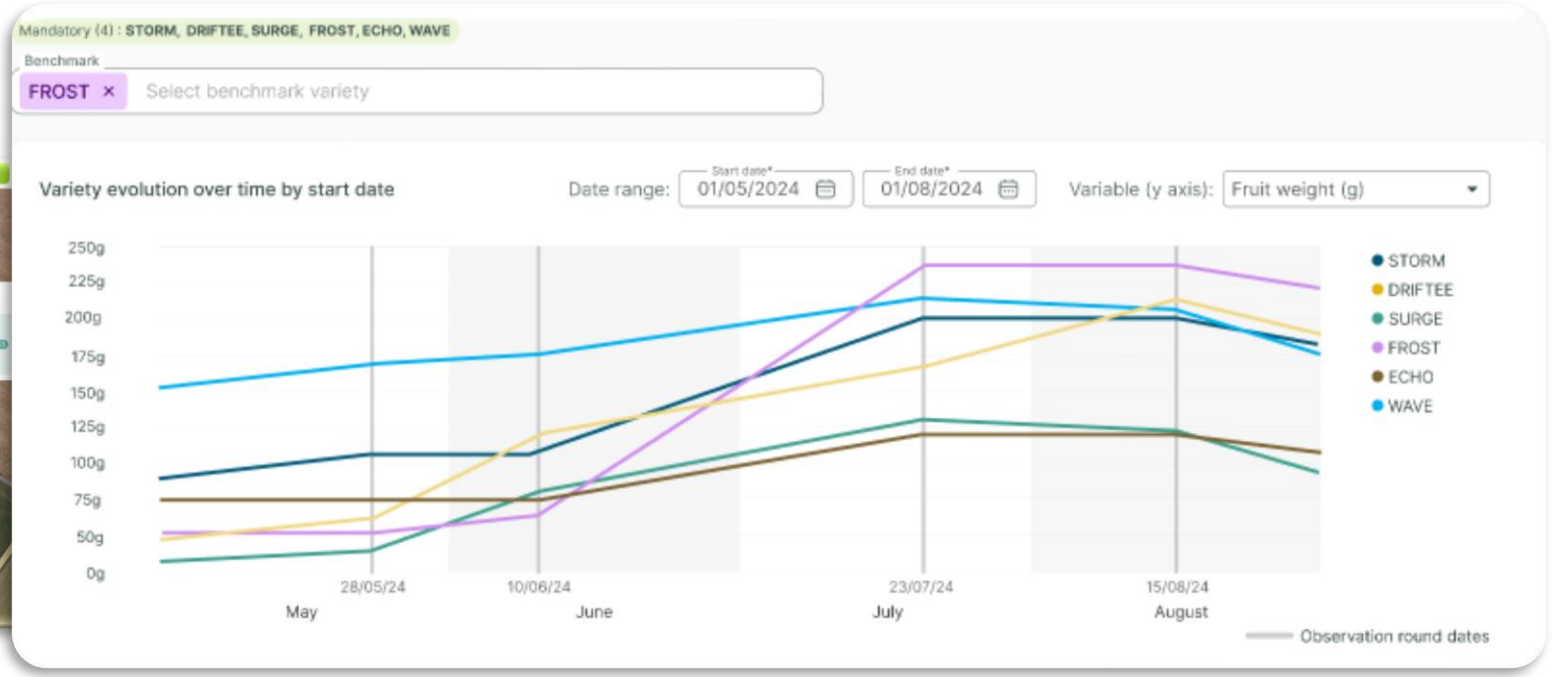
Three Key Insights from Digitalizing Alfalfa R&D

1. Technical Insight : Field to Data Integration

- Using **mobile tools** for real-time trial data and grower feedback.
- Enables the study of **environmental × management × genetic interactions**.





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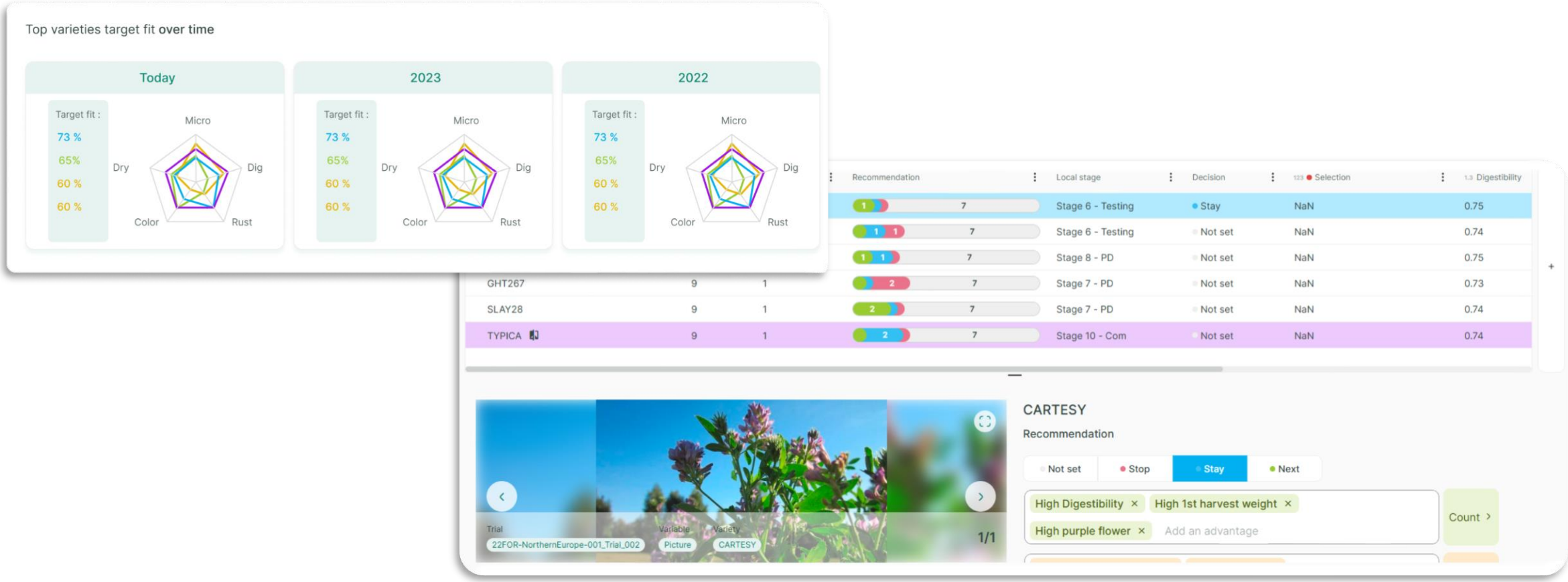
Three Key Insights from Digitalizing Alfalfa R&D

2. Strategic Insight : Connecting Market Needs to Traits

- Data-driven assessment of whether a breeding line **meets market and sustainability goals** (e.g., water use, soil benefit).
- Supports **trait prioritization for agroecological performance**, not just yield.



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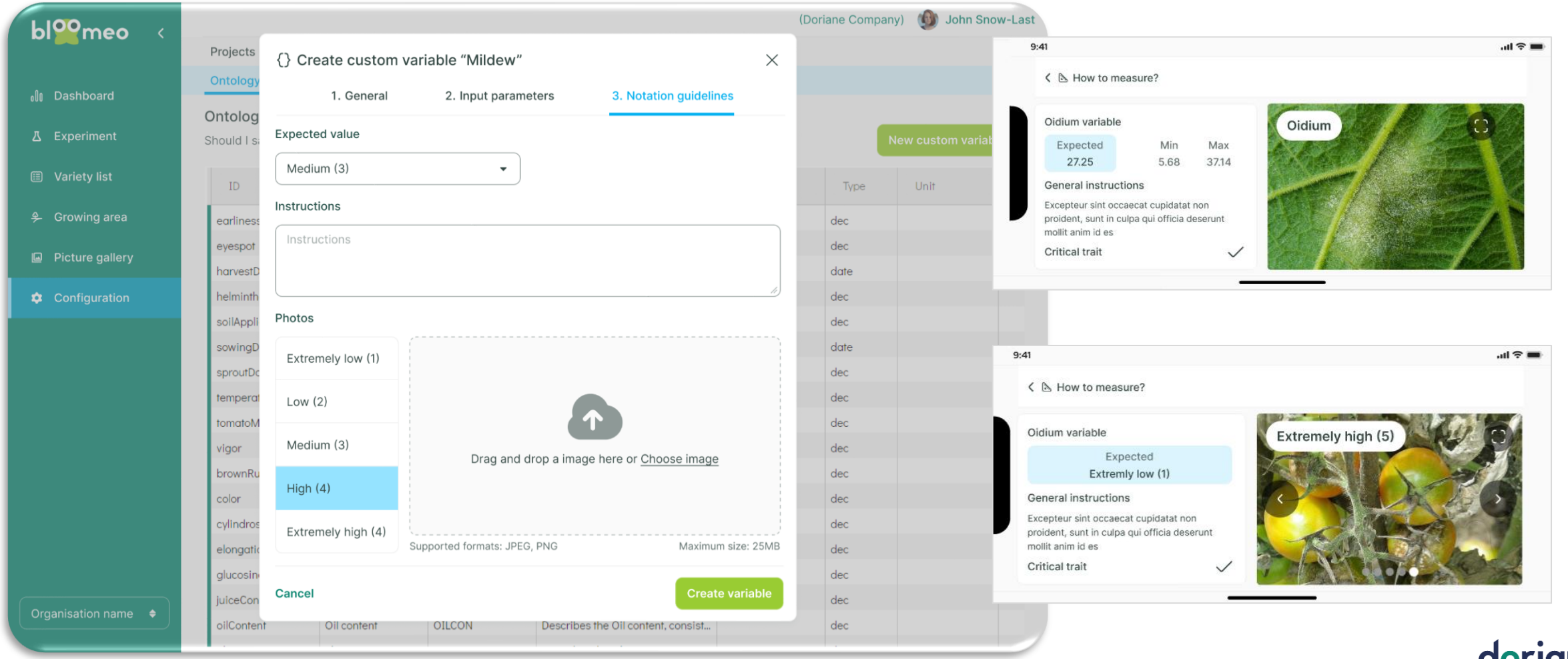
Three Key Insights from Digitalizing Alfalfa R&D

3. Organizational Insight : Multidisciplinary Collaboration

- Shared database and unified dictionaries **break silos between breeding and product development**.
- Facilitates integrated **innovation with connected systems**.



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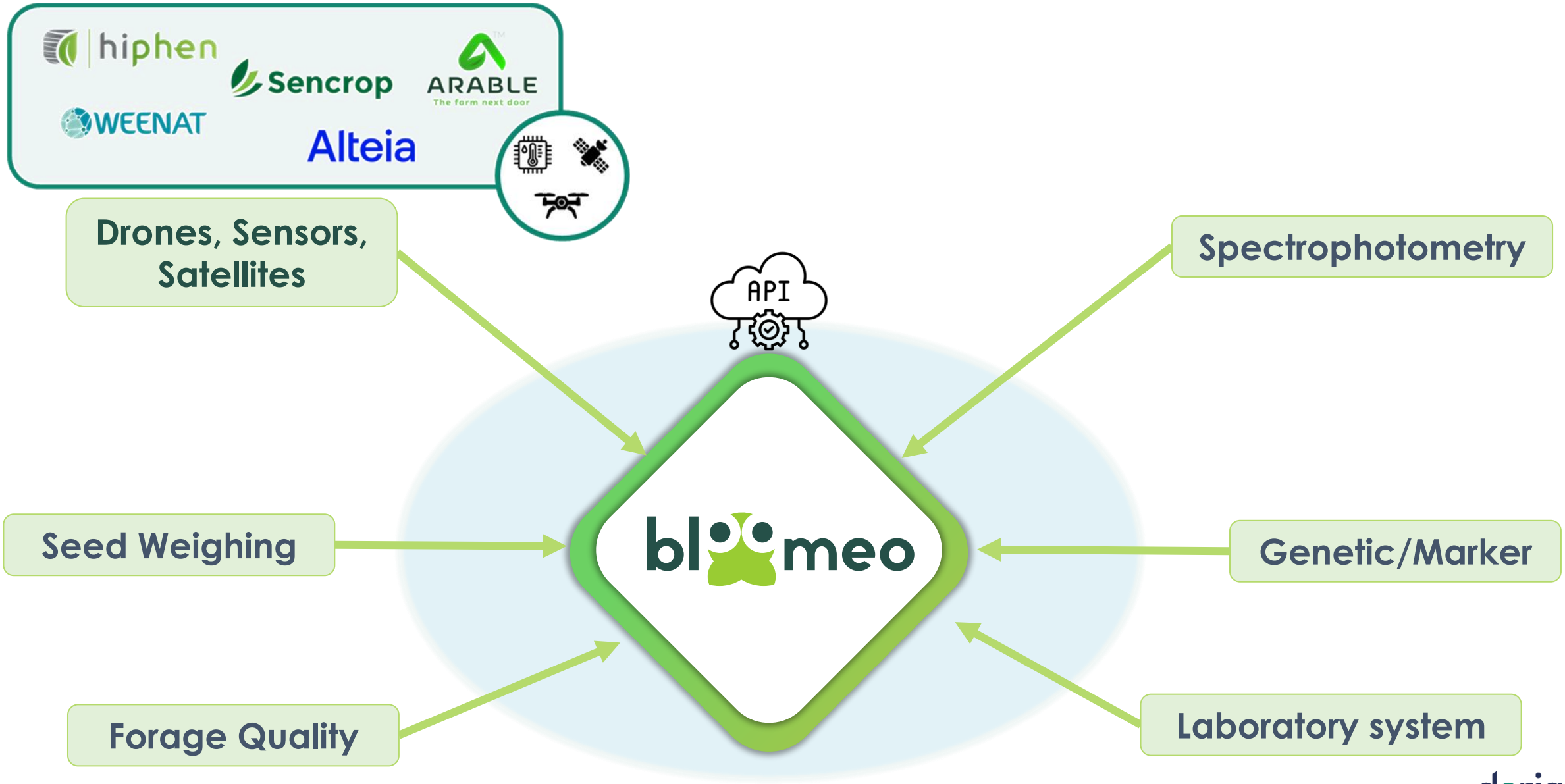

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How to maximize the ROI of your Alfalfa R&D investments?

Streamline processes, increase collaboration	Make sure the addressable market for each market is relevant	Increase the variety launch success rate	Reduce the time to get a new variety into the market
Digitalization	Market Segments	Market Segments	Digitalization
Breeding Stages	Product Designs	Product Designs	Analytics

Benefits expected from Digitalization

- Improved traceability and reproducibility of experiments.
- Easier integration of field and grower feedback (participatory breeding).
- Data standardization to support multi-disciplinary research (geneticists ↔ agronomists ↔ marketers).

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Thank you for your attention!

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Alfalfa to get back into planetary boundaries

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