UPOV

International Union for the Protection of New Varieties of Plants

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Technical Working Party on Testing Methods and Techniques **TWM/4/18**

Fourth Session
Cambridge, United Kingdom, June 2 to 5, 2026

Original: English
Date: May 28, 2026

ARTEMIS: DIGITAL SOLUTIONS FOR CLIMATE-RESILIENT AGRICULTURE

Document prepared by an expert from the Consultative Group on International Agricultural Research (CGIAR)

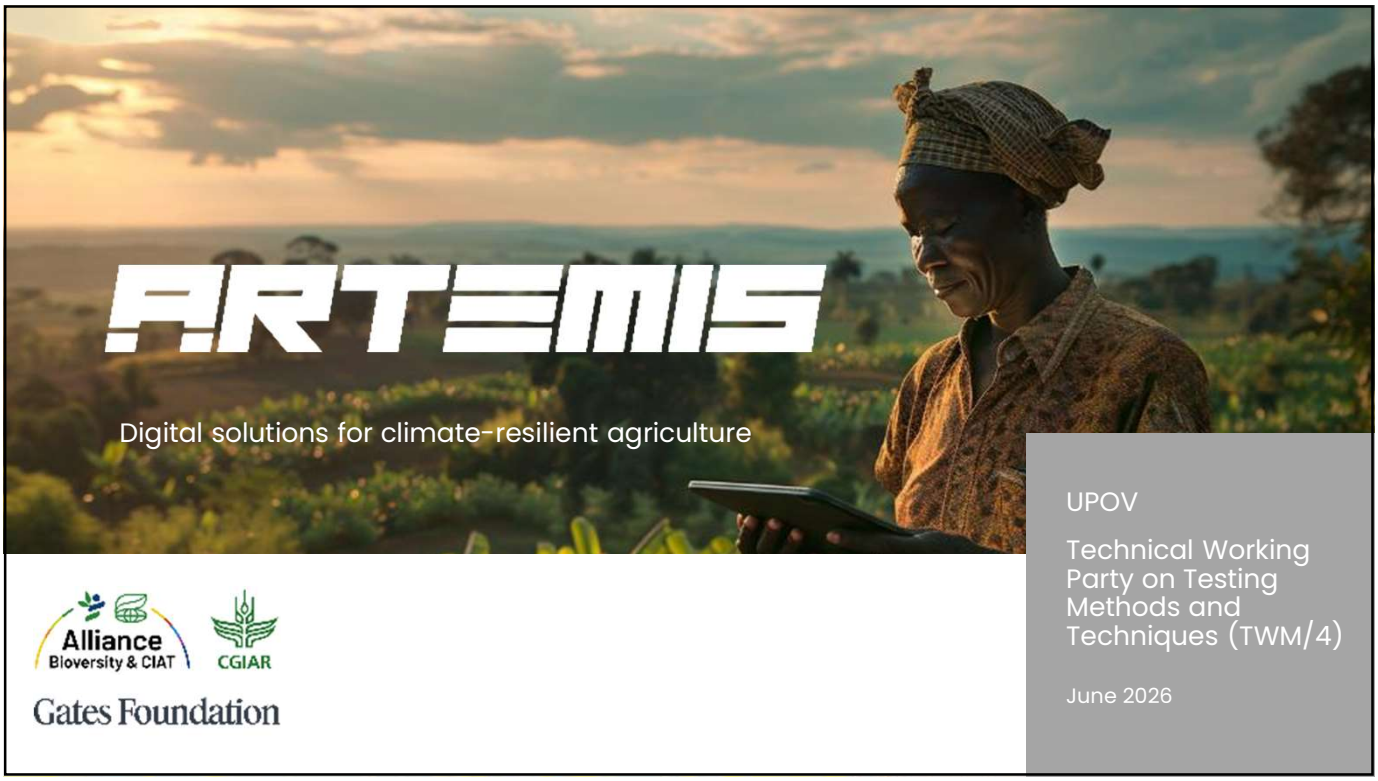
Disclaimer: this document does not represent UPOV policies or guidance

1. The Artemis project has developed Ona, a smartphone-based computer vision system for quantitative crop phenotyping designed for use in public breeding programs in low-resource settings. Smartphones are attached to a pushcart called “Bruno” to capture images of a 4 x 5 m plot in less than 30 seconds and supports rapid extraction of plot-level characteristics from field images. Across applications in beans, cowpea, and sorghum, model outputs have shown strong agreement with reference measurements, including correlations of >0.9 for stand, flower and pod counts for common beans between Bruno-derived and ground-truth values.

2. This presentation will focus on the use of Ona for on-station phenotyping, where it reduces phenotyping time and cost while improving consistency relative to visual scoring. Results presented in the Artemis work show time savings across several characteristics, with image-based methods reducing plot-level assessment time by roughly 42% to 75%, and economic analysis from multi-site trials in Nigeria indicating about 50% lower phenotyping costs and 17% lower costs per season for an advanced yield trial. The presentation will also discuss current testing of Ona in on-farm conditions, where the use of smartphones enables wider participation in standardized phenotyping by technicians, breeders, and other non-specialist users.

3. The annex to this document contains a presentation “ARTEMIS: Digital solutions for climate-resilient agriculture”, to be made by an expert from the Consultative Group on International Agricultural Research (CGIAR), at the fourth session of the TWM.

[Annex follows]


ARTEMIS
Digital solutions for climate-resilient agriculture
Alliance
Bioversity & CIAT
CGIAR
Gates Foundation
UPOV
Technical Working Party on Testing Methods and Techniques (TWM/4)
June 2026

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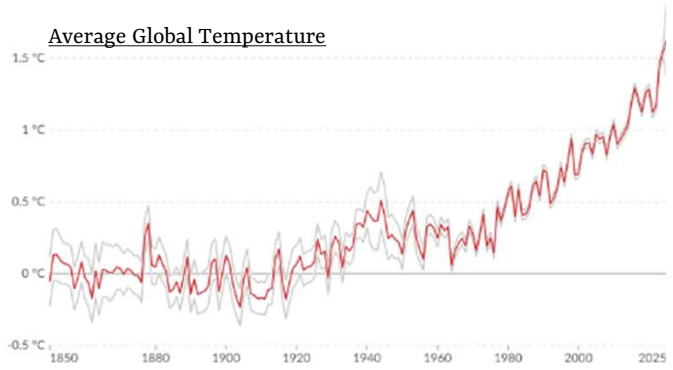
ARTEMIS
Breeding: Everything you eat has been designed....

2

Average Global Temperature



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NEWS

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Faster pace of climate change is 'scary', former chief scientist says

The persistent threat of emerging plant disease pandemics to global food security

Jean B. Ristaino, Pamela K. Anderson, Daniel P. Bebber, +13, and Qingshan Wei Authors Info & Affiliations

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May 21, 2021 | 118 (23) e2022239118 | https://doi.org/10.1073/pnas.2022239118 | PNAS

3

It takes 10 years to develop a new variety…

Slow

&

not demand responsive

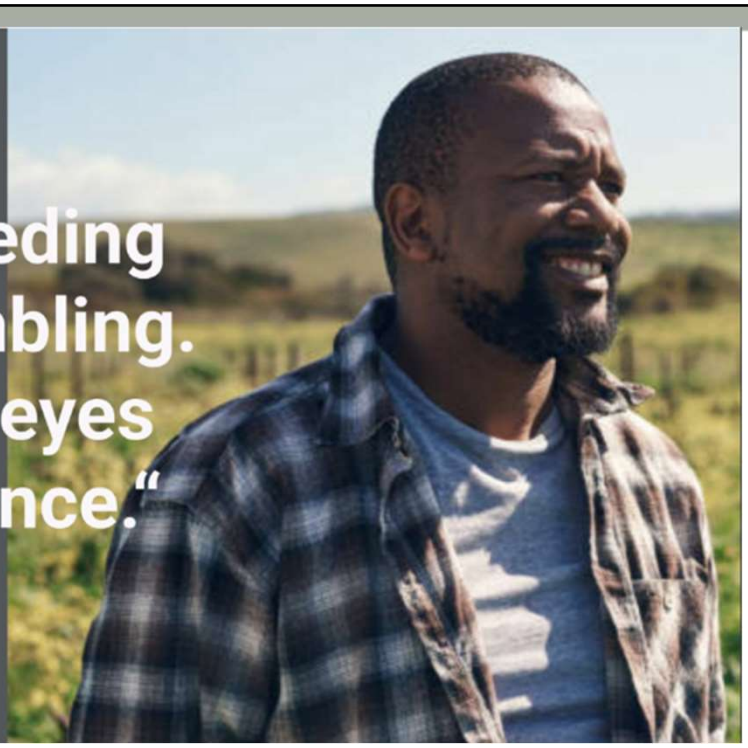
The Phenotyping Bottleneck: Human vision is error-prone and slow.

Low adoption
Little timely data and feedback from real farmer conditions

4

ARTEMIS

"Sometimes breeding can feel like gambling. You rely on your eyes and your experience."



User Research:
Aline Weinsheimer, Berta Ortiz

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ARTEMIS

Better data for better decisions

- Can we leverage AI?
  For the poorest?
  For the public good?

....and have fun doing it?....

First use case: crop breeding

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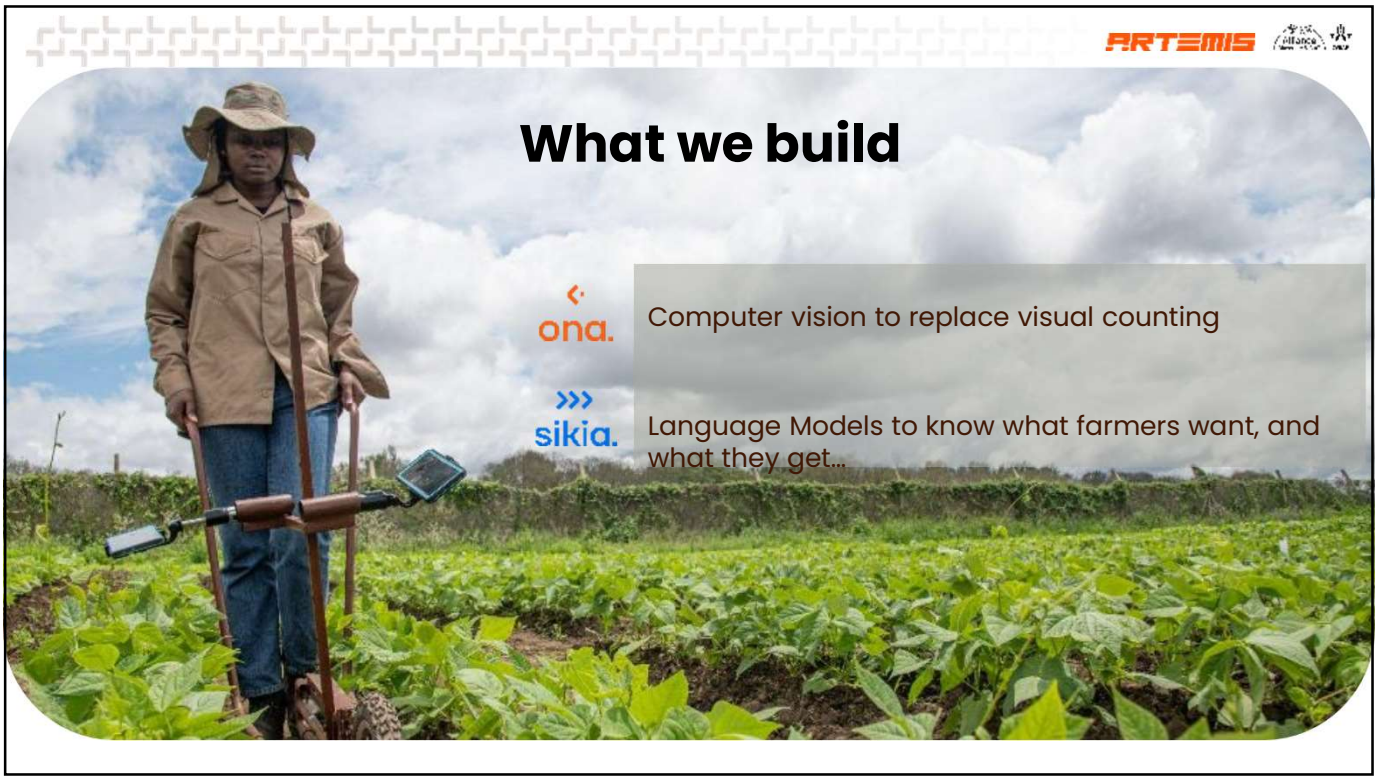
ARTEMIS
What we build
ona.
Computer vision to replace visual counting
sikia.
Language Models to know what farmers want, and what they get...

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ARTEMIS
Tech transfer?
- Equipment
- Models
15,000-50,000 USD
50,000-100,000 USD
250,000 USD

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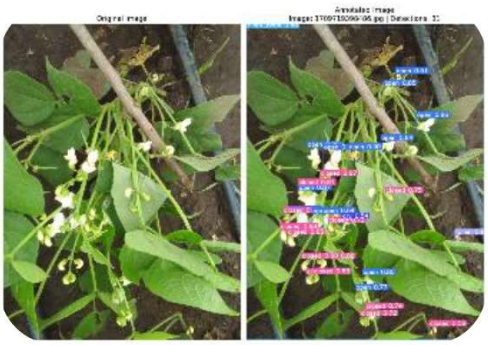
ARTEMIS

Ona: AI powered digital phenotyping on a smartphone

2x accuracy and **2x efficiency** in a **standardized** and **transparent** way



<1000 USD

Computer-vision models | ***Ona* Software** | ***Bruno* Hardware**

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ARTEMIS

IMAGERY — **ANNOTATIONS** — **MODELS** — **INFERENCE**

≈ 6 M
Images collected

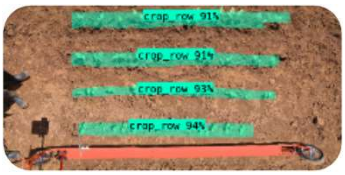
18
Crops captured

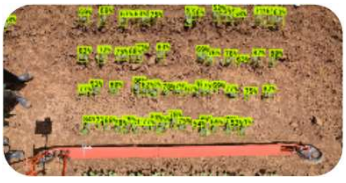
≈ 10k
Images annotated

Deploying
3 trait models for bush beans

Region/area of each plant part

Count whole plant





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Filling the phenotyping gap in the Global South.

			
	Fieldbook (manual)	**Bruno + ONA**	**Drone**
Ease of Use	Easy	**Easy** ✅	Medium
Speed	500 plots/day	1,000 plots/day	100,000 plots/day

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Filling the phenotyping gap in the Global South.

			
	Fieldbook (manual)	**Bruno + ONA**	**Drone**
Ease of Use	Easy	**Easy** ✅	Medium
Speed	500 plots/day	1,000 plots/day	100,000 plots/day
Capex	$300 (tablet)	$1,000	$15,000 (drone)
Labor (per season)	$30,000	**$15,000** ✅	$20,000
Data > Decision	Slow, error-prone	**Quick** ✅	Quick

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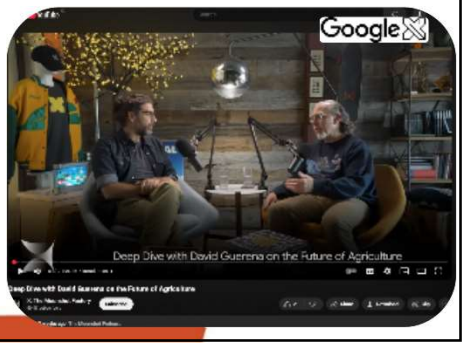
ARTEMIS

Traction



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ARTEMIS

What we build

sikia.

Farmer feedback and demand at scale, fast

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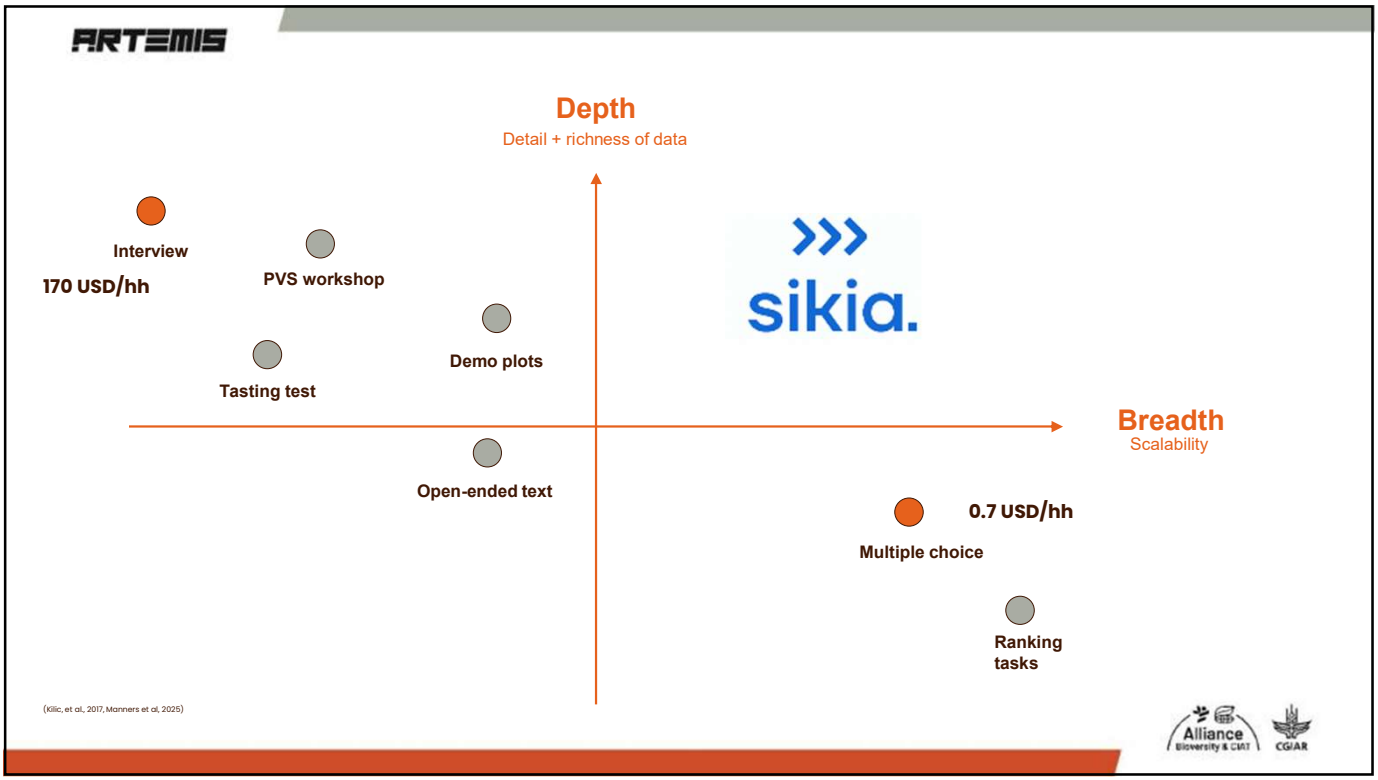
ARTEMIS
Depth
Detail + richness of data
Interview
170 USD/hh
PVS workshop
Demo plots
Tasting test
Open-ended text
sikia.
Breadth
Scalability
0.7 USD/hh
Multiple choice
Ranking tasks
(Kilic, et al., 2017, Manners et al, 2025)
Alliance
Bioversity & CIAT
CGIAR

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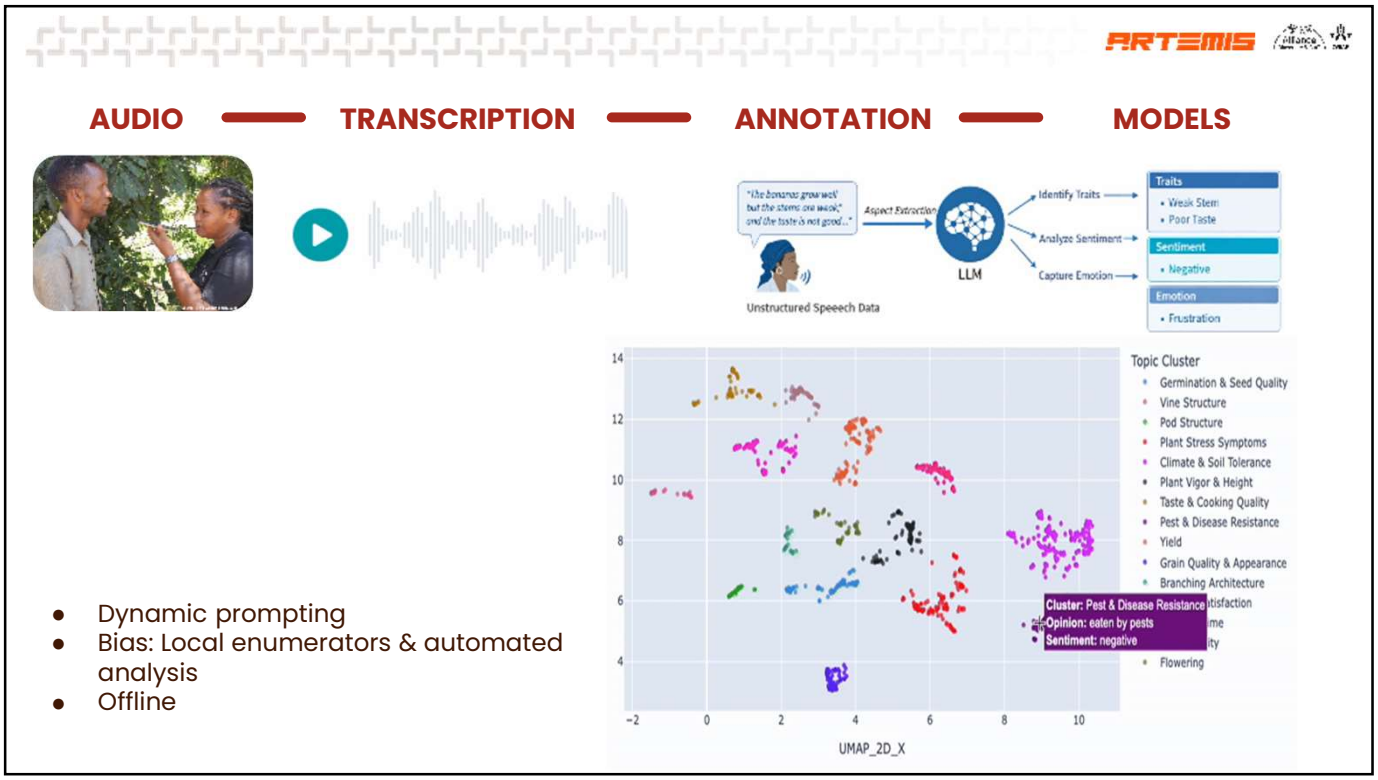
ARTEMIS
AUDIO
TRANSCRIPTION
ANNOTATION
MODELS
Aspect Extraction
LLM
Identify Traits
Analyze Sentiment
Capture Emotion
Traits
Weak Stem
Poor Taste
Sentiment
Negative
Emotion
Frustration
Unstructured Speeech Data
Topic Cluster
Germination & Seed Quality
Vine Structure
Pod Structure
Plant Stress Symptoms
Climate & Soil Tolerance
Plant Vigor & Height
Taste & Cooking Quality
Pest & Disease Resistance
Yield
Grain Quality & Appearance
Branching Architecture
Flowering
Cluster: Pest & Disease Resistance
Opinion: eaten by pests
Sentiment: negative
UMAP_2D_X
Dynamic prompting
Bias: Local enumerators & automated analysis
Offline

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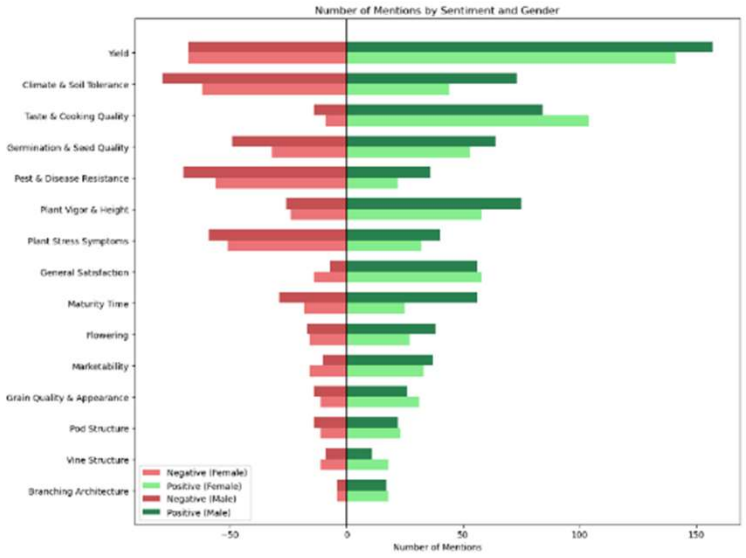
ARTEMIS

Trait Prioritization: Gender Lens



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ARTEMIS

Anyone can collect data anywhere

Sikia.

What do farmers want?

Field

<1000 USD

Ona.

Can we get what they want?

On-Station

Sikia.

Do they really get what they wanted?

Field

Better varieties for farmers, faster

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Conclusion

Public breeding needs better evidence from **fields** and **farmers**.

- Ona helps structure phenotyping data.
- Sikia helps structure farmer feedback.

Together, they can support more consistent, scalable, and inclusive testing.

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3 questions for discussion

- How can smartphone phenotyping benefit in DUS trials?
- Where could AI-supported feedback collection tools support farmer trials for UPOV members?
- Which use cases are most relevant for UPOV members?

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Thank You.

Gates Foundation

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www.alliancebioversityciat.org/projects/artemis
www.ona.farm

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[End of Annex and of document]