

PhenoApps to Accelerate Plant Breeding

Trevor Rife
2018-10-04

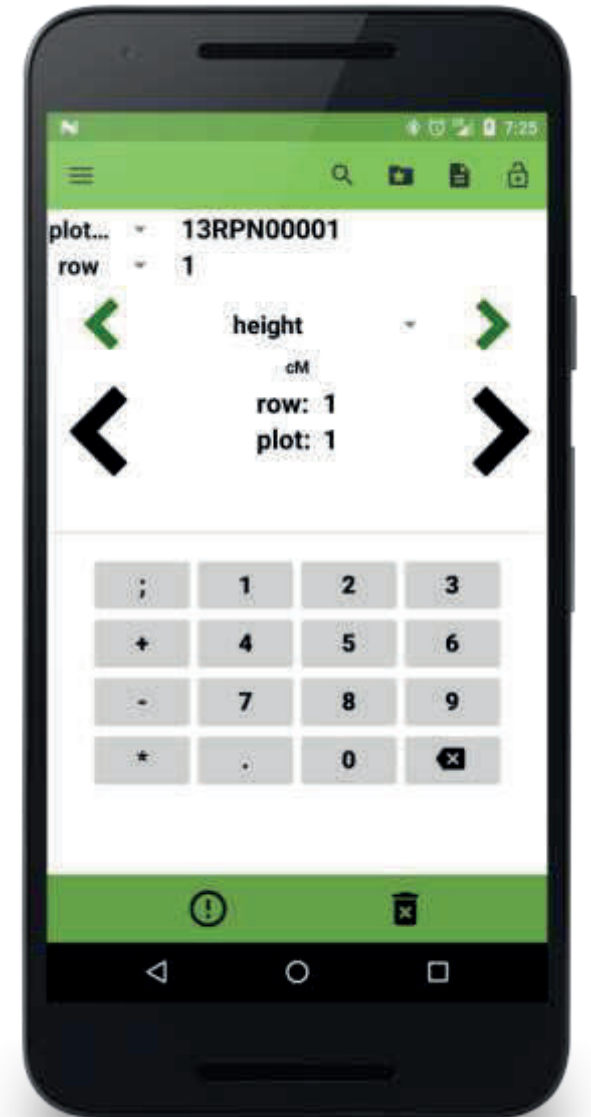






Field Book

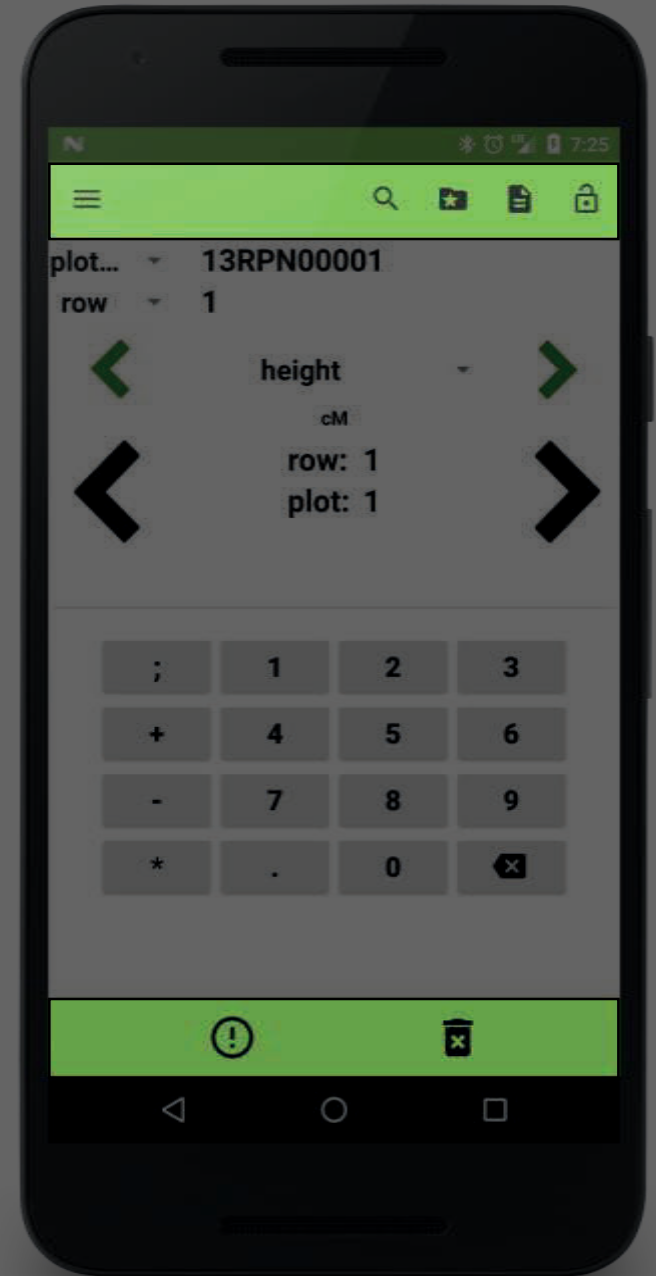
- Phenotypic data collection app
- Highly customizable
- Navigate between plots or traits
- Extra plot information displayed
- Manage traits within the app
- Different trait formats
- 8000+ total installs





Toolbars

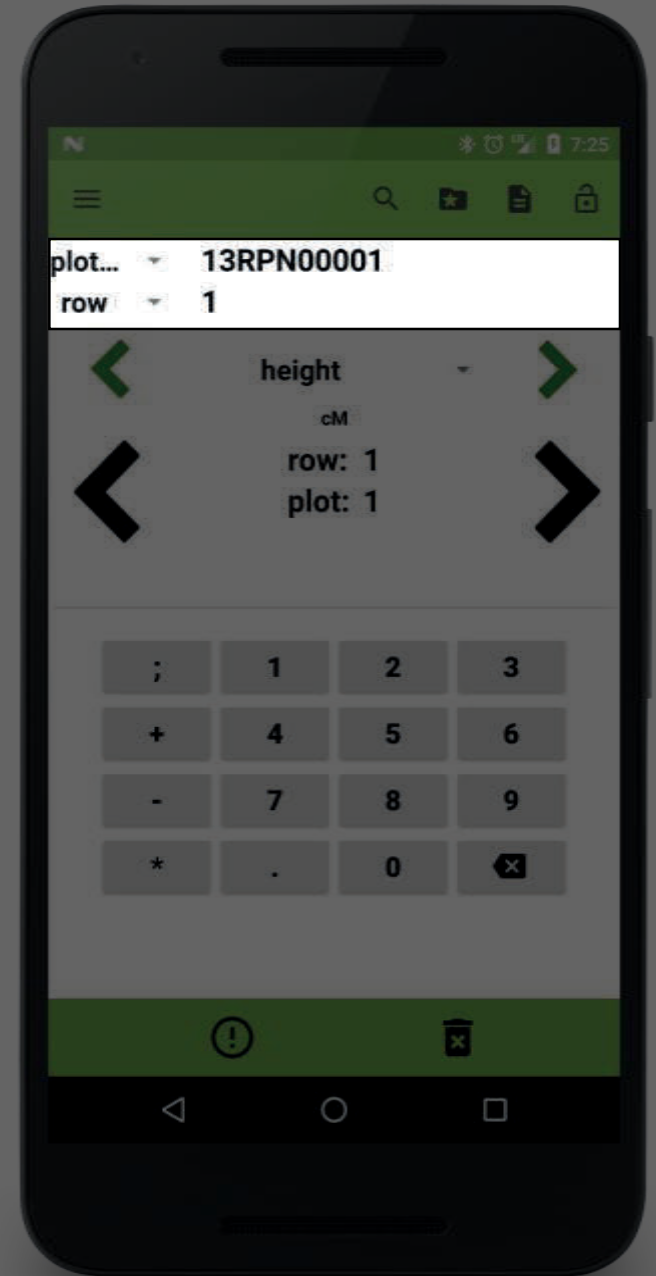
- Custom interactions
- Top
 - Search
 - Resources
 - Details
 - Lock
- Bottom
 - NA
 - Delete





InfoBars

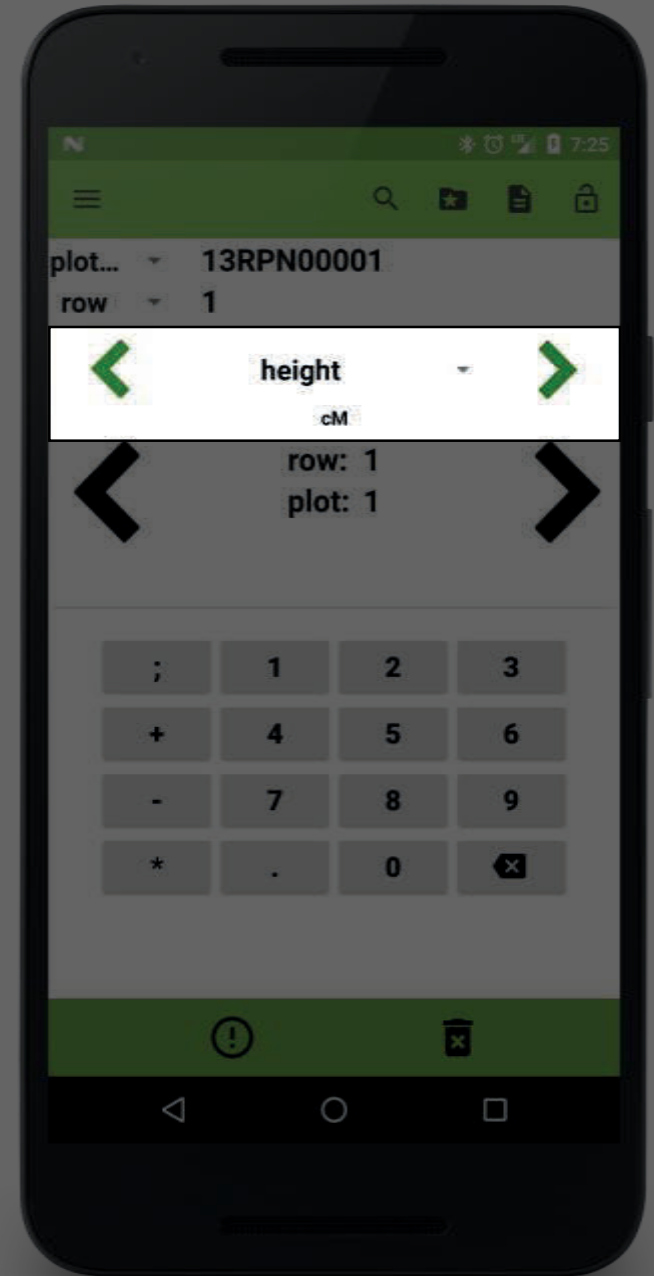
- Extra plot data from imported file





Trait Navigation

- Move forward or backward between traits
- Trait details below trait name





Plot Navigation

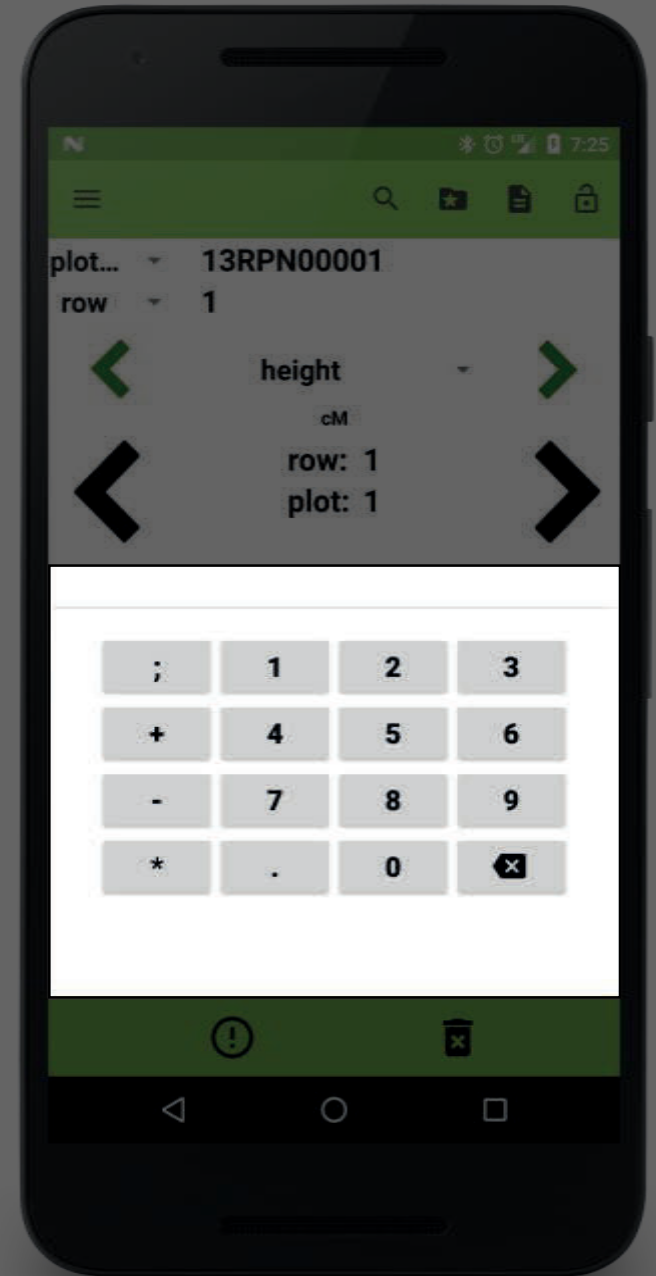
- Move forward or backward between plots
- Primary/Secondary order between arrows





Data Entry

- Area to collect and interact with the app
- Dynamic based on trait type





Traits

Numeric

22

:	1	2	3
+	4	5	6
-	7	8	9
*	.	0	✖

Categorical

Red	Orange	Yellow
Green	Blue	Purple
White	Black	Brown
Cyan	Magenta	Gray

Percent

22%

Date

Sep 22

-1 +1

Text

Disease Rating

25:MS

0	5	10	15	20	25
30	35	40	45	50	55
60	65	70	75	80	85
90	95	100			

R M S /

Location

19.9281, -155.8876

Counter

22

-1 +1

Boolean

FALSE

Photo

Audio

Data has been saved

Multicat

Yellow:Terminal:Short

Yellow	Purple	Asil
Terminal	Long	Short
Round	Wrinkled	Yellow
Green		



Export

Database

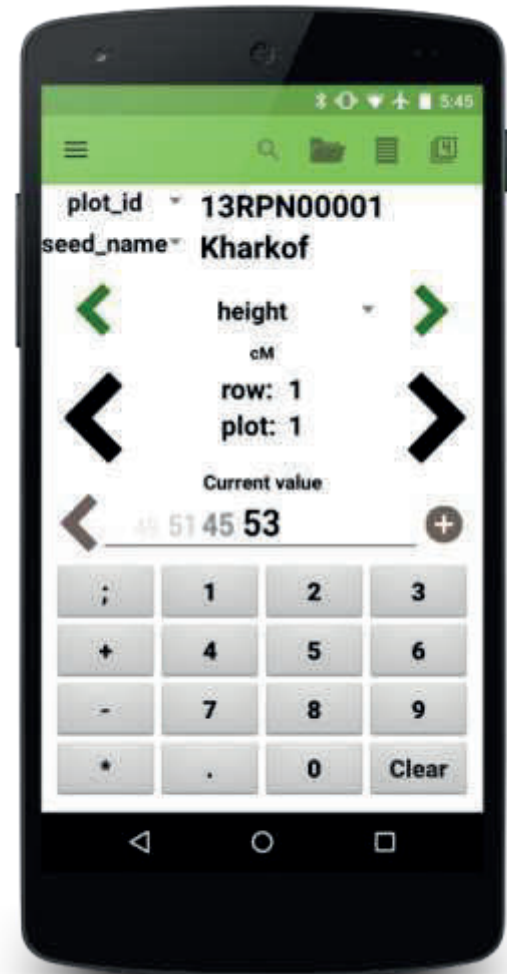
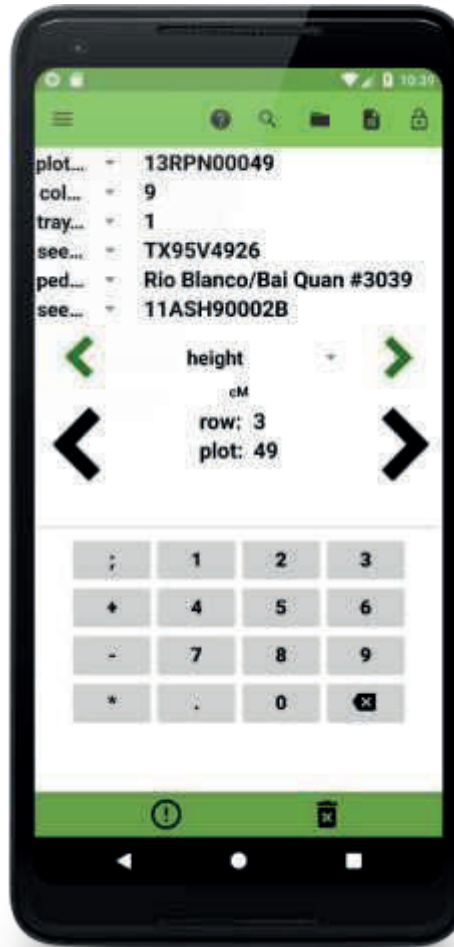
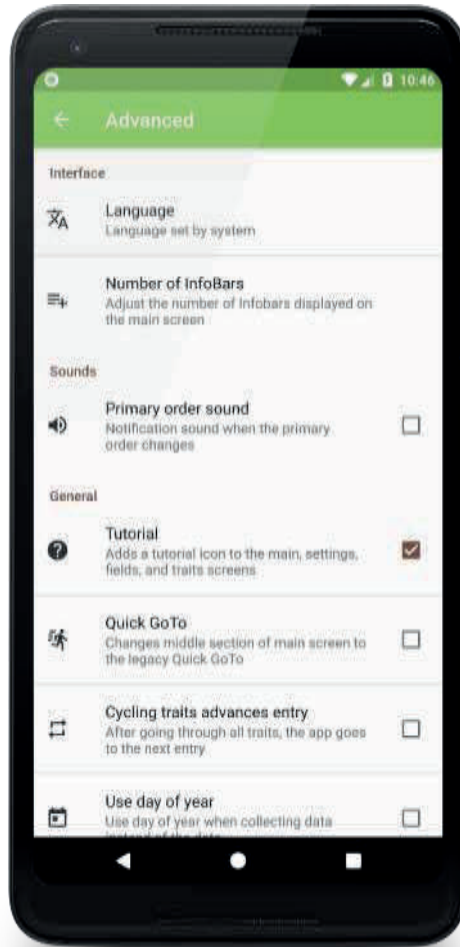
plot_id	seed_id	seed_name	trait	value	person	timestamp
13RPN00001	11ASH90002B	NW97S412-1	height	75	trevor_rife	2014.01.09 13:52:32
13RPN00002	11ASH90002B	Kharkof	height	45	trevor_rife	2014.01.09 13:52:33
13RPN00003	12GHT00002B	Roughrider	disease	Yellow	trevor_rife	2014.01.09 13:52:39
13RPN00004	12GHT00003B	Nuplains	disease	Purple	trevor_rife	2014.01.09 13:52:39
13RPN00001	11ASH90002B	G980172W	lodging	10	trevor_rife	2014.01.09 13:52:59

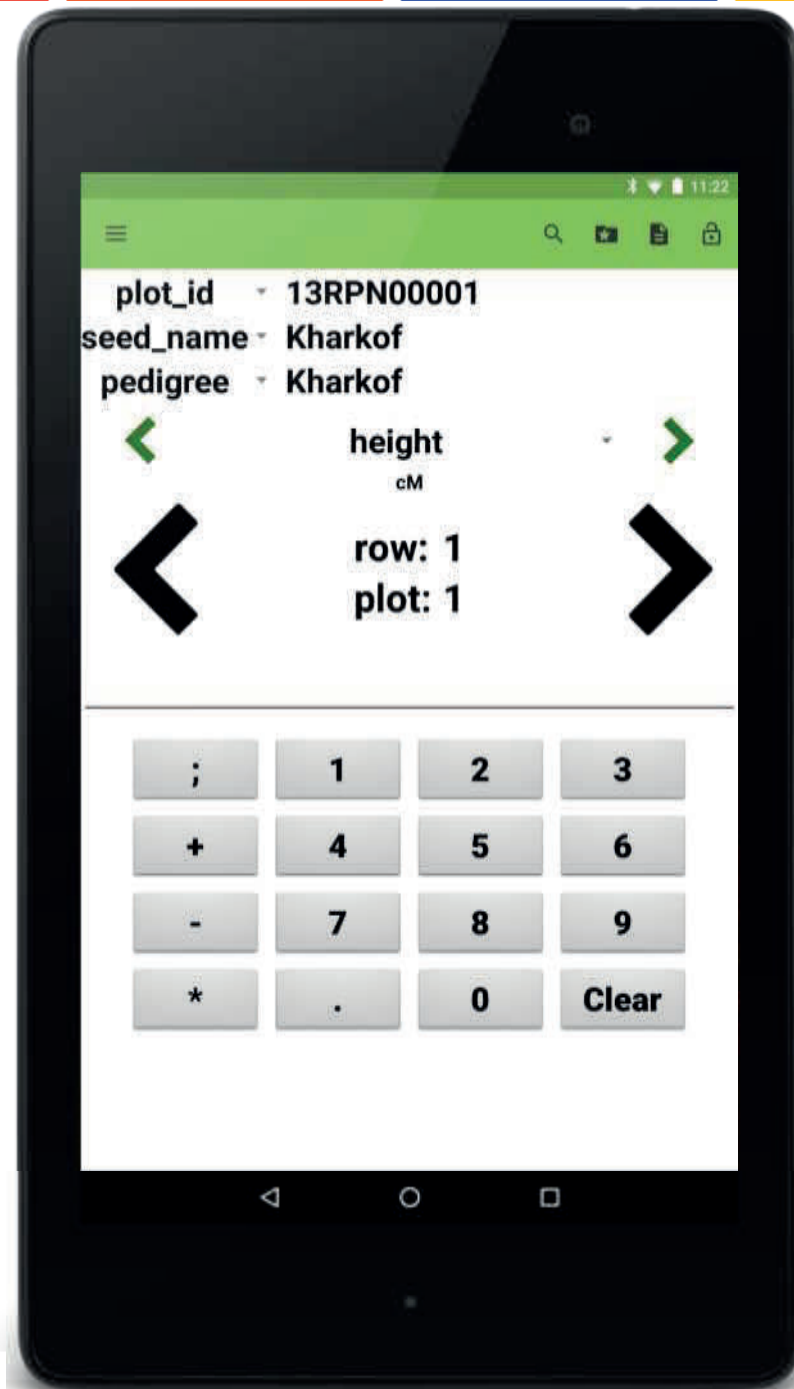
Table

plot_id	seed_id	seed_name	height	disease	lodging
13RPN00001	12GHT00001B	Kharkof	75	Blue	10
13RPN00002	12GHT00002B	Roughrider	45	Yellow	15
13RPN00003	12GHT00003B	Nuplains	63	Purple	0
13RPN00004	12GHT00004B	Nekota	14	Orange	20
13RPN00005	11ASH90002B	G980172W	15	Black	50



Field Book Future







Inventory v2

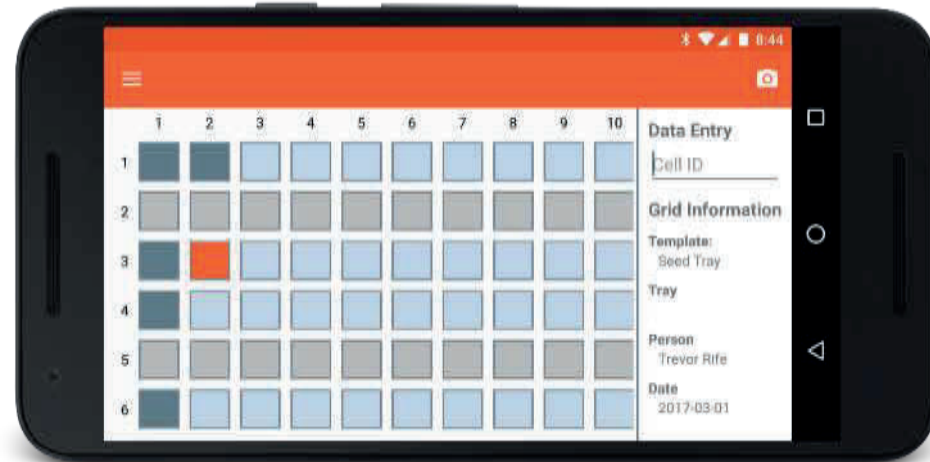
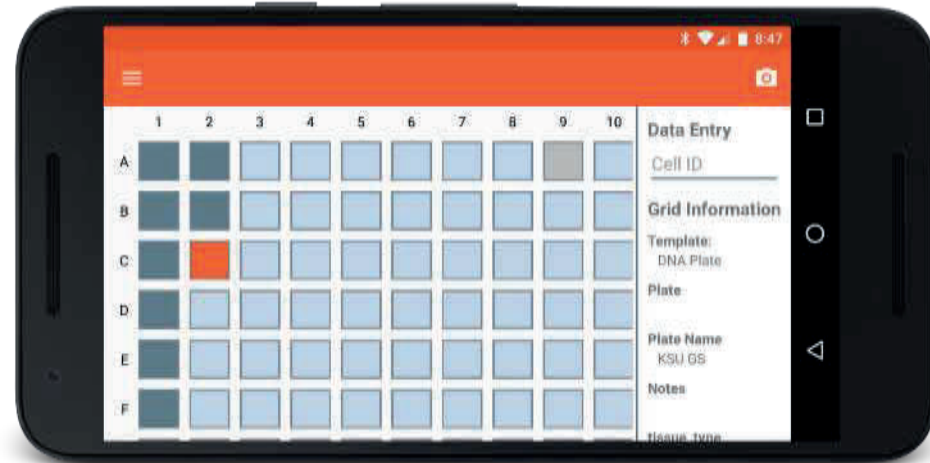
- Associate sample ID with a specific box
- Simultaneously collect sample weight
- Export to database-ready CSV file





Coordinate v2

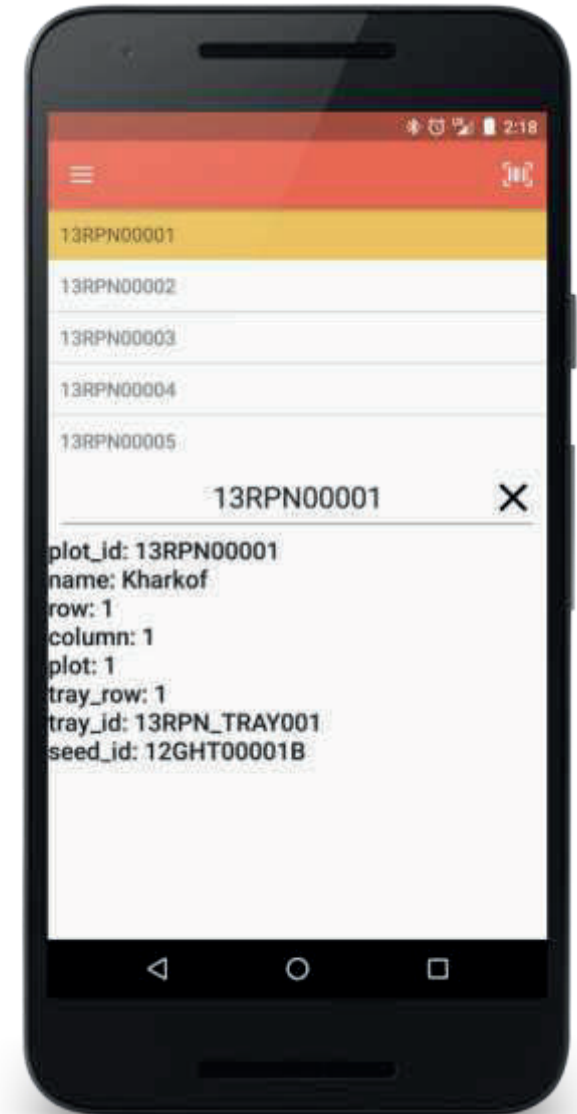
- Organize samples in grids
- Create custom templates
 - Exclude rows, columns
 - Change naming schemes
 - Custom metadata fields
 - Import/Export templates
- Default templates
 - DNA plates
 - Seed trays
- Projects
 - Export grids together





Verify

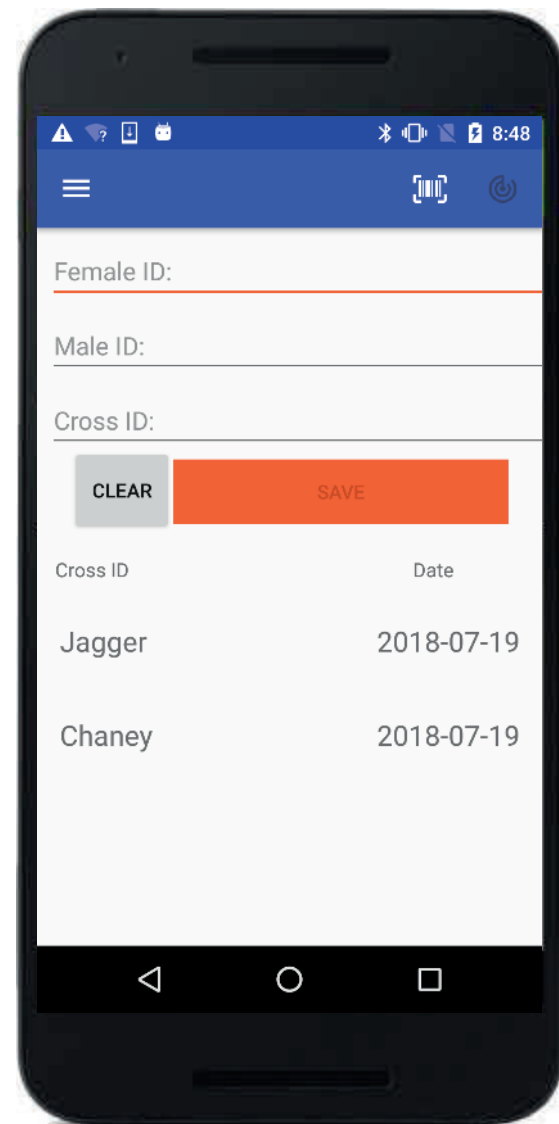
- Data viewing and verification
 - Import list of entries and data
 - Select barcode column
 - Scan entry barcodes
- Different modes:
 - Default: show entry info
 - Order: match entry order
 - Filter: remove scanned items
 - Color: paint scanned items
 - Pair: match individual entries





Intercross*

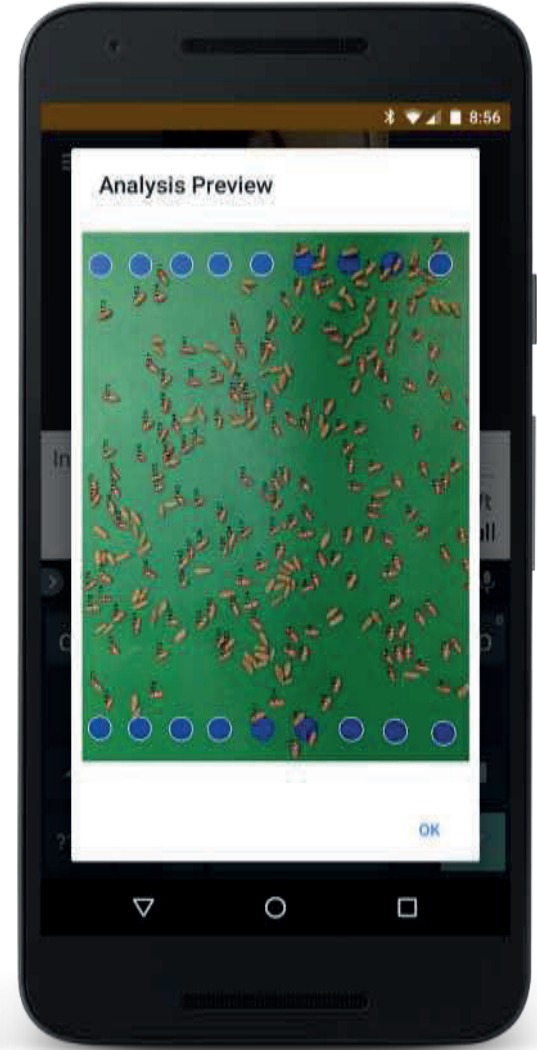
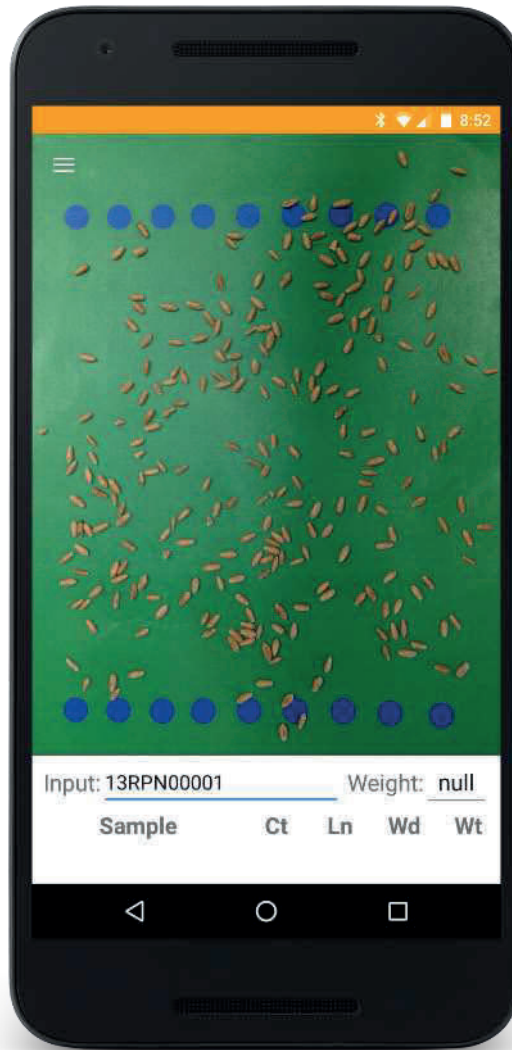
- Manage plant crossing blocks
- Organize parent and cross IDs
- Collect metadata about cross
- Print labels to Bluetooth printer
- Pre-plan crosses

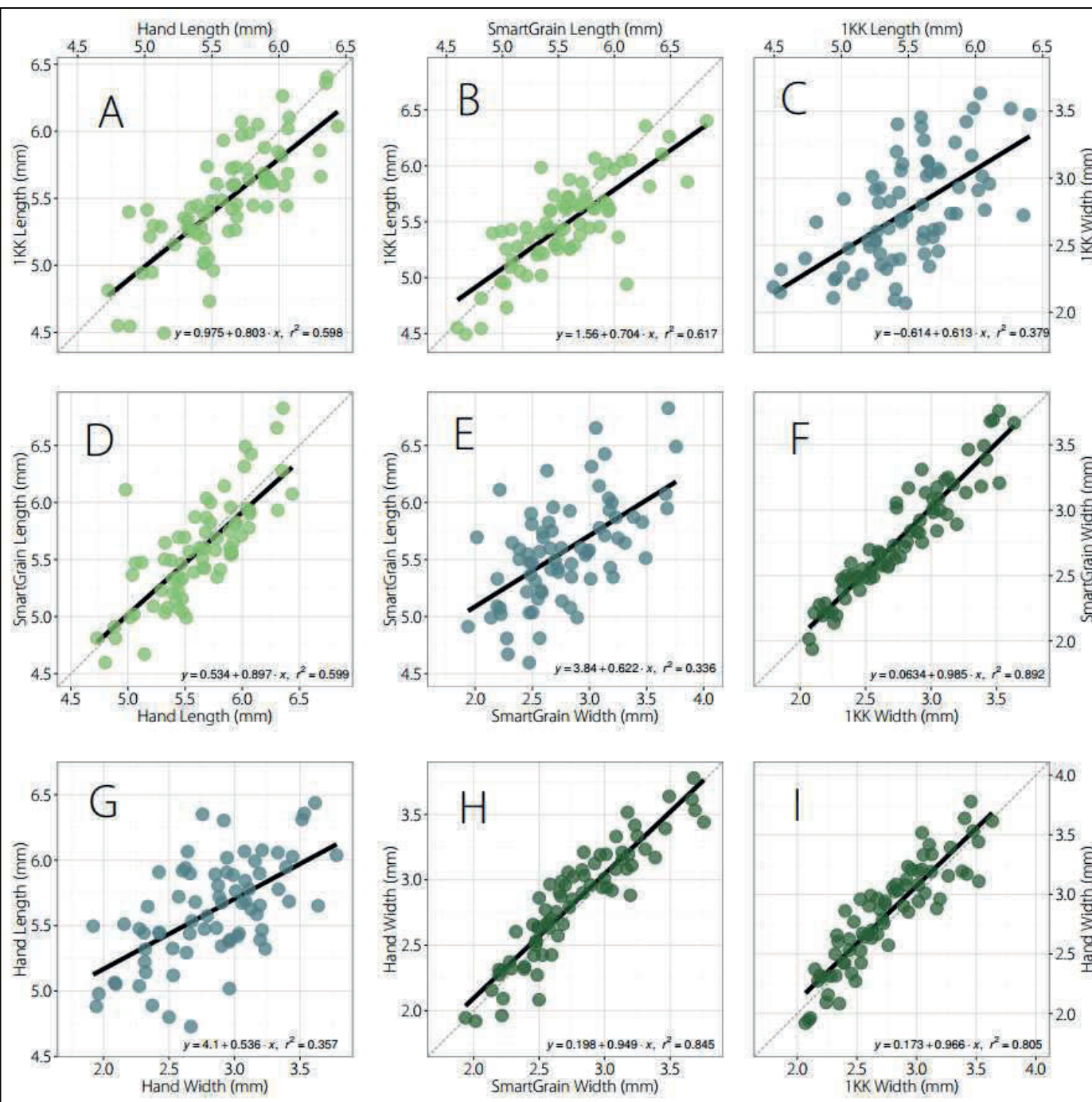


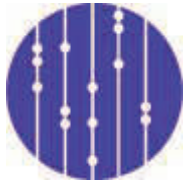


OneKK*

- Seed image analysis app
- One thousand kernel weight
- Non-parametric identification
- In progress







Abacus*

Security Feed

Counting Status: Counting
Counting number: 132

Monday 27 February 2017 04:48:08PM

Frame Delta

Search

Search

Thresh

19.png
20.png
21.png

motion_detector.py
tipof photo.txt
videos

```
macBook-Pro:~$ python motion_detector.py --vi  
macBook-Pro:~$ python motion_detector.py --vi  
macBook-Pro:~$ python motion_detector.py --vi
```

BrAPI - The Breeding API

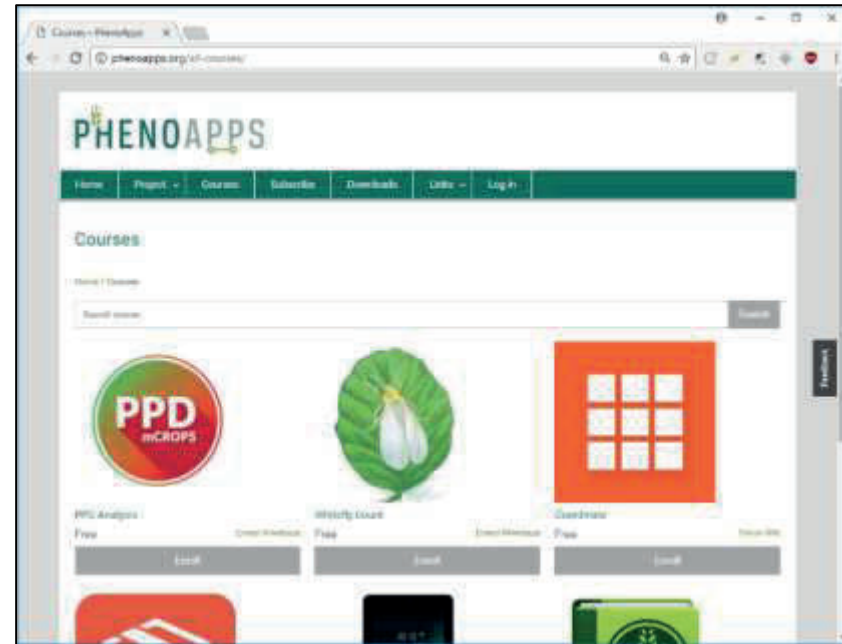
- Standardized, RESTful, Web Service, Application Programming Interface, Specification for connecting plant breeding data
- Supported by breeding database developers
- Allows simple communication between different development groups





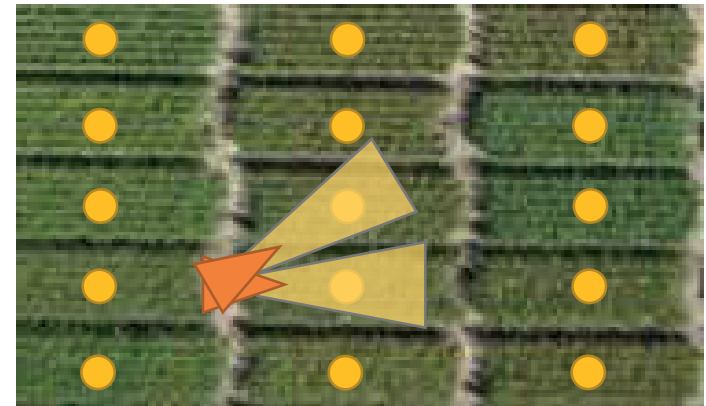
Outreach and Training

- www.phenoapps.org
 - Information about apps and hardware
 - Free courses to guide users
- Workshops
 - 2017 Oct – BARI, India
 - 2017 Nov – Makerere, Uganda
 - 2017 Dec – Hyderabad, India
 - 2018 Feb – Dar es Salaam, Tanzania
 - 2018 Mar – BGRI, Morocco
 - 2018 Jul – Hackathon, Cornell



Phenotyping Future

- Vast majority of entries in plant breeding are identified by relative location
- Geospatial-based breeding could increase data quality, quantity, and throughput
- Components:
 - 📍 Survey: collect coordinates via RTK GNSS
 - 🌱 GeoNav: identify point nearest to breeder
 - 🌱 Field Book AR
 - Display information from app
 - Voice control to navigate



Acknowledgments

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