

# Driving Innovation in Global Crop Breeding

## EBS: Where Cutting-Edge Technology Meets Breeding Expertise

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BR Digital Solutions Operations Lead, CIMMYT

# BRS Digital Solutions: a triple goal supported by three powerful teams!



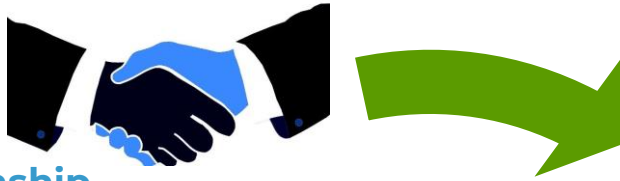
INITIATIVE ON  
Breeding Resources

## Our purpose:

*"We deliver digital solutions that enhance efficiency in research data management, knowledge sharing, and decision-making by the CGIAR community."*

### Business Relationship Management

actively listens to customers and stakeholders leveraging the expertise of our Global User Support along with our skilled business analysts and project managers.



### Solutions Engineering and Innovation

turns ideas into reality and drives new business capabilities through research and the rapid piloting of innovative solutions.



**Solutions Enablement** ensures digital services run smoothly and are robust, reliable, and secure across CGIAR and partners.



## Services available

### Enterprise Breeding System:

CGIAR's preferred breeding data management platform.

### Cloud Computing Resources:

Cloud engineering, infrastructure, and technical support all in one place.

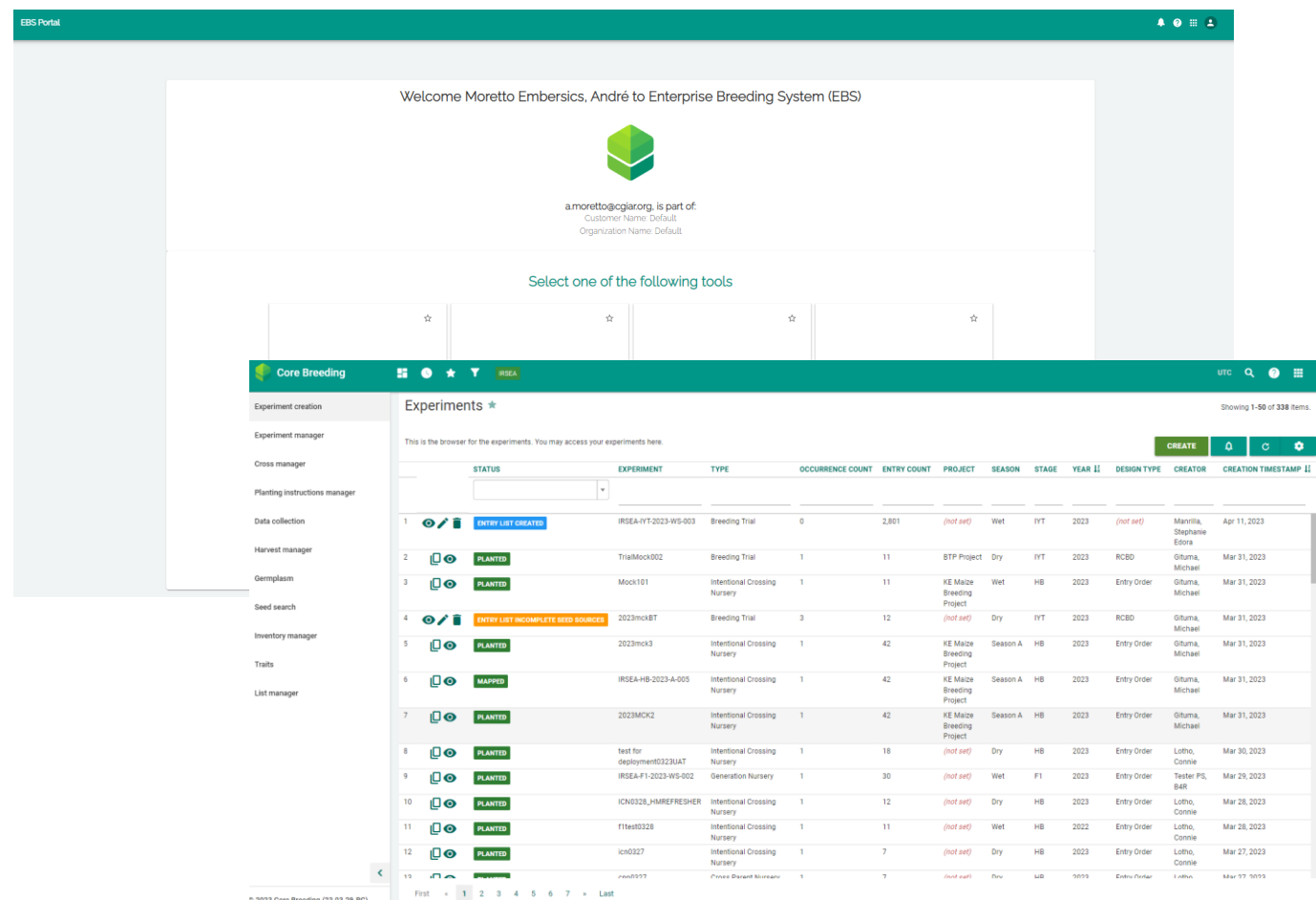
# What is Enterprise Breeding System (EBS)

EBS is a **breeding data management system** that is:

- Fit-for-purpose
- Open-source
- License-free
- Cloud-based
- User-friendly

Enabling:

- End-to-end, breeding data flow
- All operational data to be stored in one single place
- Data sharing and network breeding



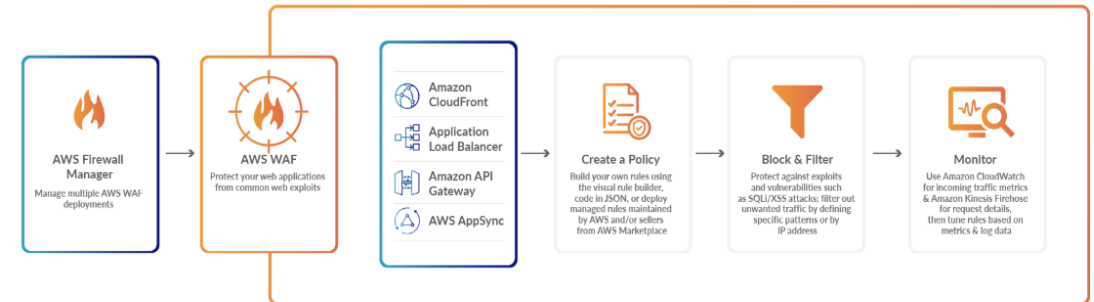
The screenshot displays the EBS Portal interface. At the top, a teal header bar contains the 'EBS Portal' label and user navigation icons. Below the header, a white card area shows a welcome message: 'Welcome Moretto Embersics, André to Enterprise Breeding System (EBS)'. A green hexagonal logo is centered below the message, followed by the text 'a.moretto@cgiar.org, is part of: Customer Name: Default, Organization Name: Default'. Below this, a section titled 'Select one of the following tools' contains four placeholder boxes with star icons. The main content area is titled 'Core Breeding' and features a sidebar with navigation links: 'Experiment creation', 'Experiment manager', 'Cross manager', 'Planting instructions manager', 'Data collection', 'Harvest manager', 'Germplasm', 'Seed search', 'Inventory manager', 'Traits', and 'List manager'. The main panel displays a table of experiments with columns: STATUS, EXPERIMENT, TYPE, OCCURRENCE COUNT, ENTRY COUNT, PROJECT, SEASON, STAGE, YEAR, DESIGN TYPE, CREATOR, and CREATION TIMESTAMP. The table lists 12 experiments, including 'IRSEA-017-2023-W5-003', 'TrialMock002', 'Mock101', '2023MockBT', '2023Mock3', 'IRSEA-HB-2023-A-005', '2023MCK2', 'test for deployment0223UAT', 'IRSEA-F1-2023-W5-002', 'ICN0328\_HMREFRESHER', 'F1test0328', and 'ICN0327'. Each row includes icons for actions like 'ENTRY LIST CREATED', 'PLANTED', 'ENTRY LIST INCOMPLETE SEED SOURCES', and 'MAPPED'. The footer of the interface shows '© 2023 Core Breeding (23.03.29-RC)' and pagination controls.

# Enterprise system - Security

Single Sign on



Compliance with the organization's security policies and practices



Monthly security patches

01:12 **CB BrAPI (ebsproject/cb-brapi:25.01.13.175-DEV)**

#### Build Details

- ✓ Successful Build at 2025-01-13 09:12:19
- Git Branch: develop
- Changes by Maria Relliza Pasang (IRRI) <m.pasang@irri.org>

#### Test Summary

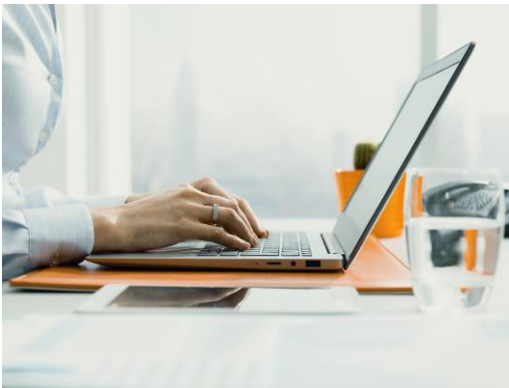
- Trivy test: 0 critical, 27 high
- Vulnerabilities:
  - HIGH: ncurses-bin (CVE-2021-39537)
  - HIGH: ncurses-base (CVE-2021-39537)
  - HIGH: libtinfo6 (CVE-2021-39537)
- Unit tests (40.99%): 37 passed, 0 failed


#### EBS Core Breeding Deployment Updates

EBS Core Breeding services were successfully deployed to EBS DEV ECS

- CB-API: 25.01.10.1159-DEV
- CB-DB: 25.01.10.977-DEV-liquibase
- CB-UI: 25.01.13.2505-DEV
- CB-Workers: 25.01.10.376-DEV
- CB-BrAPI: 25.01.13.175-DEV

# Enterprise System - Authentication





## Enterprise Breeding System

Sign in with your corporate ID

CIMMYTAD

CGIARAD


or

Sign in with your email and password

Email

Password

Sign in with your social account

 Continue with Google

Sign in

We won't post to any of your accounts without asking first

# Enterprise System - Authorization



Organizational unit

---> unit members

-----> Role within the unit

## Basic Information

### Organization

CIMMYT

### Unit Name

CIMMYT Mexico Maize  
Molecular Laboratory

### Unit Abbreviation

LAM

### Unit Type

Service Unit

### Crop

Maize

### Address

Mexico-Veracruz, El Batan  
Km. 45, 56237 Mex. , 9999 R  
Mexico, Mexico

## Service to Provider

### Service Type

Genotyping Analysis1

### Forms Available

CIMMYT Request Genotyping Service

### Workflow Services

Shipment Outgoing CIMMYT

## Members

Contact	Role
Apolinario, Ricardo Jr	Lab Manager
Rojas Olivares, Jorge Alberto	Admin
Dreher, Kate	Admin
Moreno, Juan Carlos	Lab Manager
Bashyal, Asmita	SM Admin
Zavala Martinez, Fernando	Lab Manager
Hudson, Phil	Unit Leader
Lacambra, Jessa Niña	Admin
Mutesi, Irene Peace Musoke	Lab Manager
Musoke, Irene Mutesi	CB User

# Administration tools



Core System

- Global Settings
- User Management
- CRM
- Printout
- Workflow Management
- Email Template
- Place Manager
- Organizational Units

<input type="checkbox"/>		Organization
<input type="checkbox"/>		IRRI
<input type="checkbox"/>		IRRI
<input type="checkbox"/>		CIMMYT
<input type="checkbox"/>		CIMMYT
<input type="checkbox"/>		IRRI

Core System

- Global Settings
- User Management
- CRM
- Printout
- Workflow Management
- Email Template
- Place Manager
- Organizational Units

## User Management

Ability to create and manage users and user roles.

USERS | Registers

ROLES

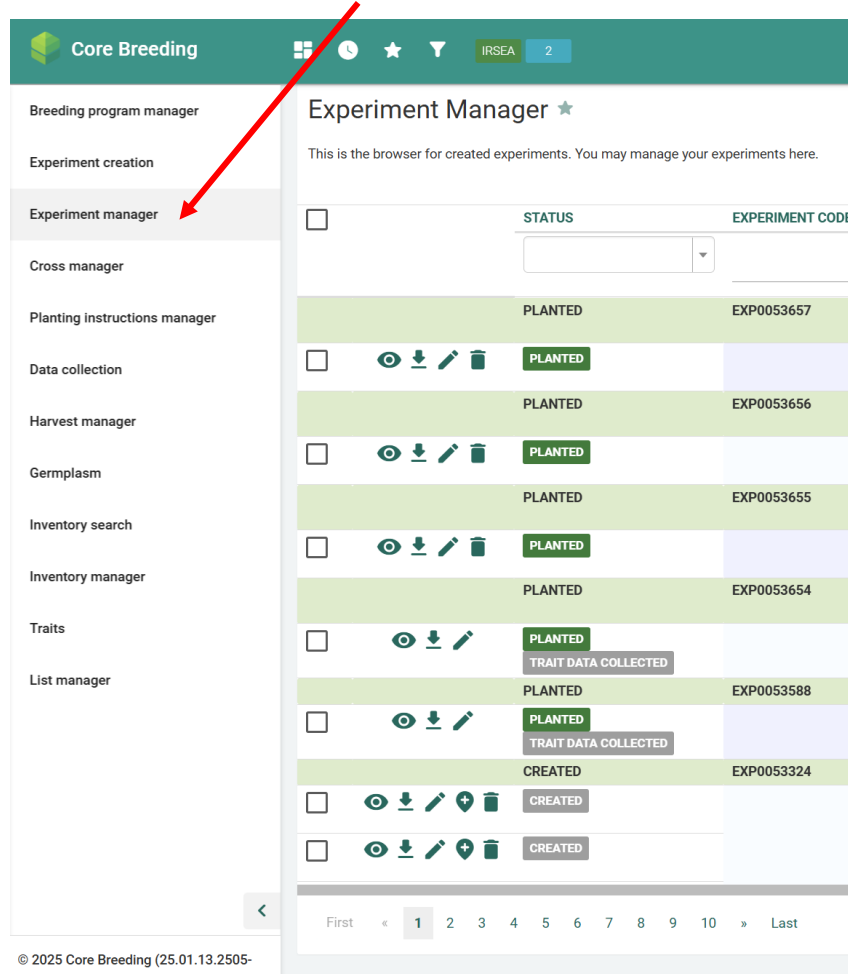
SECURITY RULES

<input type="checkbox"/>		Status
		All
<input type="checkbox"/>		Active
<input type="checkbox"/>		Active
<input type="checkbox"/>		Disabled



# Enterprise System - Role-based access control

## BREEDER – permissions to all tools



**Core Breeding** | IRSEA | 2

**Experiment Manager** ★

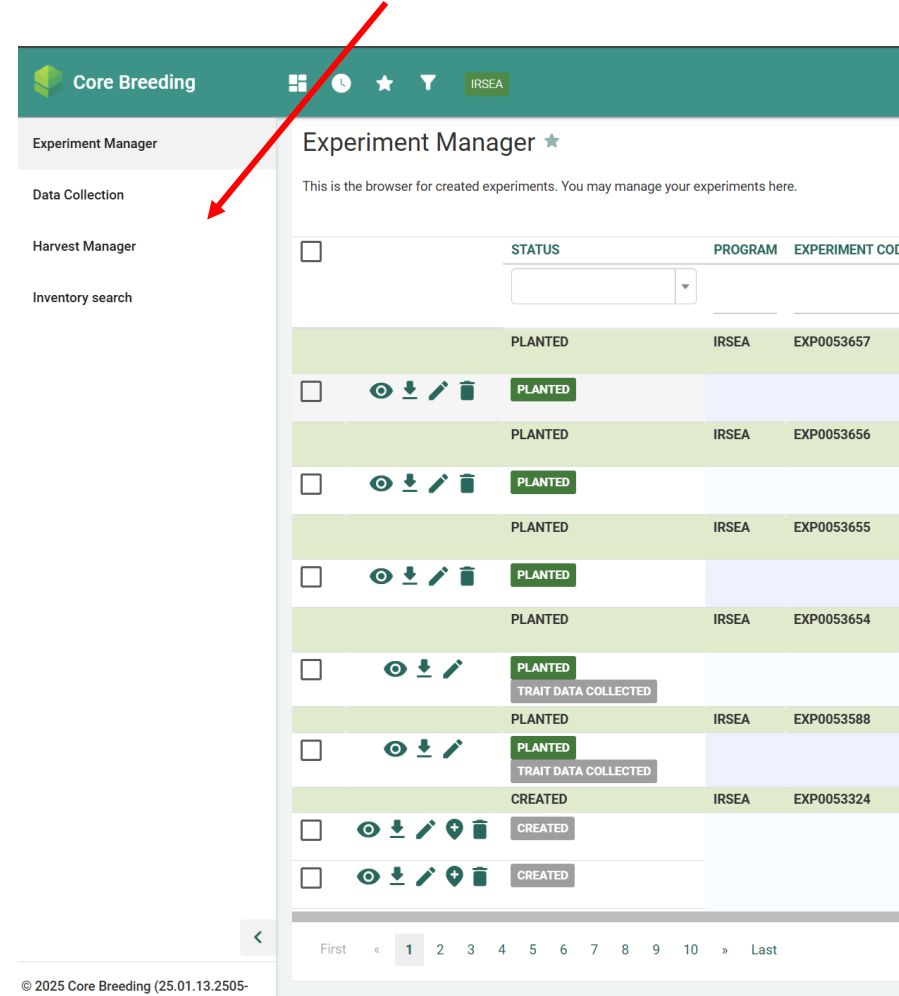
This is the browser for created experiments. You may manage your experiments here.

	STATUS	EXPERIMENT CODE
<input type="checkbox"/>	PLANTED	EXP0053657
<input type="checkbox"/>	PLANTED	EXP0053656
<input type="checkbox"/>	PLANTED	EXP0053655
<input type="checkbox"/>	PLANTED	EXP0053654
<input type="checkbox"/>	PLANTED TRAIT DATA COLLECTED	EXP0053588
<input type="checkbox"/>	PLANTED TRAIT DATA COLLECTED	EXP0053324
<input type="checkbox"/>	CREATED	
<input type="checkbox"/>	CREATED	

First « 1 2 3 4 5 6 7 8 9 10 » Last

© 2025 Core Breeding (25.01.13.2505-

## TECHNICIAN – permissions to some of the tools



**Core Breeding** | IRSEA

**Experiment Manager** ★

This is the browser for created experiments. You may manage your experiments here.

	STATUS	PROGRAM	EXPERIMENT COD
<input type="checkbox"/>	PLANTED	IRSEA	EXP0053657
<input type="checkbox"/>	PLANTED	IRSEA	EXP0053656
<input type="checkbox"/>	PLANTED	IRSEA	EXP0053655
<input type="checkbox"/>	PLANTED	IRSEA	EXP0053654
<input type="checkbox"/>	PLANTED TRAIT DATA COLLECTED	IRSEA	EXP0053588
<input type="checkbox"/>	PLANTED TRAIT DATA COLLECTED	IRSEA	EXP0053324
<input type="checkbox"/>	CREATED		
<input type="checkbox"/>	CREATED		

First « 1 2 3 4 5 6 7 8 9 10 » Last

© 2025 Core Breeding (25.01.13.2505-



# Enterprise System – Network breeding



The owner of the experiment can grant permissions to collaborators

Core Breeding

IRSEA

Experiment Permissions

This is the browser for experiment permissions. You may manage your permissions here.

STATUS

EXPERIMENT NAME

EXPERIMENT STEWARD

OCCURRENCE

COUNTRY

PLANTED

TRAIT DATA COLLECTED

TRAIT DATA QUALITY CHECKED

IRSEA-BRE-2024-DS-007

Sumague, Eug

PLANTED

TRAIT DATA COLLECTED

TRAIT DATA QUALITY CHECKED

IRSEA-BRE-2024-WS-016

Lagare, Jack

PLANTED

TRAIT DATA COLLECTED

TRAIT DATA QUALITY CHECKED

IRSEA-F1-2024-DS-002

Reyes, Micha

Share to Collaborators

Wheat Test Program (WTP)

Select P

READWRITE

ADD

Update Permissions

READWRITE

APPLY TO SELECTED

Showing 1-3 of 3 items.

Add new permissions using the **Share to Collaborators** menu.  
To **Update Permissions**, select the checkboxes and click **APPLY** to apply the desired permission.

IRSEA-BRE-2024-DS-007

IRSEA-BRE-2024-DS-007-001

PH

IRRIHQ

program

WTP

WRITE

IRSEA-BRE-2024-WS-016

IRSEA-BRE-2024-WS-016-001

PH

IRRIHQ

program

WTP

WRITE

IRSEA-F1-2024-DS-002

IRSEA-F1-2024-DS-002-001

PH

IRRIHQ

program

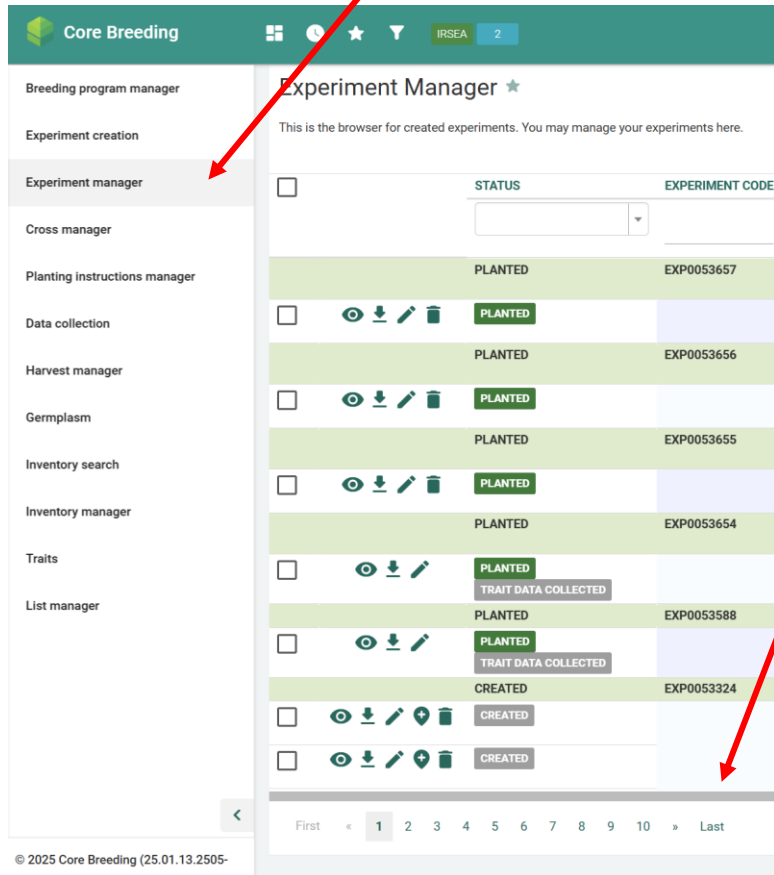
WTP

WRITE

CLOSE

# Enterprise System - Network breeding

**BREEDER & Owner – permissions to all tools and data**



Core Breeding

Breeding program manager

Experiment creation

Experiment manager

Cross manager

Planting instructions manager

Data collection

Harvest manager

Germplasm

Inventory search

Inventory manager

Traits

List manager

Experiment Manager

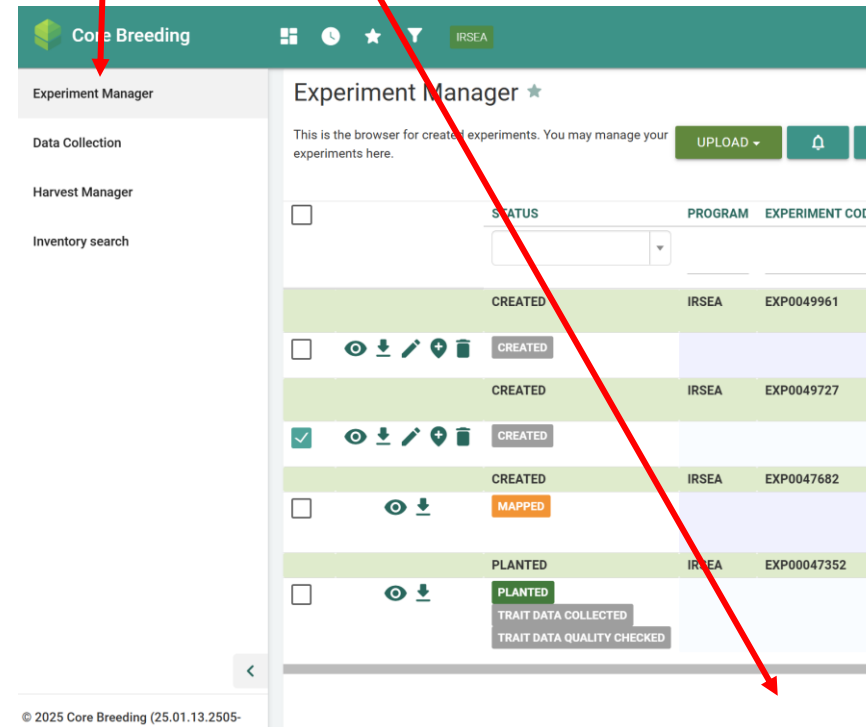
This is the browser for created experiments. You may manage your experiments here.

	STATUS	EXPERIMENT CODE
<input type="checkbox"/>	PLANTED	EXP0053657
<input type="checkbox"/>	PLANTED	EXP0053656
<input type="checkbox"/>	PLANTED	EXP0053655
<input type="checkbox"/>	PLANTED	EXP0053654
<input type="checkbox"/>	PLANTED	EXP0053588
<input type="checkbox"/>	PLANTED	EXP0053324
<input type="checkbox"/>	CREATED	
<input type="checkbox"/>	CREATED	

First < 1 2 3 4 5 6 7 8 9 10 > Last

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**TECHNICIAN & collaborator– permissions to some of the tools and data that they have been given permission**



Core Breeding

Experiment Manager

Data Collection

Harvest Manager

Inventory search

Experiment Manager

This is the browser for created experiments. You may manage your experiments here.

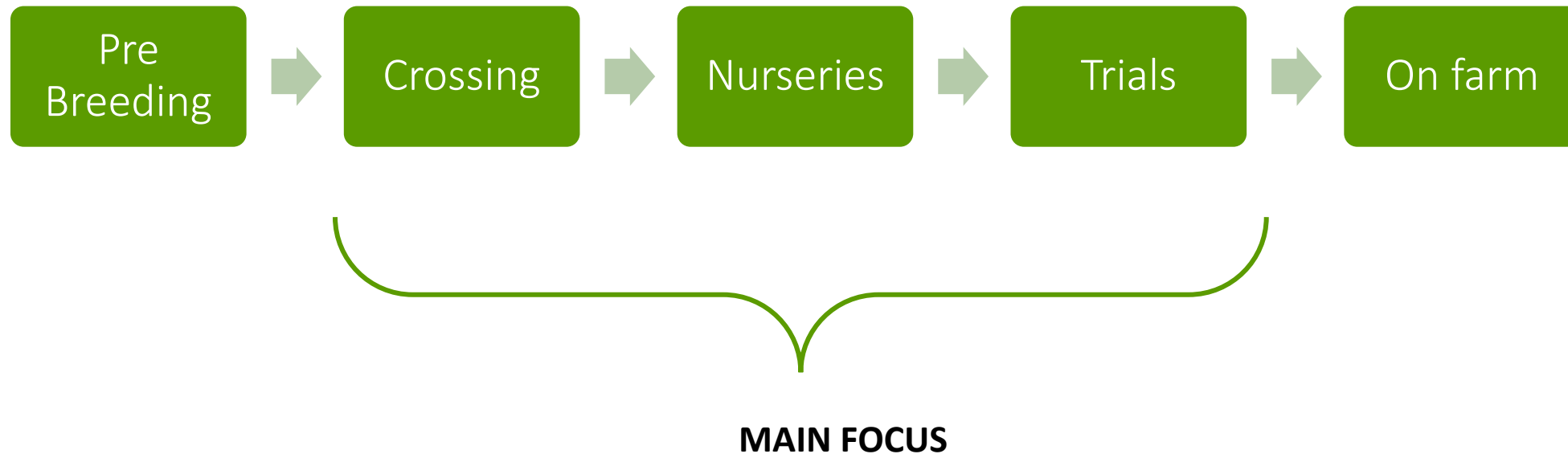
UPLOAD

	STATUS	PROGRAM	EXPERIMENT CODE
<input type="checkbox"/>	CREATED	IRSEA	EXP0049961
<input type="checkbox"/>	CREATED	IRSEA	EXP0049727
<input checked="" type="checkbox"/>	CREATED		
<input type="checkbox"/>	CREATED	IRSEA	EXP0047682
<input type="checkbox"/>	MAPPED		
<input type="checkbox"/>	PLANTED	IRSEA	EXP00047352
<input type="checkbox"/>	PLANTED		
<input type="checkbox"/>	TRAIT DATA COLLECTED		
<input type="checkbox"/>	TRAIT DATA QUALITY CHECKED		

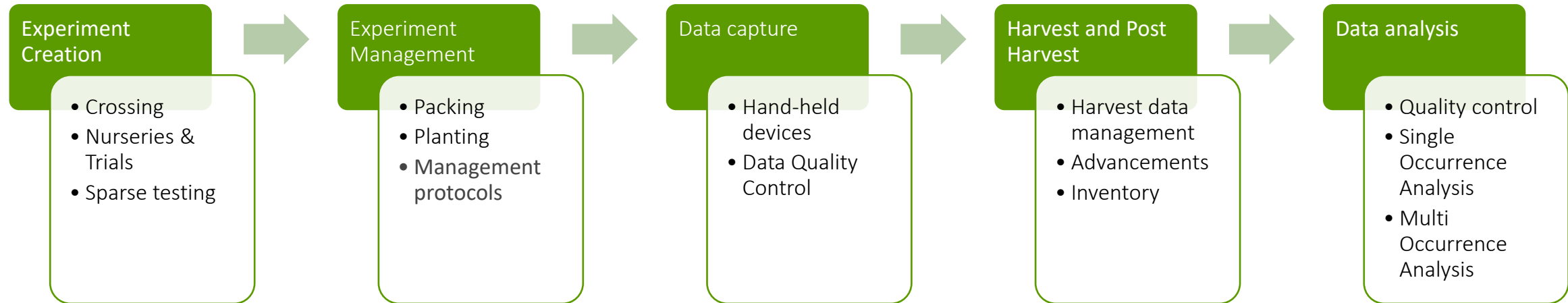
First < 1 2 3 4 5 6 7 8 9 10 > Last

© 2025 Core Breeding (25.01.13.2505-


# End to end processes – Breeding schema



# End to end processes – Breeding cycle



# Tools for the breeding programs - Core Breeding



Core Breeding

Breeding program manager

Experiment creation

Experiment manager

Cross manager

Planting instructions manager

Data collection

Harvest manager

Germplasm

Inventory search

Inventory manager

Traits

List manager

Experiment Manager

Showing 101-150 of 25,736 items.

No selected items.

UPLOAD

1

STATUS

EXPERIMENT CODE

EXPERIMENT

OCCURRENCE

SITE

FIELD

LOCATION

EXPERIMENT TYPE

STAGE

YEAR

SEAS

EXP0051114

IRSEA-IYT-2024-WS-062

Breeding Trial

IYT

2024

WS

IRSEA-IYT-2024-WS-062-001

IRRIHQ

(not set)

IRSEA-IYT-2024-WS-062-002

IRRIHQ

(not set)

EXP0051114

IRSEA-IYT-2024-WS-062

Breeding Trial

IYT

2024

WS

IRSEA-IYT-2024-WS-062-001

IRRIHQ

(not set)

IRSEA-IYT-2024-WS-062-002

IRRIHQ

(not set)

EXP0051114

IRSEA-IYT-2024-WS-062

Breeding Trial

IYT

2024

WS

IRSEA-IYT-2024-WS-062-001

IRRIHQ

(not set)

IRSEA-IYT-2024-WS-062-002

IRRIHQ

(not set)

EXP0051114

IRSEA-IYT-2024-WS-062

Breeding Trial

IYT

2024

WS

IRSEA-IYT-2024-WS-062-001

IRRIHQ

(not set)

IRSEA-IYT-2024-WS-062-002

IRRIHQ

(not set)

Inventory Manager

CREATE

UPDATE

SEED TRANSFER

This is the browser for all uploaded seed and package update transactions. Transactions across all programs are displayed.

TEMPLATE

FILE STATUS

FILE NAME

SEED COUNT

PACKAGE COUNT

1

ESD\_5803\_UPDATE\_PACKAGE\_TEMPLATE\_MAIZE\_KE

(not set)

3

2

FOR\_VOLUMEUPDATE\_UPDATE\_PACKAGE\_TEMPLATE\_RICE\_IRSEA\_inactive

(not set)

1

3

FOR\_VOLUMEUPDATE\_UPDATE\_PACKAGE\_TEMPLATE\_RICE\_IRSEA

(not set)

3

4

GENOTYPE\_DATA\_SAMPLE\_LIST\_PPT\_1024\_UPDATE\_PACKAGE\_TEMPLATE\_RICE\_IRSEA

(not set)

160

5

TEST\_PKG\_DATA\_LIST\_UPDATE\_PACKAGE\_TEMPLATE\_RICE\_IRSEA\_1\_

(not set)

5

6

TEST\_PKG\_DATA\_LIST\_UPDATE\_PACKAGE\_TEMPLATE\_RICE\_IRSEA

(not set)

(not set)

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# Tools for the breeding programs - Data Analysis



Phenotypic Data Manager

Analysis Request Manager

Molecular Data Analysis

## Phenotypic Data Manager » TestingData1\_NewCB-UI-001

Use this tool to curate experiment data in preparation for analysis

Occurrence:

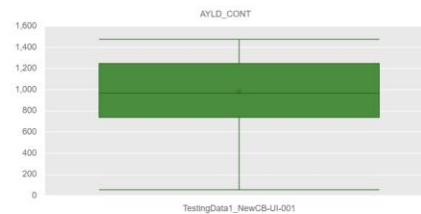
Table **Box Plot** Histogram Scatter Plot Heatmap

This is the browser to view data in the form of box plots. Select at least one trait below. You can interact with the data by hovering over specific points on the graph.

Trait(s):

AYLD\_CONT ☒

☒ Quality Checked



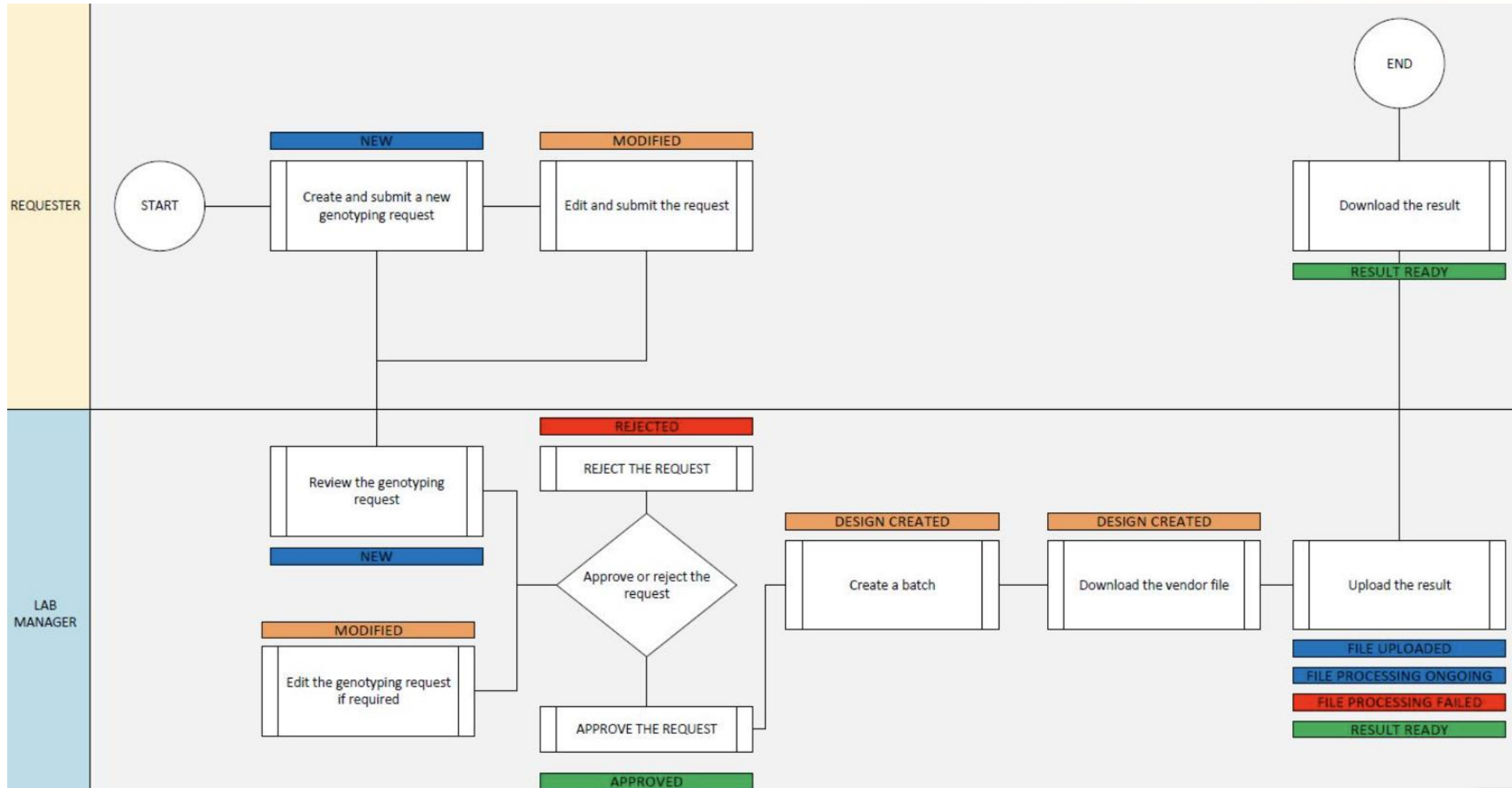
## Analysis Request Manager

Use the browser below to view your analysis requests.

#		Request Name <span>↑↓</span>	Jobs <span>↑↓</span>	Status <span>↑↓</span>	Analysis Type <span>↑↓</span>
1	<input type="checkbox"/>	Analysis Request #1	Multiple (3)	<input type="button" value="Open"/>	single-occurrence
2	<input type="checkbox"/>	Analysis Request #3	Multiple (3)	<input type="button" value="Closed"/>	single-occurrence
			1	<input type="button" value="Error"/>	
	<input type="checkbox"/>		2	<input type="button" value="Void"/>	
	<input type="checkbox"/>		3	<input type="button" value="Finalized"/>	

Breeding Analytics									
Molecular Data Analysis » RLB-20240819-1344									
Use the browser below to view your genotype data matrix.									
1 Parental Purity 2 View Results 3 Statistics									
#	Germplasm Code <span>↑↓</span>	Germplasm Name <span>↑↓</span>	Sample ID <span>↑↓</span>	Results <span>↑↓</span>	MSU7_6 <span>↑↓</span>	IRRI_SNP0868_CHR11_18936070 <span>↑↓</span>	IRRI_SNP0129_CHR02_2819095 <span>↑↓</span>	IRRI_SNP1068_WFP1 <span>↑↓</span>	IRRI_SNP0300_CH35636092 <span>↑↓</span>
1	GE000000024343	IR 108008-B-B-B	IRSEA24GS_003417	FALSE	G/G	T/T	G/G	G/G	G/G
2	GE000000024344	IR 108018-B-B-B	IRSEA24GS_003418	FALSE	G/G	T/T	G/G	G/G	G/G
3	GE000000024348	IR 107989-B-B-B	IRSEA24GS_003419	FALSE	G/G	T/T	G/G	G/G	G/G
4	GE000000024350	IR 107980-B-B-B	IRSEA24GS_003420	FALSE	G/G	T/T	G/G	G/G	G/G
5	GE000000024351	IR 107982-B-B-B	IRSEA24GS_003421	FALSE	G/G	T/T	G/G	G/G	G/G
6	GE000000024352	IR 107984-B-B-B	IRSEA24GS_003422	FALSE	G/G	T/T	G/G	G/G	G/G
7	GE000000024345	IR 107995-B-B-B	IRSEA24GS_003423	FALSE	A/A	C/C	G/G	G/G	G/G
8	GE000000024346	IR 108000-B-B-B	IRSEA24GS_003424	FALSE	A/A	C/C	G/G	G/G	G/G
9	GE000000024347	IR 107971-B-B-B	IRSEA24GS_003425	FALSE	A/A	C/C	G/G	G/G	G/G
10	GE000000024349	IR 107976-B-B-B	IRSEA24GS_003426	FALSE	A/A	C/C	G/G	G/G	G/G

# Tools for service teams - Genotyping



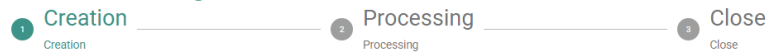


# Tools for service teams - Material Transfers

Workflows are customized to match the processes of the service teams






## IRRI

### Workflow Progress



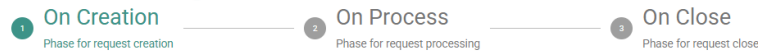
Shipment Name	
IRSEA-2024-12-11-0000718	
Status	Sender
Done	Team member, Koni
Requestor	Recipient
collab, Koni	collab, Koni
Program	Submitted On
Irrigated South-East Asia	2024-12-11

### Workflow history

-  General Information  
Completed on: 2024-12-11
-  Items  
Completed on: 2024-12-11
-  Documents  
Completed on: 2024-12-11
-  SUBMIT  
Completed on: 2024-12-11
-  Process Shipment  
Completed on: 2024-12-11






## CIMMYT

### Workflow Progress

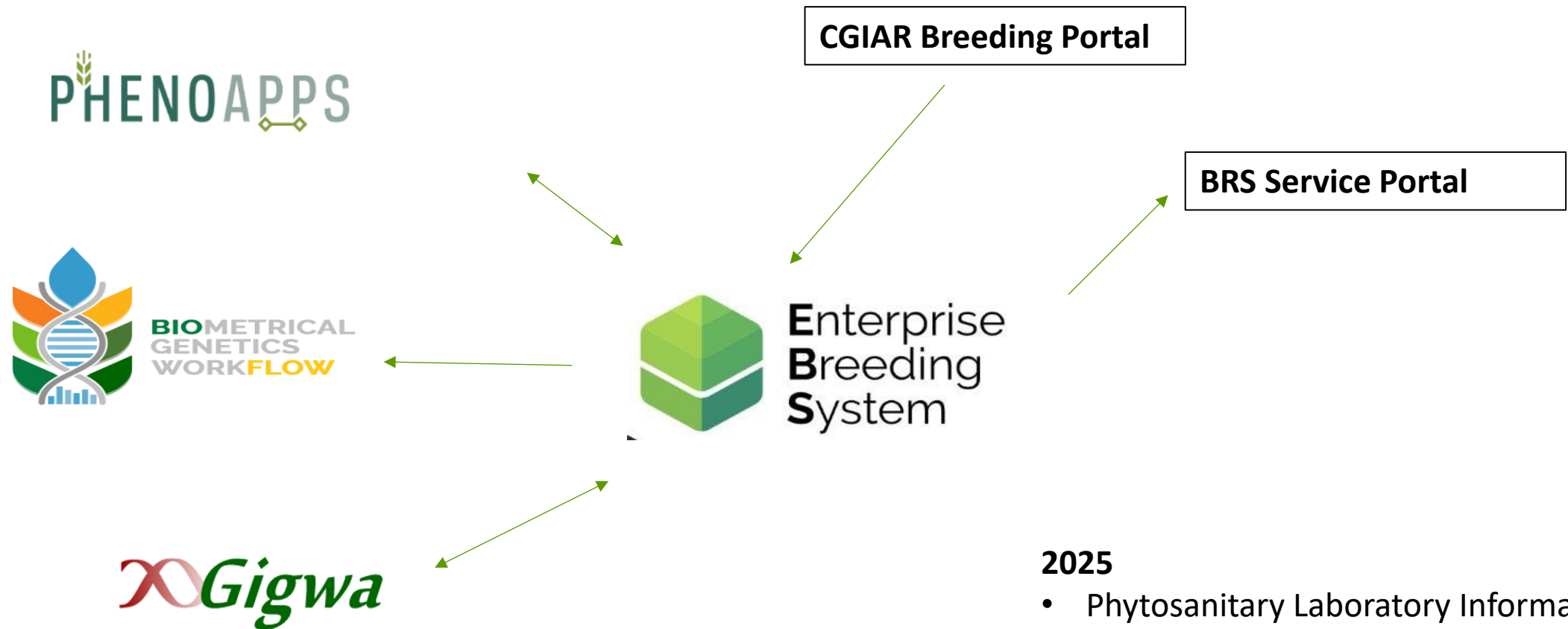


Shipment Name	
BW-CIMMYT-2024-10-18-0000657	
Status	Sender
Processing Completed	Cooperator A, IWIN
Requestor	Recipient
ABLE.80-0&, CLARE % JOY !	Roselyn, Cornor
Program	Submitted On
BW Wheat Breeding Program	2024-10-18

### Workflow history

-  Basic Information  
Completed on: 2024-10-18
-  Occurrences  
Completed on: 2024-10-18
-  Documents  
Completed on: 2024-10-18
-  Submit Request  
Completed on: 2024-10-18
-  Send to Phytosanitary Review  
Completed on: 2024-10-18

# Interoperability with systems and tools



**2025**

- Phytosanitary Laboratory Information System
- High Throughput Phenotyping

# Some of the latest new tools and improvements

- Statistical designs - Enabled Sparse testing
- New Molecular Analytics workflows
  - Parental Purity & Hybridity testing (F1 verification)
- Interoperability to BioFlow
- Material transfers
  - Outgoing shipments for IRRI and CIMMYT
- Digitalize all data capture
  - Data transfer (BrAPI) with Fieldbook
  - Post harvest data collection
    - Utilization of barcodes and readers
    - Data interfaces to moisture meter and scale
- Enabled 10 new crops
  - crossing and harvest methods
  - germplasm coding



# In plans for 2025

Enable new crops

Digitalize all data capture

- Enable timeseries & repeated measurements
- Enable upload of pictures
- More data interfaces to measurement devices
- Enable data capture on seed packages

Data analysis

- New molecular data analysis workflows
- Data transfer of analysis results from BioFlow to EBS

Data Migration tool

- Second version of the from BMS to EBS
- First version of the from BreedBase to EBS

# EBS Adoption & Usage

## Crops

- **Chickpea**
- **Cowpea**
- **Groundnut**
- **Finger millet**
- **Forages**
- **Groundnut**
- Maize
- **Pigeonpea**
- **Pearl millet**
- Rice
- **Sorghum**
- **Soybean**
- Wheat

## Customers

- Africa Rice
- **BRRI**
- **CIAT - Forages**
- **CIMMYT Dryland Crop Program**
- CIMMYT Global Maize Program
- CIMMYT Global Wheat Program
- IRRI
- **IITA – Legumes**
- IITA – Maize
- **PhilRice**

The green color indicates the new additions during 2024

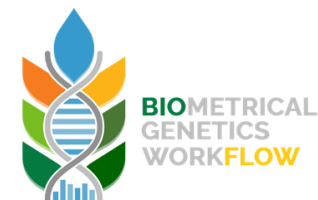
# Acknowledgement



## CGIAR-BRS leadership



## Digital Solutions staff members



# Final acknowledgement:



**Visit our website:**

[www.cgiar.org/initiatives/breeding-resources](http://www.cgiar.org/initiatives/breeding-resources)

**LinkedIn:**

CGIAR Genetic Innovation

**X / Twitter:**

@CGIARgenetic



**Order our services through our Service Request Portal:**

<https://cgiar-service-portal-prd.azurewebsites.net/register>



BILL & MELINDA  
GATES foundation



IITA  
Transforming African Agriculture

