iniav
Instituto Nacional de Investigação Agrária e Veterinária, I.P.

The implementation of GRIN-Global in Portugal

History, challenges, experiences and prospects

Prague
19 October 2022

Introductory note

- BPGV - The Portuguese Plant Genebank

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Introductory note

- BPGV - The Portuguese Plant Genebank

➢History

1977
- Collecting missions start

1982
- Morphological Characterization of Maize
- 1st Cold chambers

1983
- Maize Mediterranean Collection

1985
- Collecting Missions (Forages and Pastures)

1987
- Collecting Missions (Fibers)

1990
- Collecting Missions (Vegetables)

1992
- Digitization and Documentation

2000
- Collecting Missions Aromatic and Medicinal Plants and Crop Wild Relatives (CWR)

2002
- “In vitro” conservation
- Molecular biology

2004
- “on farm” conservation

2005
- Animal Genetic Resources

2012
- “In vitro” conservation of fruit trees

2013
- Cryo Conservation

2015
- GRIN Global public presentation
- National Plan for Plant Genetic Resources

2017
- Networking on National Collections

2020
- Data collection in digital format

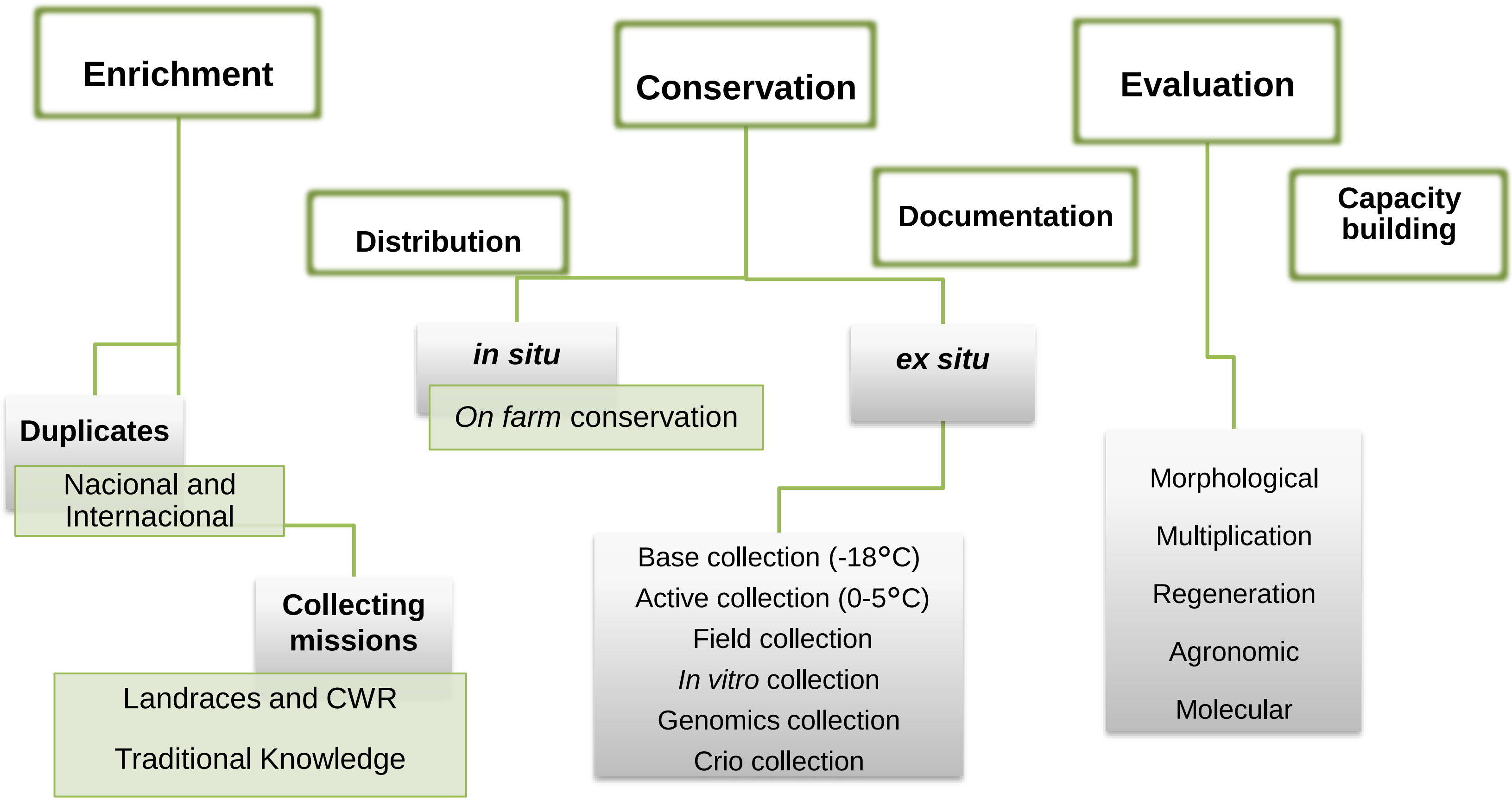
2021
- Implementation of barcodes

- *National Plant Germplasm System*

Introductory note

- BPGV - The Portuguese Plant Genebank

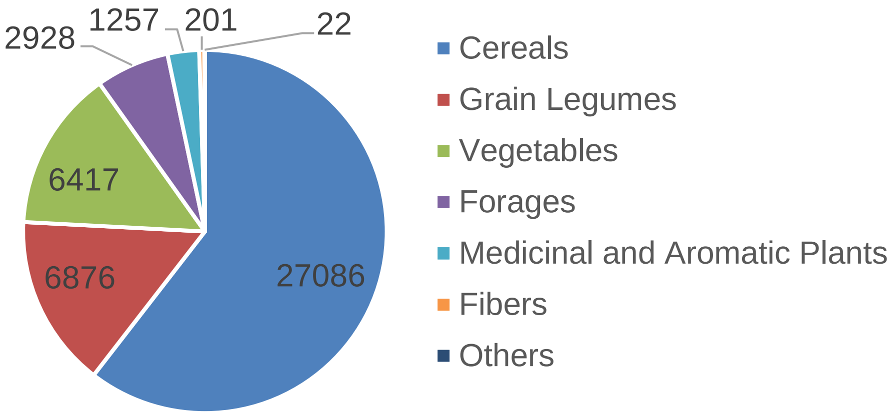
  ➢Main activities

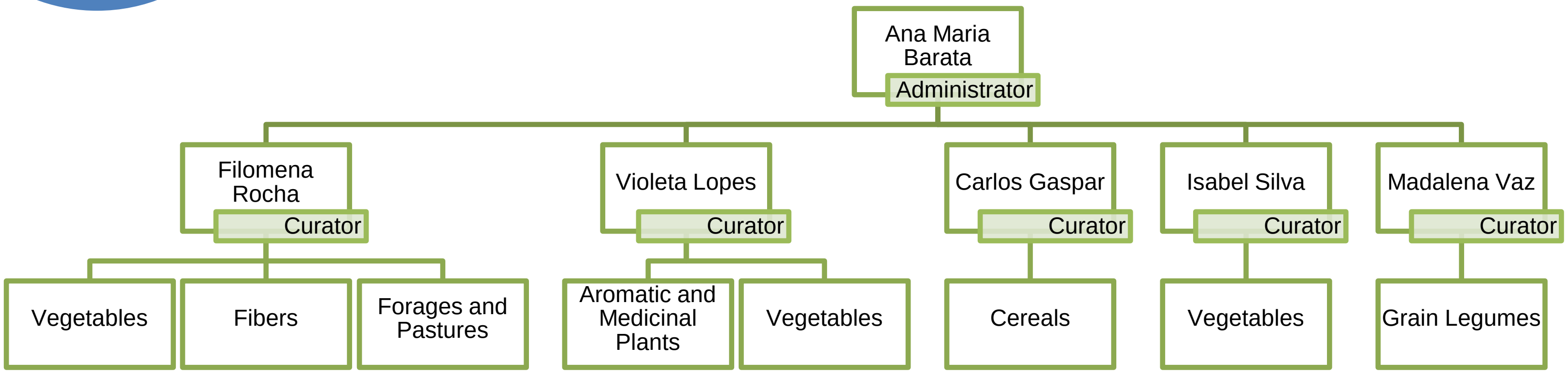


Introductory note

- BPGV - The Portuguese Plant Genebank

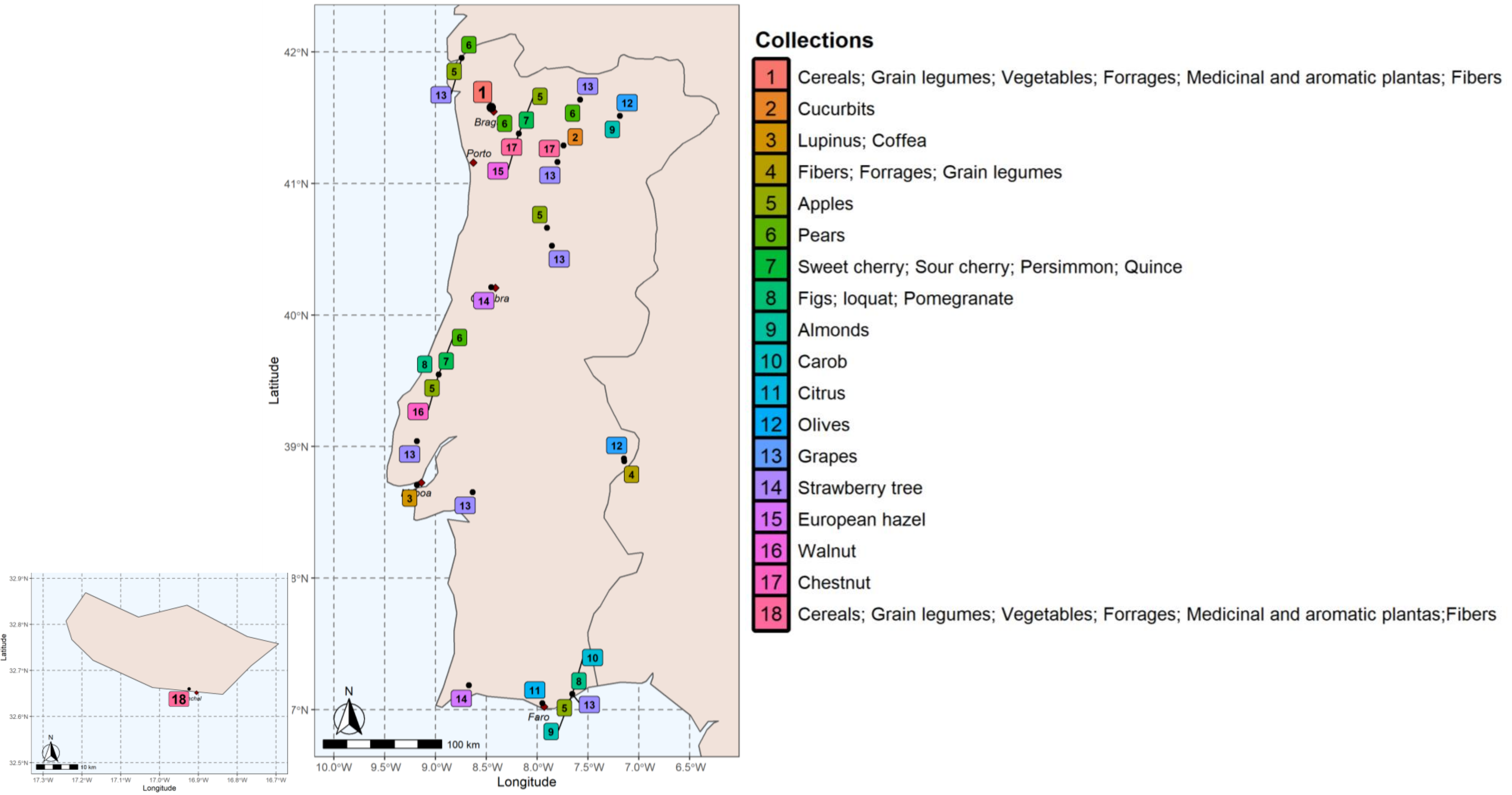
  ➢ Collections and curators





Introductory note

- The collections of Plant Genetic Resources for food and agriculture in Portugal



Introductory note

- National Plan for Plant Genetic Resources

<u>Strategic priorities</u>

➢To promote and strengthen the mid and long term *ex situ* conservation of cultivated species and CWR

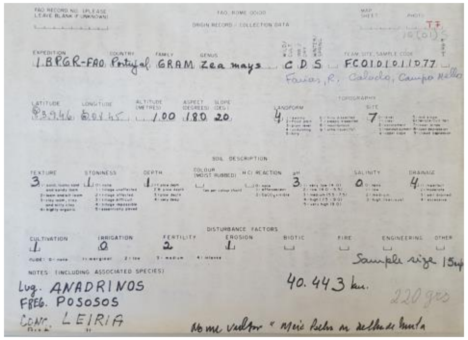
➢To promote and strengthen the *in situ* conservation of agrobiodiversity and CWR, in which the benefits of their usage, the farmer's rights and the access to PGR are the core guiding lines

➢To update and deliver the **National Germplasm system of PGR**

➢To **strengthen the documentation system** through a common platform.

Implementation of GRIN-Global

- Our starting point before GRIN-Global



➢All data was available in paper format (and still is nowadays)

➢Digitization of data started in **1992**

Since very early BPGV was committed to use informatics as a tool to help handle the large amounts of data and information that is typically generated in Genebanks.

During approximately two decades, data was stored using **Microsoft access, File Maker, Microsoft Excel and Microsoft Word**.

Despite the advantage and convenience of digital data availability, information was dispersed over different files and/or databases. We lacked <u>**integration and functionality.**</u>

➢First contact with GRIN-Global in **2011**

Implementation of GRIN-Global

- Initial steps with GRIN-Global

First training session to become familiar with the tool in 2011

➢ The main goal was to evaluate if the system had the capacity to accommodate all the genebanks needs.

➢ By the end of the session, the main functionalities of GG proved to support BPGV and ISOplexis needs, so **the implementation phase started**.

Braga, June 6th-10th, 2011

Funchal, June 13th-17th, 2011

Implementation of GRIN-Global

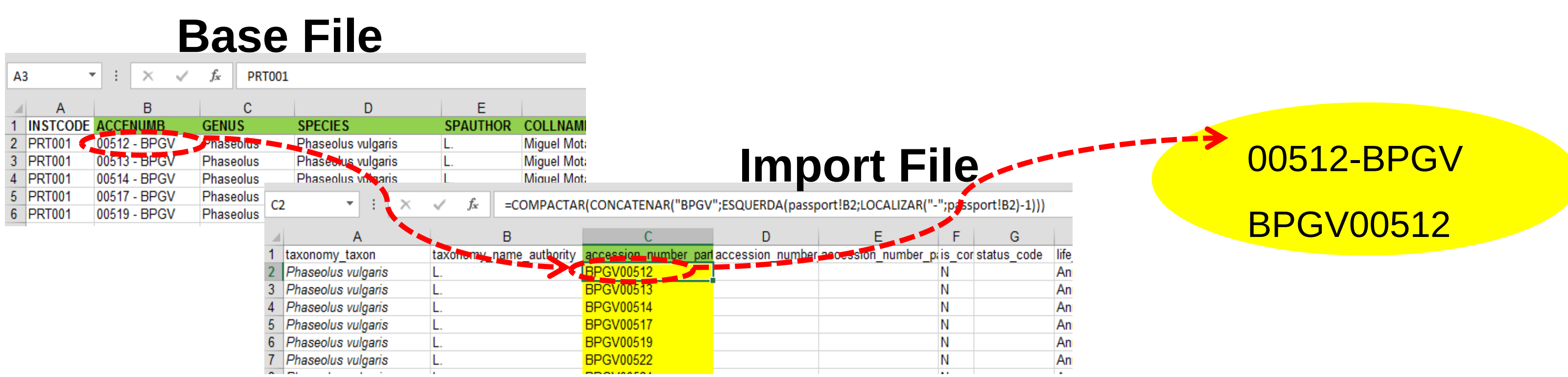
- Implementation phase and learning process

➢In the beginning: a team of 4 people (2 IT and 2 PGR) (1day/week)

➢Understanding the overall structure of the database and the relationship between different tables (**this was the hardest think to learn; took us long time**)

➢Conversion of data in various formats into Excel files

➢Rearrangement of data in Excel to satisfy the new structure of GRIN-Global database (**most painful task!**)



Implementation of GRIN-Global

- Implementation phase and learning process

➢Code values

- *Are enough for our reality? Create new ones?*

➢Development of taxonomy

- *Standard taxonomy available with GRIN-Global missed some of our species*

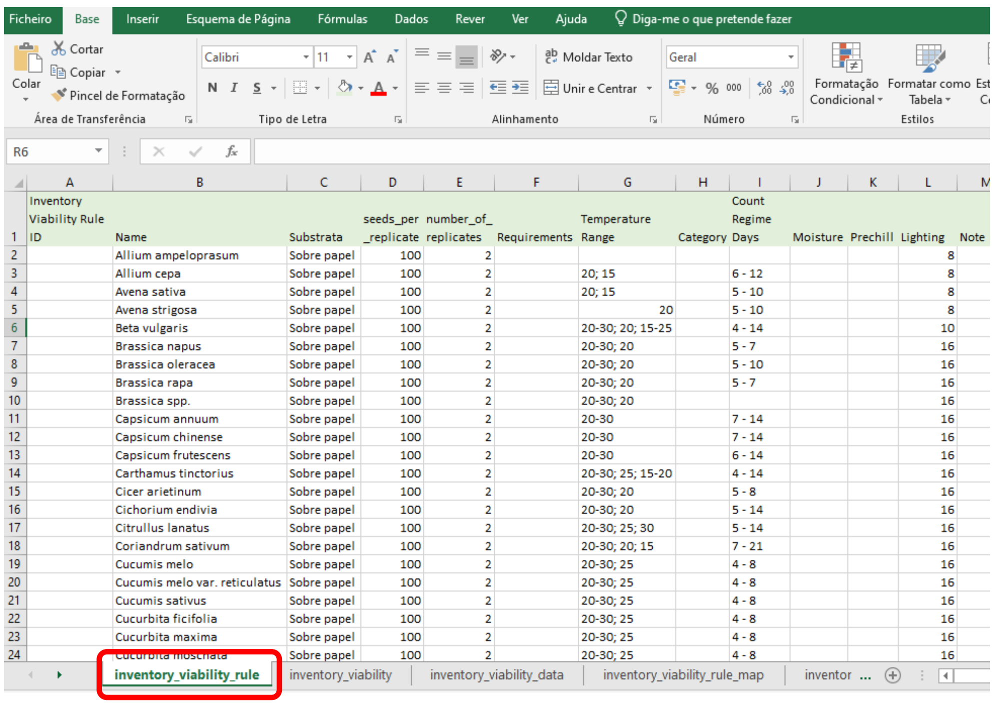
➢Passport data

- *Accessions vs samples/inventory*

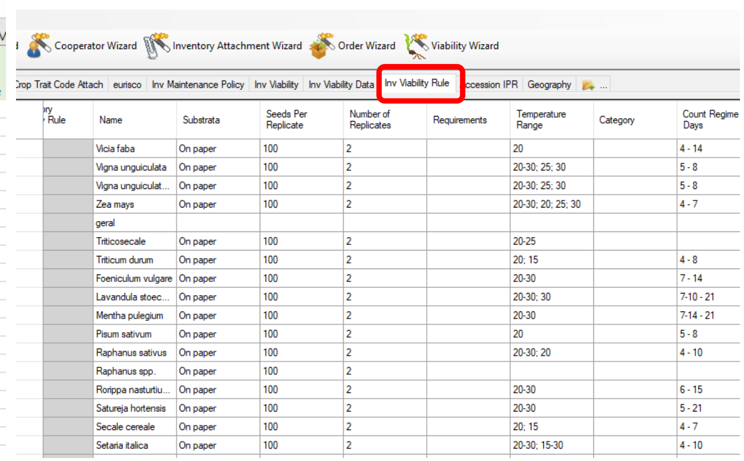
Implementation of GRIN-Global

- Implementation phase and learning process

  - ➢Viability



	Inventory Viability Rule ID	Name	Substrata	seeds_per_replicate	number_of_replicates	Requirements	Temperature Range	Category	Count Regime Days	Moisture	Prechill	Lighting	Note
2		Allium ampeloprasum	Sobre papel	100	2							8	
3		Allium cepa	Sobre papel	100	2		20; 15		6 - 12			8	
4		Avena sativa	Sobre papel	100	2		20; 15		5 - 10			8	
5		Avena strigosa	Sobre papel	100	2		20		5 - 10			8	
6		Beta vulgaris	Sobre papel	100	2		20-30; 20; 15-25		4 - 14			10	
7		Brassica napus	Sobre papel	100	2		20-30; 20		5 - 7			16	
8		Brassica oleracea	Sobre papel	100	2		20-30; 20		5 - 10			16	
9		Brassica rapa	Sobre papel	100	2		20-30; 20		5 - 7			16	
10		Brassica spp.	Sobre papel	100	2		20-30; 20					16	
11		Capsicum annuum	Sobre papel	100	2		20-30		7 - 14			16	
12		Capsicum chinense	Sobre papel	100	2		20-30		7 - 14			16	
13		Capsicum frutescens	Sobre papel	100	2		20-30		6 - 14			16	
14		Carthamus tinctorius	Sobre papel	100	2		20-30; 25; 15-20		4 - 14			16	
15		Cicer arietinum	Sobre papel	100	2		20-30; 20		5 - 8			16	
16		Cichorium endivia	Sobre papel	100	2		20-30; 20		5 - 14			16	
17		Citrullus lanatus	Sobre papel	100	2		20-30; 25; 30		5 - 14			16	
18		Coriandrum sativum	Sobre papel	100	2		20-30; 20; 15		7 - 21			16	
19		Cucumis melo	Sobre papel	100	2		20-30; 25		4 - 8			16	
20		Cucumis melo var. reticulatus	Sobre papel	100	2		20-30; 25		4 - 8			16	
21		Cucumis sativus	Sobre papel	100	2		20-30; 25		4 - 8			16	
22		Cucurbita ficifolia	Sobre papel	100	2		20-30; 25		4 - 8			16	
23		Cucurbita maxima	Sobre papel	100	2		20-30; 25		4 - 8			16	
24		Cucurbita moschata	Sobre papel	100	2		20-30; 25		4 - 8			16	

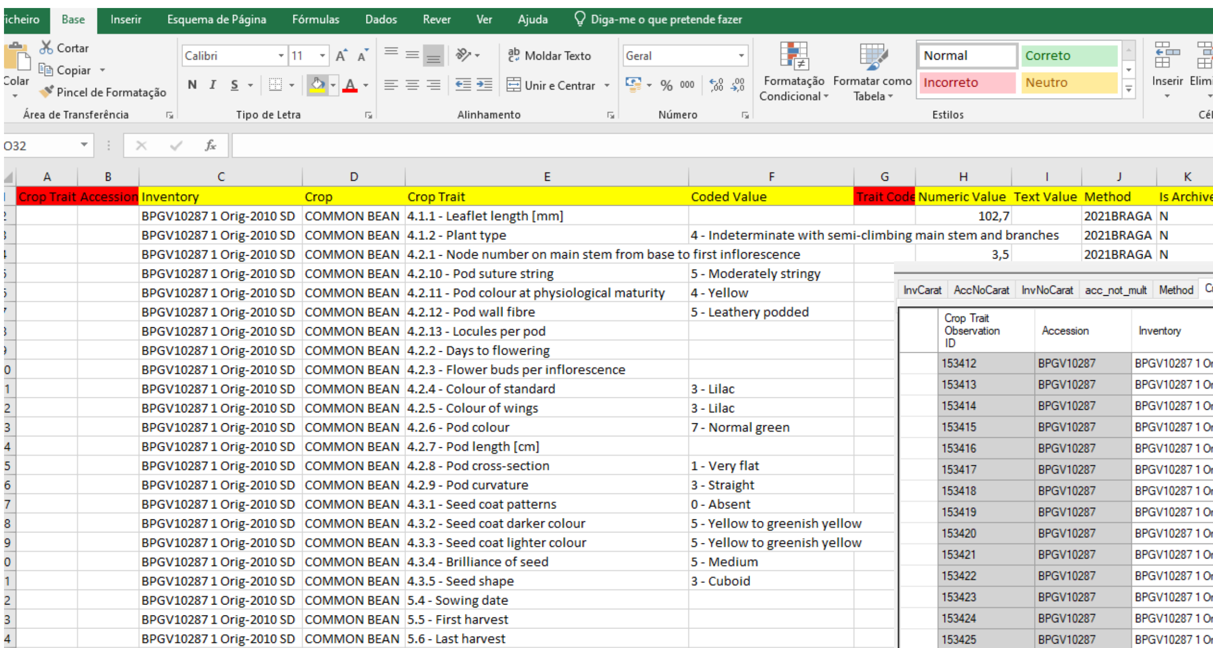


Name	Substrata	Seeds Per Replicate	Number of Replicates	Requirements	Temperature Range	Category	Count Regime Days
Vicia faba	On paper	100	2		20		4 - 14
Vigna unguiculata	On paper	100	2		20-30; 25; 30		5 - 8
Vigna unguiculat...	On paper	100	2		20-30; 25; 30		5 - 8
Zea mays	On paper	100	2		20-30; 20; 25; 30		4 - 7
geral							
Triticosecale	On paper	100	2		20-25		
Triticum durum	On paper	100	2		20; 15		4 - 8
Foeniculum vulgare	On paper	100	2		20-30		7 - 14
Lavandula stoec...	On paper	100	2		20-30; 30		7-10 - 21
Mentha pulegium	On paper	100	2		20-30		7-14 - 21
Pisum sativum	On paper	100	2		20		5 - 8
Raphanus sativus	On paper	100	2		20-30; 20		4 - 10
Raphanus spp.	On paper	100	2				
Rorippa nasturtiu...	On paper	100	2		20-30		6 - 15
Satureja hortensis	On paper	100	2		20-30		5 - 21
Secale cereale	On paper	100	2		20; 15		4 - 7
Setaria italica	On paper	100	2		20-30; 15-30		4 - 10

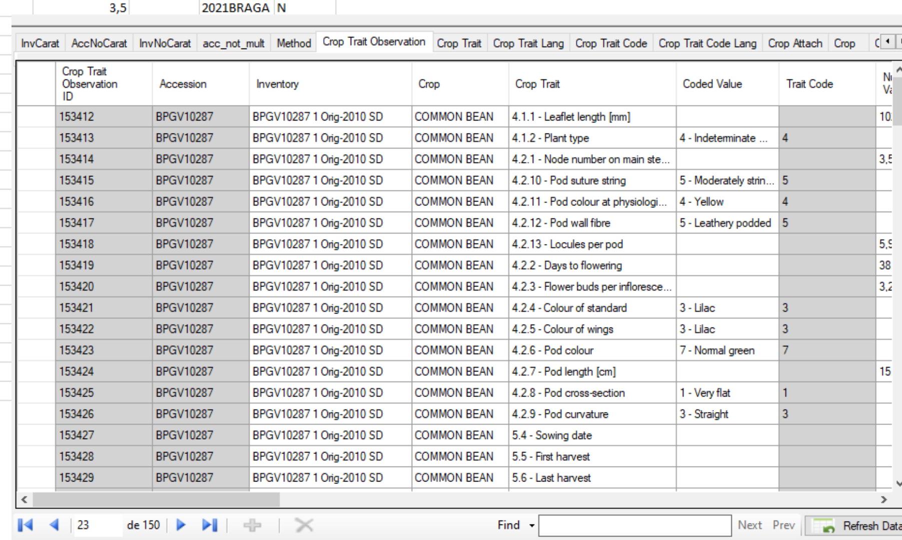
Implementation of GRIN-Global

- Implementation phase and learning process

  ➢CROPs and species descriptors



	A	B	C	D	E	F	G	H	I	J	K
1	Crop Trait	Accession	Inventory	Crop	Crop Trait	Coded Value	Trait Code	Numeric Value	Text Value	Method	Is Archive
2			BPGV10287 1 Orig-2010 SD	COMMON BEAN	4.1.1 - Leaflet length [mm]			102,7		2021BRAGA	N
3			BPGV10287 1 Orig-2010 SD	COMMON BEAN	4.1.2 - Plant type	4 - Indeterminate with semi-climbing main stem and branches				2021BRAGA	N
4			BPGV10287 1 Orig-2010 SD	COMMON BEAN	4.2.1 - Node number on main stem from base to first inflorescence			3,5		2021BRAGA	N
5			BPGV10287 1 Orig-2010 SD	COMMON BEAN	4.2.10 - Pod suture string	5 - Moderately stringy					
6			BPGV10287 1 Orig-2010 SD	COMMON BEAN	4.2.11 - Pod colour at physiological maturity	4 - Yellow					
7			BPGV10287 1 Orig-2010 SD	COMMON BEAN	4.2.12 - Pod wall fibre	5 - Leathery podded					
8			BPGV10287 1 Orig-2010 SD	COMMON BEAN	4.2.13 - Locules per pod						
9			BPGV10287 1 Orig-2010 SD	COMMON BEAN	4.2.2 - Days to flowering						
10			BPGV10287 1 Orig-2010 SD	COMMON BEAN	4.2.3 - Flower buds per inflorescence						
11			BPGV10287 1 Orig-2010 SD	COMMON BEAN	4.2.4 - Colour of standard	3 - Lilac					
12			BPGV10287 1 Orig-2010 SD	COMMON BEAN	4.2.5 - Colour of wings	3 - Lilac					
13			BPGV10287 1 Orig-2010 SD	COMMON BEAN	4.2.6 - Pod colour	7 - Normal green					
14			BPGV10287 1 Orig-2010 SD	COMMON BEAN	4.2.7 - Pod length [cm]						
15			BPGV10287 1 Orig-2010 SD	COMMON BEAN	4.2.8 - Pod cross-section	1 - Very flat					
16			BPGV10287 1 Orig-2010 SD	COMMON BEAN	4.2.9 - Pod curvature	3 - Straight					
17			BPGV10287 1 Orig-2010 SD	COMMON BEAN	4.3.1 - Seed coat patterns	0 - Absent					
18			BPGV10287 1 Orig-2010 SD	COMMON BEAN	4.3.2 - Seed coat darker colour	5 - Yellow to greenish yellow					
19			BPGV10287 1 Orig-2010 SD	COMMON BEAN	4.3.3 - Seed coat lighter colour	5 - Yellow to greenish yellow					
20			BPGV10287 1 Orig-2010 SD	COMMON BEAN	4.3.4 - Brilliance of seed	5 - Medium					
21			BPGV10287 1 Orig-2010 SD	COMMON BEAN	4.3.5 - Seed shape	3 - Cuboid					
22			BPGV10287 1 Orig-2010 SD	COMMON BEAN	5.4 - Sowing date						
23			BPGV10287 1 Orig-2010 SD	COMMON BEAN	5.5 - First harvest						
24			BPGV10287 1 Orig-2010 SD	COMMON BEAN	5.6 - Last harvest						



Crop Trait Observation ID	Accession	Inventory	Crop	Crop Trait	Coded Value	Trait Code	Numeric Value
153412	BPGV10287	BPGV10287 1 Orig-2010 SD	COMMON BEAN	4.1.1 - Leaflet length [mm]			10
153413	BPGV10287	BPGV10287 1 Orig-2010 SD	COMMON BEAN	4.1.2 - Plant type	4 - Indeterminate ...	4	
153414	BPGV10287	BPGV10287 1 Orig-2010 SD	COMMON BEAN	4.2.1 - Node number on main ste...			3,5
153415	BPGV10287	BPGV10287 1 Orig-2010 SD	COMMON BEAN	4.2.10 - Pod suture string	5 - Moderately strin...	5	
153416	BPGV10287	BPGV10287 1 Orig-2010 SD	COMMON BEAN	4.2.11 - Pod colour at physiologi...	4 - Yellow	4	
153417	BPGV10287	BPGV10287 1 Orig-2010 SD	COMMON BEAN	4.2.12 - Pod wall fibre	5 - Leathery podded	5	
153418	BPGV10287	BPGV10287 1 Orig-2010 SD	COMMON BEAN	4.2.13 - Locules per pod			5,
153419	BPGV10287	BPGV10287 1 Orig-2010 SD	COMMON BEAN	4.2.2 - Days to flowering			38
153420	BPGV10287	BPGV10287 1 Orig-2010 SD	COMMON BEAN	4.2.3 - Flower buds per infloresce...			3,
153421	BPGV10287	BPGV10287 1 Orig-2010 SD	COMMON BEAN	4.2.4 - Colour of standard	3 - Lilac	3	
153422	BPGV10287	BPGV10287 1 Orig-2010 SD	COMMON BEAN	4.2.5 - Colour of wings	3 - Lilac	3	
153423	BPGV10287	BPGV10287 1 Orig-2010 SD	COMMON BEAN	4.2.6 - Pod colour	7 - Normal green	7	
153424	BPGV10287	BPGV10287 1 Orig-2010 SD	COMMON BEAN	4.2.7 - Pod length [cm]			15
153425	BPGV10287	BPGV10287 1 Orig-2010 SD	COMMON BEAN	4.2.8 - Pod cross-section	1 - Very flat	1	
153426	BPGV10287	BPGV10287 1 Orig-2010 SD	COMMON BEAN	4.2.9 - Pod curvature	3 - Straight	3	
153427	BPGV10287	BPGV10287 1 Orig-2010 SD	COMMON BEAN	5.4 - Sowing date			
153428	BPGV10287	BPGV10287 1 Orig-2010 SD	COMMON BEAN	5.5 - First harvest			
153429	BPGV10287	BPGV10287 1 Orig-2010 SD	COMMON BEAN	5.6 - Last harvest			

Implementation of GRIN-Global

- Implementation phase and learning process

All these steps took several years but prepared the platform for our data

At the same time, we started loading all our data to the database, a process that was finished only recently

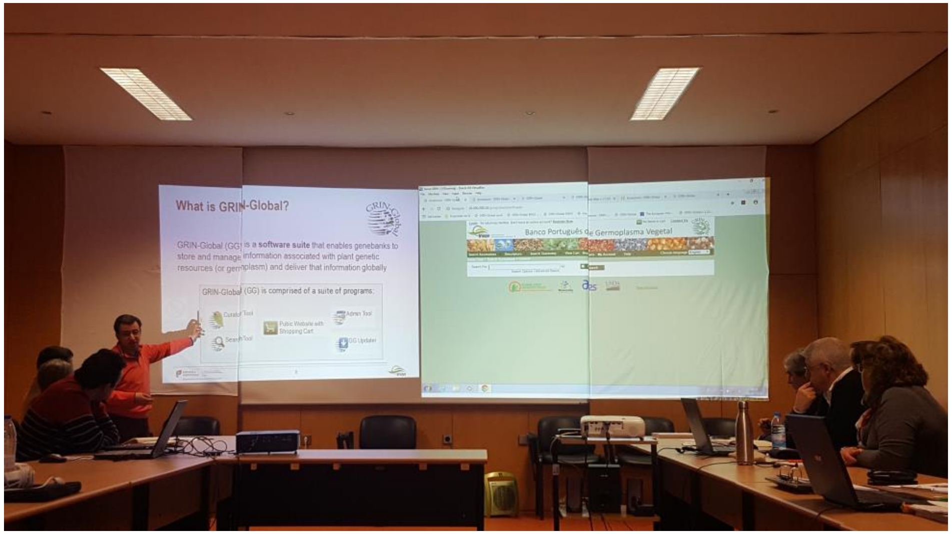
Implementation of GRIN-Global

- Implementation phase and learning process

  ➢International workshops and courses (Oman 2015, Prague 2016, Porto 2018, Prague 2022)

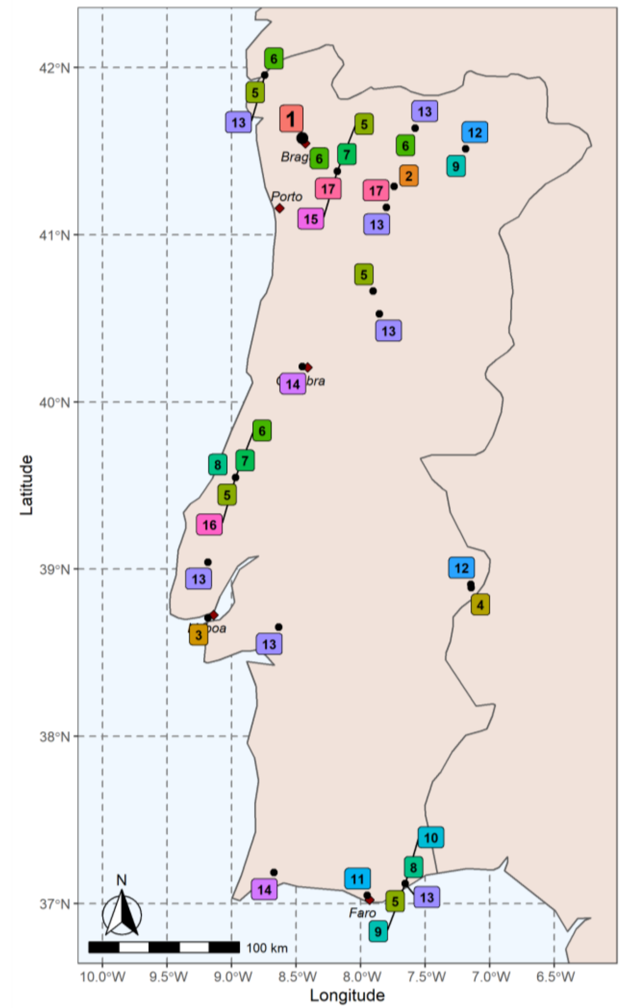
  ➢National workshops (2018 (1), 2019 (2))

  ➢Internal sessions for BPGV staff (100's over the past decade)



Implementation of GRIN-Global

- National Plant Germplasm System and broad adoption of GG



➢There are **9** institutions or research stations outside BPGV that hold unique collections of **23** different clonal species, in the field or in greenhouse.

➢All information regarding these collections is being integrated in GRIN-Global, to **deliver a National Inventory** of PGR in Portugal.

➢Data collection is centralized at BPGV to accelerate the process. Our objective is that curators outside BPGV can start using Curator tool to manage their collections right after the data collection process is finished.

Implementation of GRIN-Global

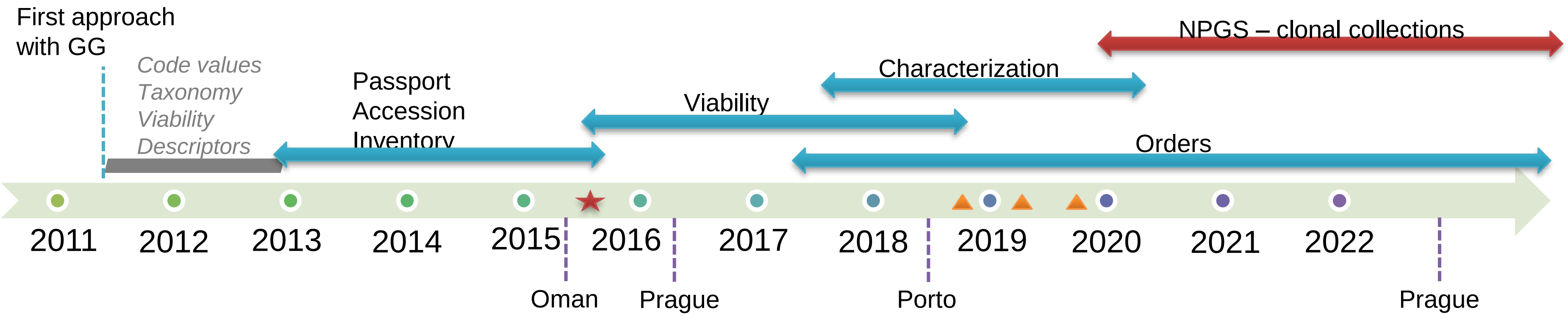
- What have we accomplished so far?

  - Regarding BPGV collections, all data was migrated to GG and everything is up to date. <u>This includes passport, inventory, characterization and viability data.</u>

  - All curators at BPGV fully use GG for the management of their collections.

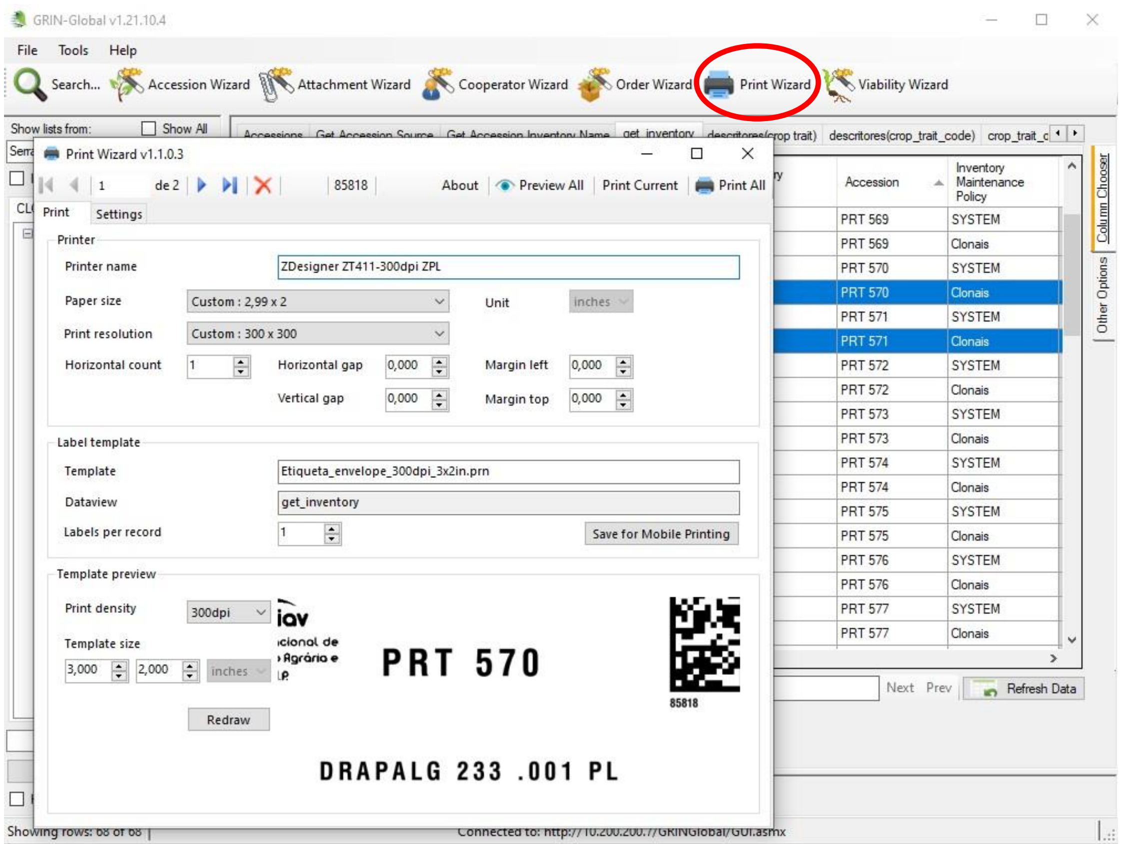
  - The handling of orders is already done using GG (in curator tool, not yet using web page)

  - Regarding the NPGS, information from 10 species (out of 23) has already migrated.



Implementation of GRIN-Global

- What have we accomplished so far?
  - ➢The printing of barcodes using GG (print wizard)



Implementation of GRIN-Global

- What have we accomplished so far?

➢ *Digital First!* Mentality

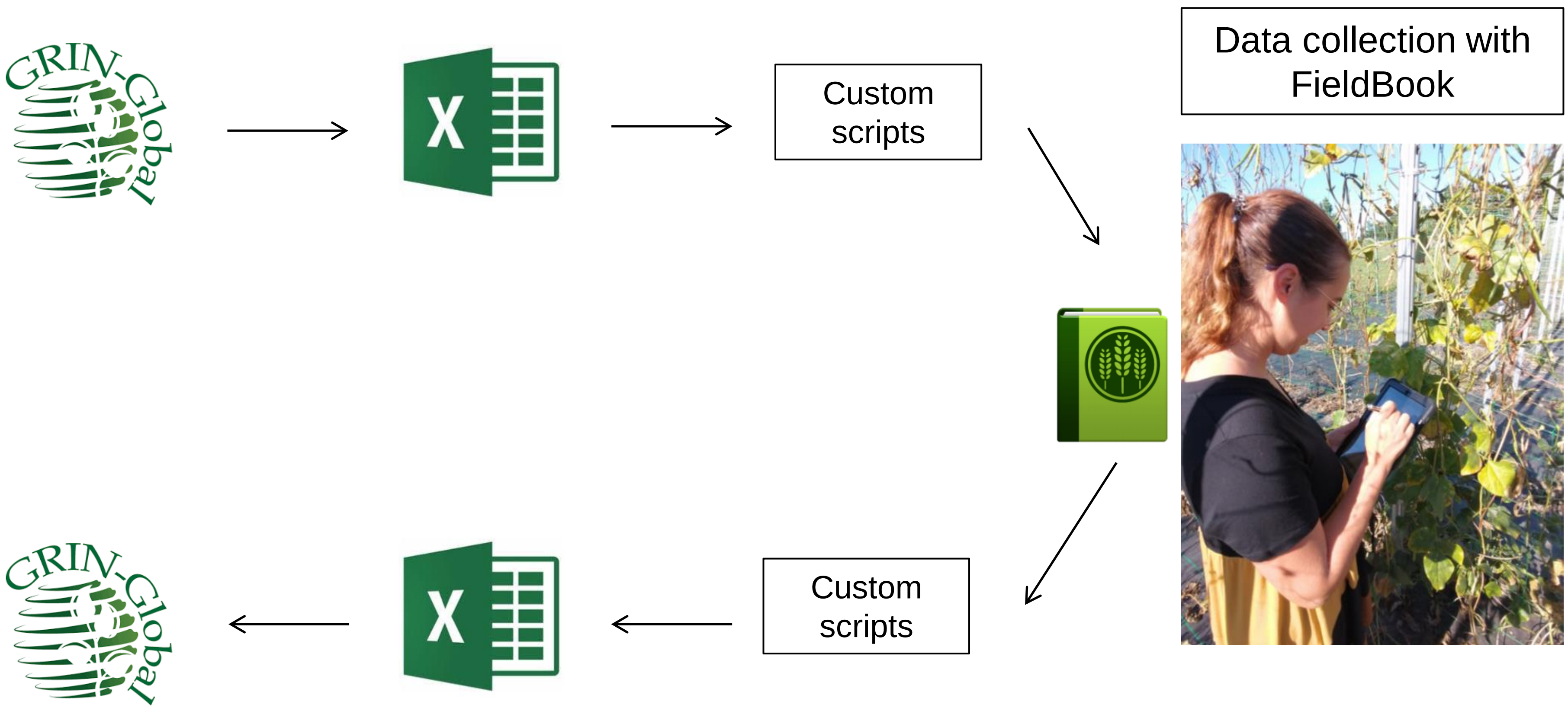
- Besides everything we have achieved using GRIN-Global, one major achievement was to build **curator's trust over the digital world.** The confidence in the system is something that was only possible with GRIN-Global.

- This confidence boosted other approaches inside the Genebank and led us to **incorporate new technologies** in our routine activities.

- Conceptually, this is what it means: data collection is performed in digital format natively; paper still exists, for safety reasons, but only as a mirror of the data in the system.

Implementation of GRIN-Global

- What have we accomplished so far?
  - ➢Data collection with FieldBook



Implementation of GRIN-Global

- What are we aiming for in the near future?

➢ To finish the **National Plant Germplasm system** (priority)

➢ Implement **orders** from the public website

➢ Import all **genomic data** generated to date into GG

➢ Import all **biochemical data** generated to date into GG

➢ Import **images** for every accession, if available, into GG

Implementation of GRIN-Global

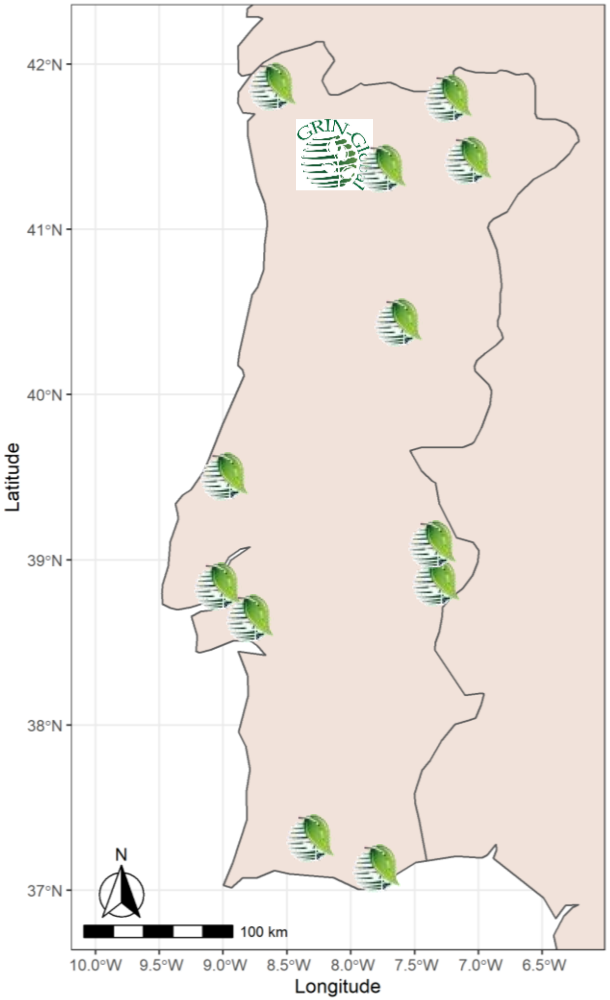
- What are we aiming for in the near future?

The National Plant Germplasm System

➢All institutions and research stations conserving PGR will be using curator tool to manage their collections.

➢BPGV will be responsible for maintaining the database and to make all data available on-line through the National node of GRIN-Global web page.

➢All PGR are managed over a single Germplasm System, that unites all information in an integrated fashion.



Suggestions and Recommendations

- ## Curator tool

  ➢Orders

  - When canceling an order on Order Wizard, the quantity is **not returned back** to the inventory. If a canceled order is resumed, quantity is reduced a **second time**.

  Manage samples like managing a stock inventory

  - At any given moment, it is only possible to know the present quantity on inventory for a given sample. It is not possible to **track the movement** of material in the past (unless tracking all the orders on that sample). Would be very useful to have this feature built in CT.

  ➢Logs for database changes

  - Example: When a user edits a record on the database, that change would be logged. This would be useful, especially for the most important/critical information.

Suggestions and Recommendations

- ## Curator tool

➢Inventory actions

- Create inventory actions automatically, after key changes to inventory. Example: after and order, automatically generate an inventory action with the key details from that order. Or if the location of the inventory is updated, create and inventory action reporting that location update automatically.

➢Crop Trait Observation

- Automatically create in *crop trait observation* the mean, mode, difference between dates, or any other calculation from individual observation data available in *crop trait observation data.*

Suggestions and Recommendations

- Genomics

  ➢The ability to integrate large datasets of genomic data into GRIN-Global (diversity data from WGS studies or SNP arrays). *Is it desirable?*

- Dashboard

  ➢We need a dashboard!

  - Curator tool is a very powerful tool to manage the collections routinely. But we miss a tool that could **read and digest all information**, making it available to curators on a visual and dynamic fashion. This would allow to immediately **answer key questions**, and facilitate **decision making**.

Final remark

Nowadays, GRIN-Global allow us to manage everything that is happening at our Genebank

Instituto Nacional de Investigação Agrária e Veterinária, I.P.

Our team