

Final Meeting for ACIAR Cassava Disease

Objective 3: Surveillance & Diagnostics



2-6 October 2023

Tay Ninh, Viet Name.

Plant Protection Sanitary and Phytosanitary Department (PPSPSD)

General Directorate of Agriculture (GDA)

 :oeurn.samoul@gmail.com



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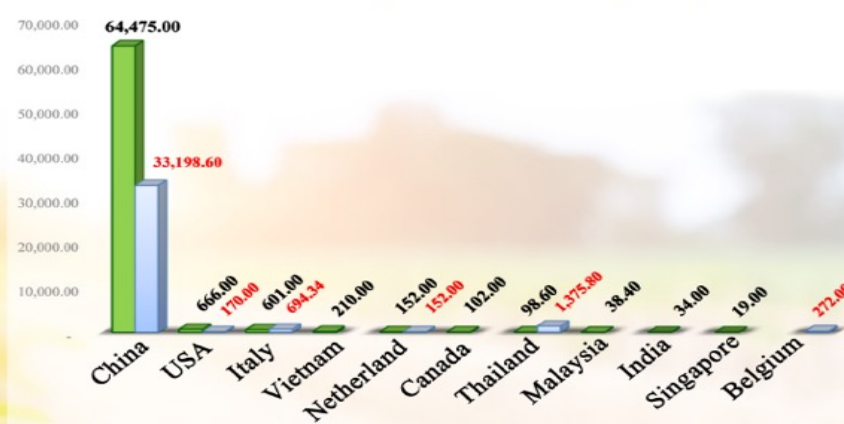
Outlines

- 1) Site Suviellance & Protocols**
- 2) Surveilance Results (CMD, CWBD and WF Incidence)**
- 3) Cassava Pests And Disease Surveilance For Fugus Identification In CWBD**
- 4) Exploratory analysis of pest and disease data from the experiments at Chamka Leu Research Station**

Total Export Destination of Cassava Products in 2022 compared to 2021 (Tons)



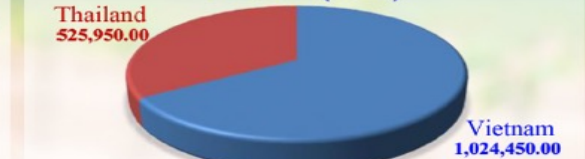
Total Export Destination of Cassava Starch in 2022 compared to 2021 (Tons)



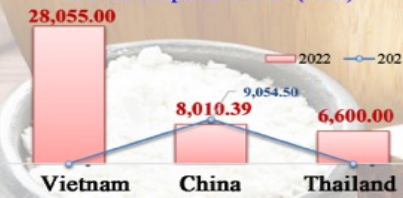
Total Export Destination of Cassava Slices in 2022 (Tons)



Total Export Destination of Fresh Cassava in 2022 (Tons)



Total Export Destination of Cassava Residue in 2022 compared to 2021 (Tons)



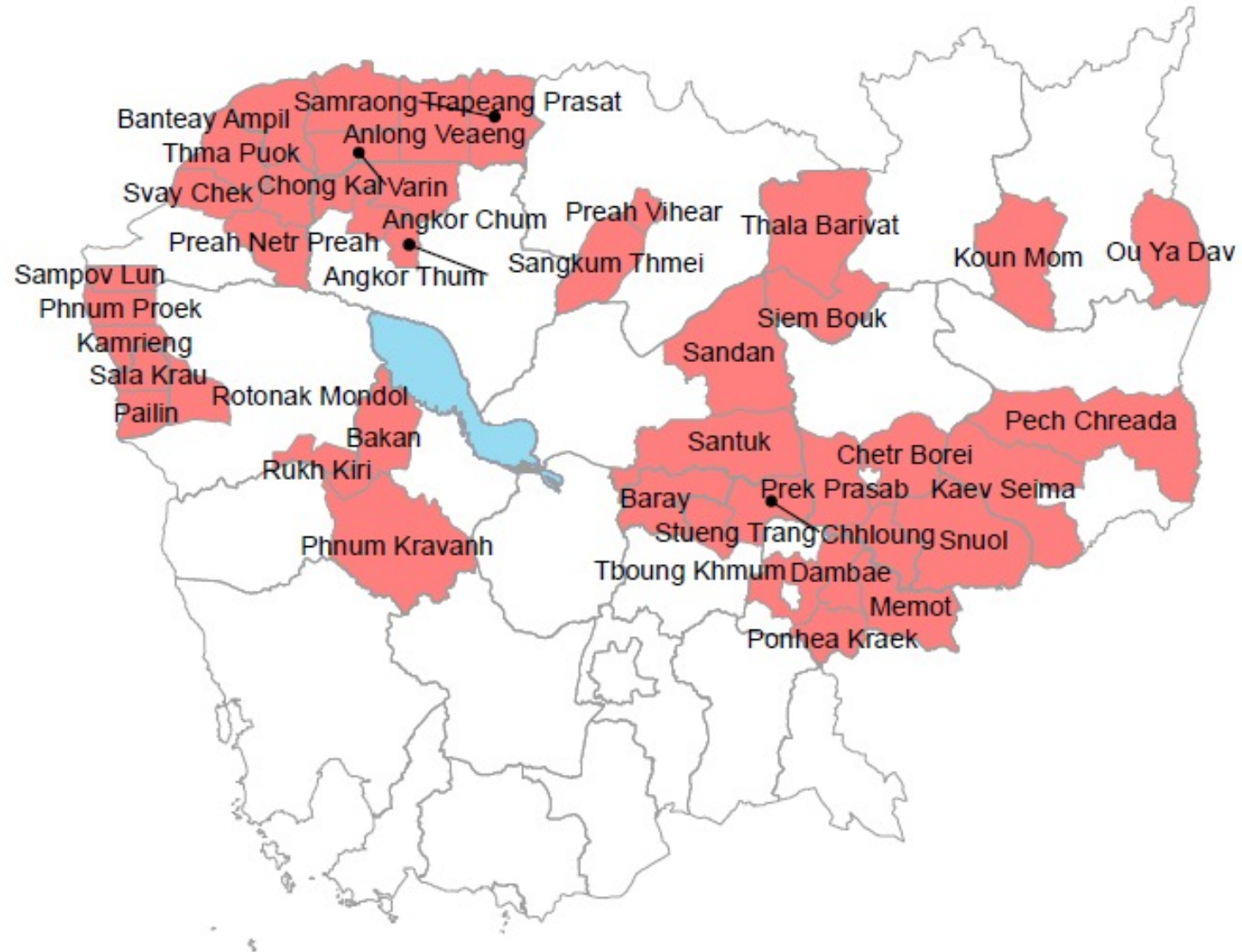
	2018	2019	2020	2021	2022
Total	2,613,220.26	3,310,092.41	2,288,527.20	2,793,728.92	3,727,547.86
Cassava Slices	1,590,326.59	1,626,165.01	1,516,476.06	1,644,591.68	2,068,086.47
Fresh Cassava	907,210.00	1,608,450.00	723,590.00	1,104,220.00	1,550,400.00
Cassava Starch	95,444.19	56,874.49	34,935.14	35,862.74	66,396.00
Cassava Residue	20,239.48	18,602.91	13,526.00	9,054.50	42,665.39

Total Export of Cassava Products from 2018 to 2022 and Export Destination in 2022 compared to 2021 (Tons)

1. Site Surveillance & Protocols

There are 14 provinces that selected to conduct CMD and CWBD.

1. Banteay Meanchey
2. Battambang
3. Odor Meanchey
4. Pailin
5. Preah Vihear
6. Pursat
7. Siem Reap
8. Kampong Cham
9. Kampong Thom
10. Kratie
11. Mondulkiri
12. Ratanakiri
13. Steung Treng
14. Tboung Khmum



Map: Jonathan Newby

Surveillance Protocols

- The field sampling protocol is follows by CIAT-Virology-Crop Protection Protocol v2.0 (*Wilmer J. Cuellar and Maria I. Gomez*)



Field sampling: Whiteflies, Cassava Mosaic Disease (CMD) and Cassava Witches' Broom Disease (CWBD)

Wilmer J. Cuellar; Maria I. Gomez, Virology Laboratory, Crops for Nutrition and Health, International Center for Tropical Agriculture (CIAT), The Americas Hub, Colombia.

Before you go to the field

1 -Prepare the following materials

- [Ziploc bags](#) of 10 x 10 cm (see figure below). Each bag should have written the Date, Field and Location identifiers e.g. 01/06/20; F1; Tay Ninh.
- Prepare each Ziploc bag with 20 g of silica gel.
- You should collect 60 leaf samples per field (see below) and each bag can contain 4 samples. So that per each field you will have a total of 15 Ziplock bags.
- A GPS tracker or a mobile phone that can store the GPS location of photographs (be sure you have your phone with 100% battery or acquire an external charger).
- Tissue paper. 1.5 mL eppendorf tubers (for collecting whiteflies), ethanol 80%, water-proof

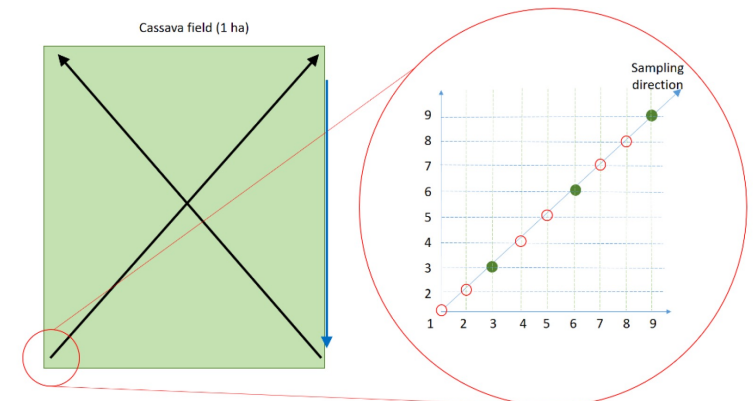
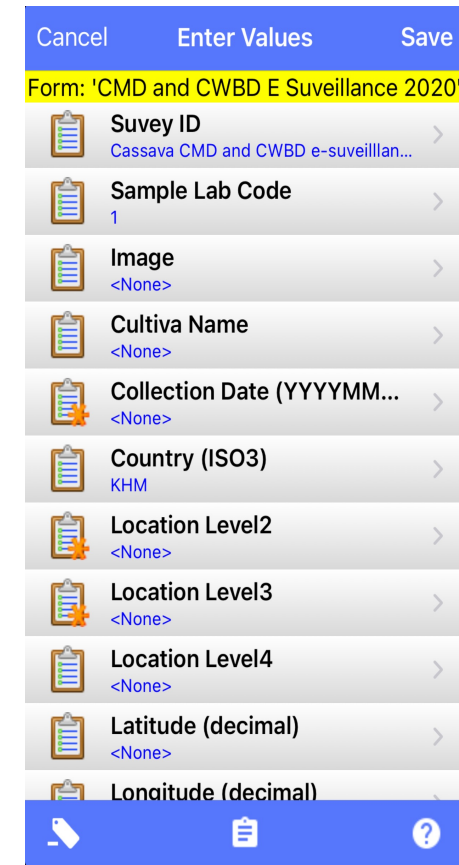


Figure 3. Sampling for CMD (photographs and top leaves) will follow the X pattern indicated by the back arrows (left panel). Sampling for whiteflies (photographs and whitefly collection) should follow only one diagonal (one black arrow). The blue arrow indicates the direction to follow (aprox 100 plants) before starting sampling in the second diagonal. For fields smaller than 1 ha, one should adjust the sampling (every second plant or every plant in the diagonal, but not the final number of samples collected).

Field Data Collection to Report



Targets: CMD, CWBD and WF

Leaf mosaic and deformation



Leaf yellowing, short petioles



Information platforms: data integration and communication

<https://pestdisplace.org>

[BACK TO PROJECTS](#) [UPLOAD DATA](#)

PDP_00063
(62458 Samples)

Submitter: **Wilmer Cuellar**
Corresponding: **Rafael Rodriguez**

Privacy: **Public**

Please fill in the following fields to complete the creation of the project, select an option to autocomplete if it exists, otherwise create a new regis institutions, and referencer

Name *

Purpose

Sampling Protocol

Grant Code

Full Name
Jenyfer Jimenez - ORCID:0000-0001-8149-6615
Samouel Oeurn - ORCID:0000-0002-0771-2495
Hoat Hoat - ORCID:0000-0002-2240-3922
pinkham Vongphachanh - ORCID:0000-0003-4440-5838
Hang Lee - ORCID:0000-0002-3504-1270
Phuong Dung Le - ORCID:0000-0002-2147-3697
Jonathan Newby - ORCID:0000-0001-8088-5491



PDP_00063

Projects / PDP_00063

Diseases

- Diagnostic Results
- Collected Samples
- Suspected
- Confirmed Diagnostics

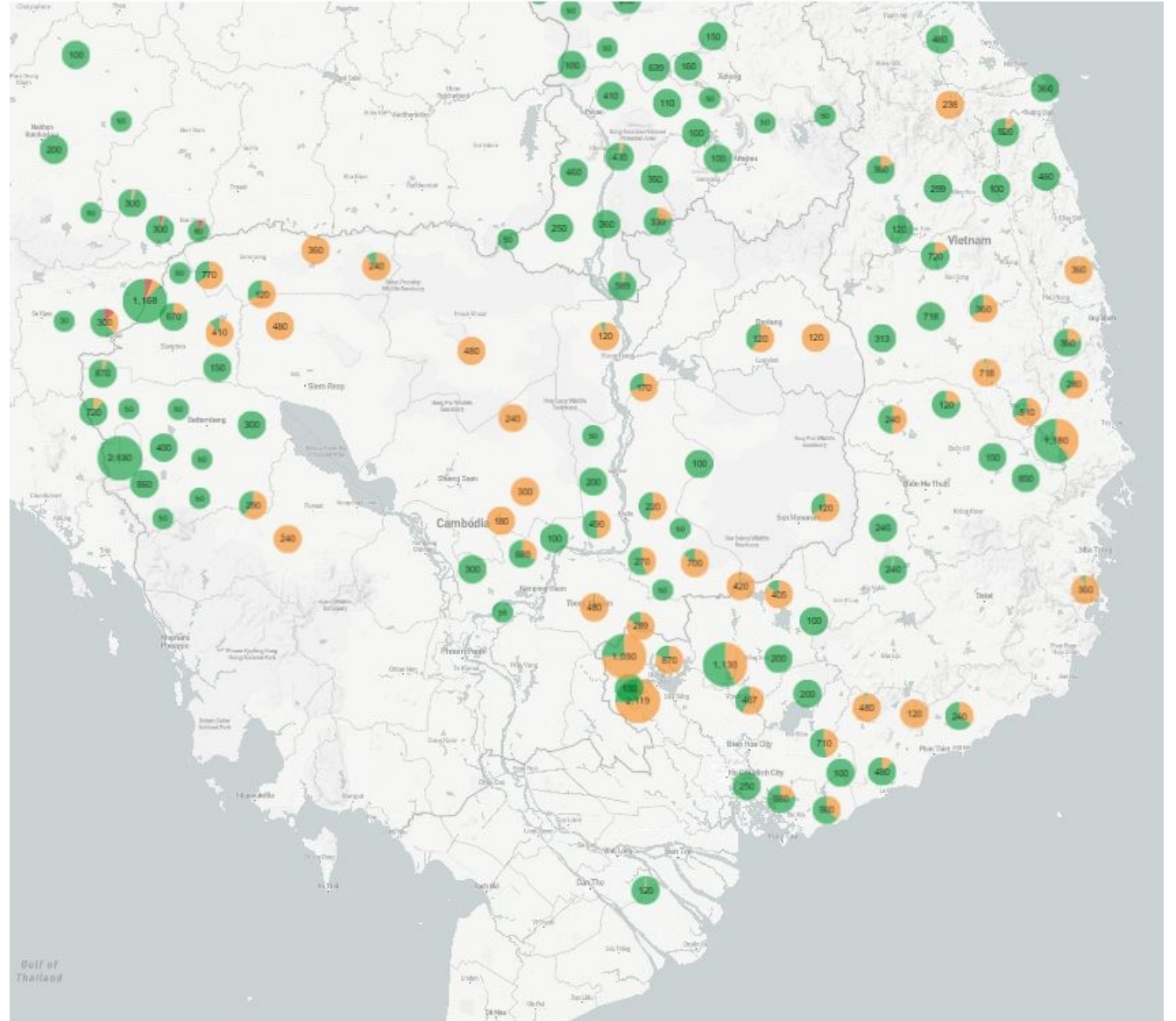
Timeline

2000 2022

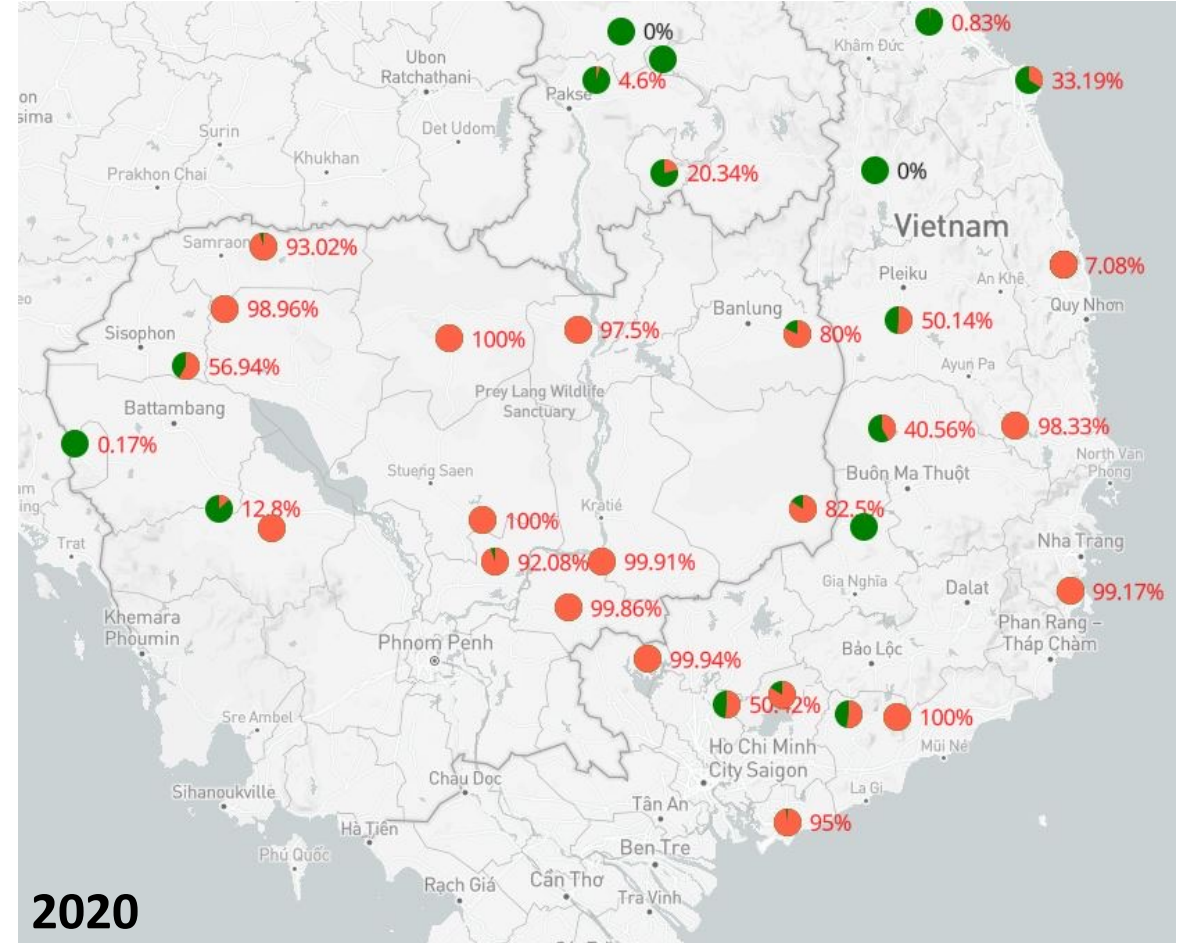
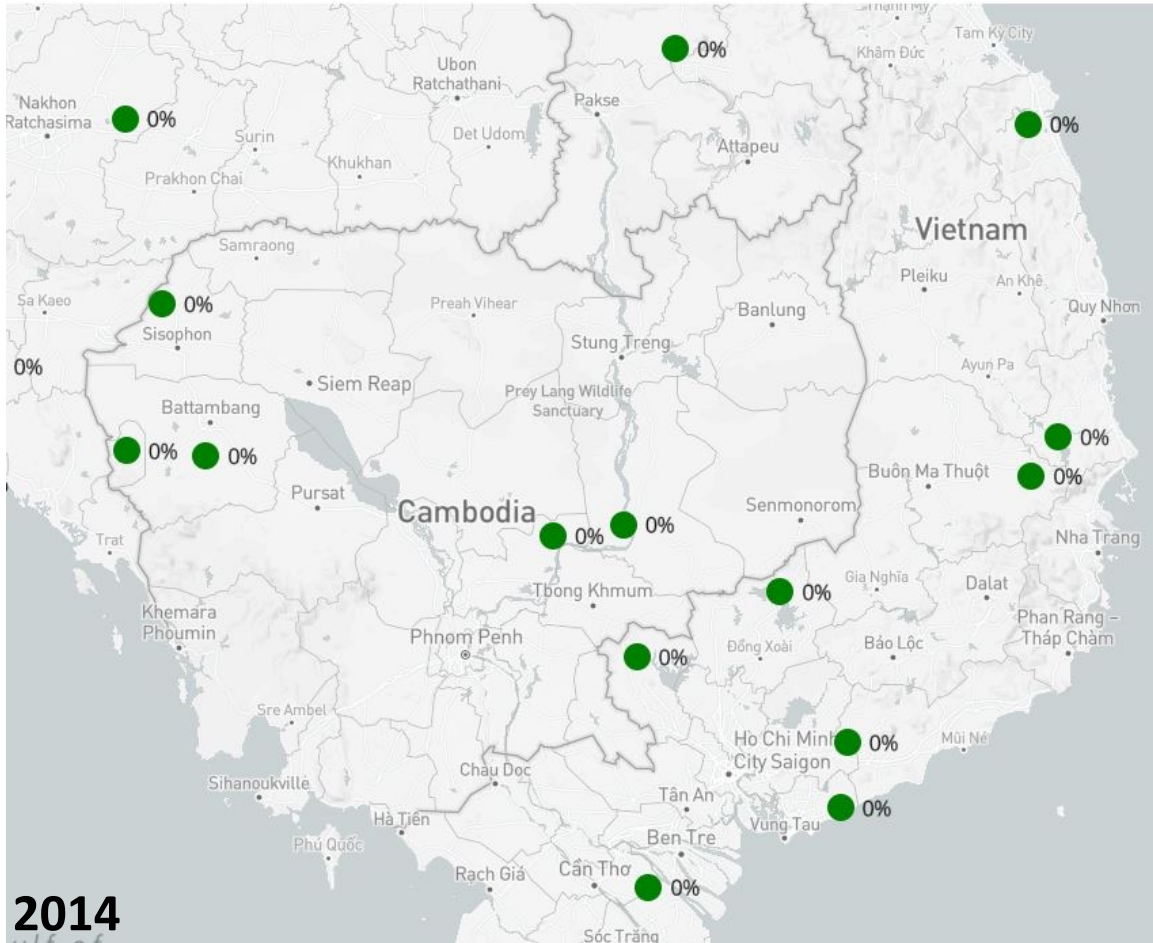


2. Surveillance

- Three consecutive years. Using a standard protocol.
- All data is shared an to the cloud.
- Photo records ‘observations’ allow the identification of CMD and CWBD symptoms.
- 9,000 ‘observations’ in 2020 and 6,120 ‘observations’ in 2021 and 3,720 ‘observations’ in 2022.

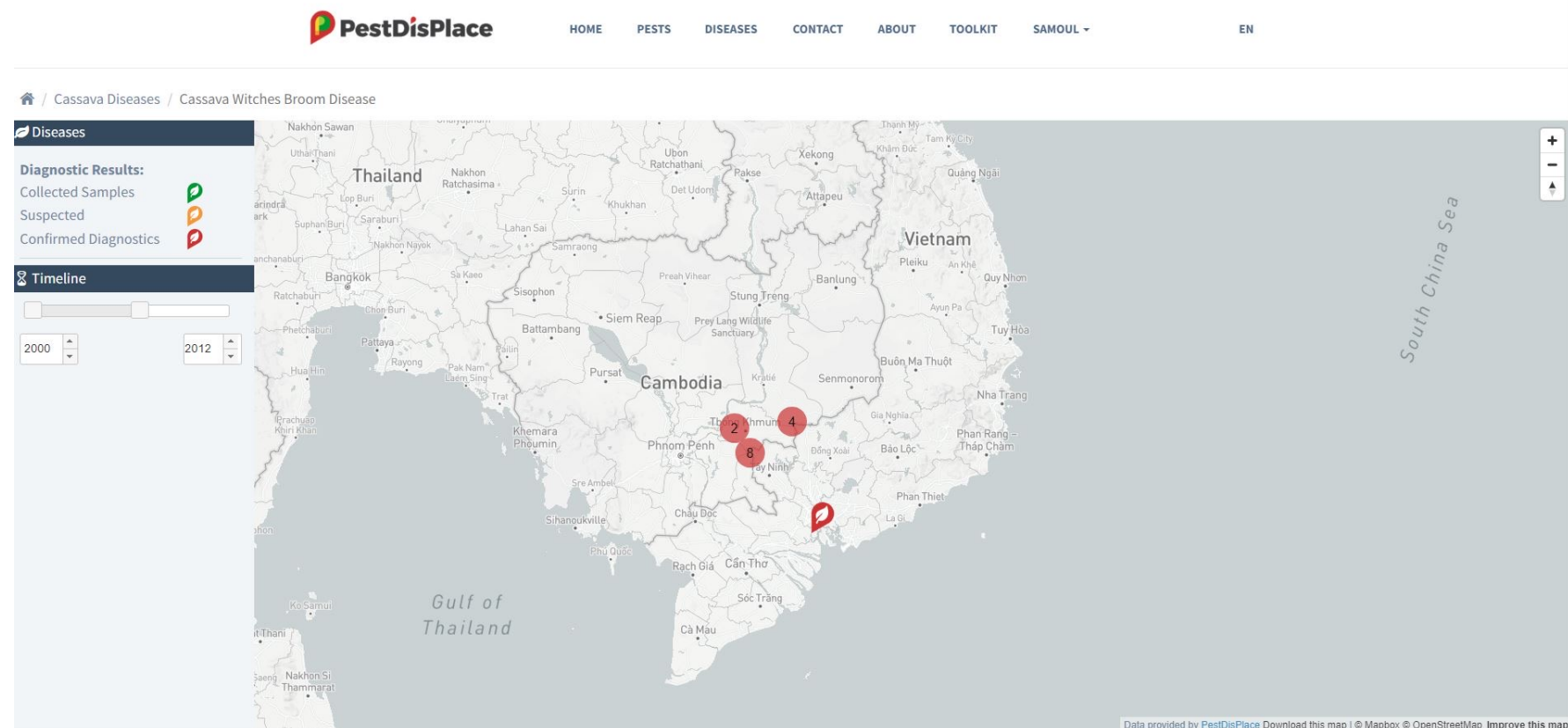


Incidence maps (Province level): CMD

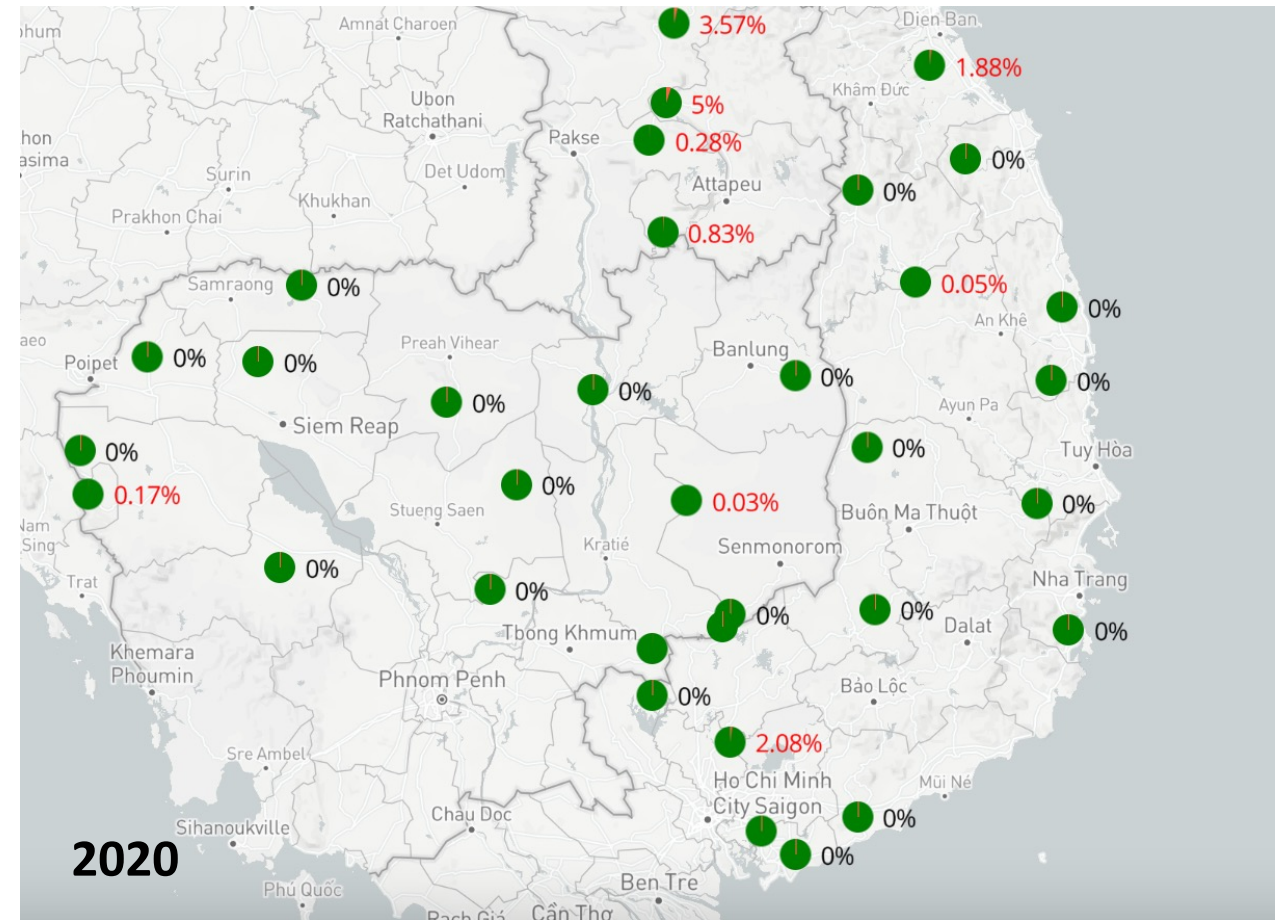
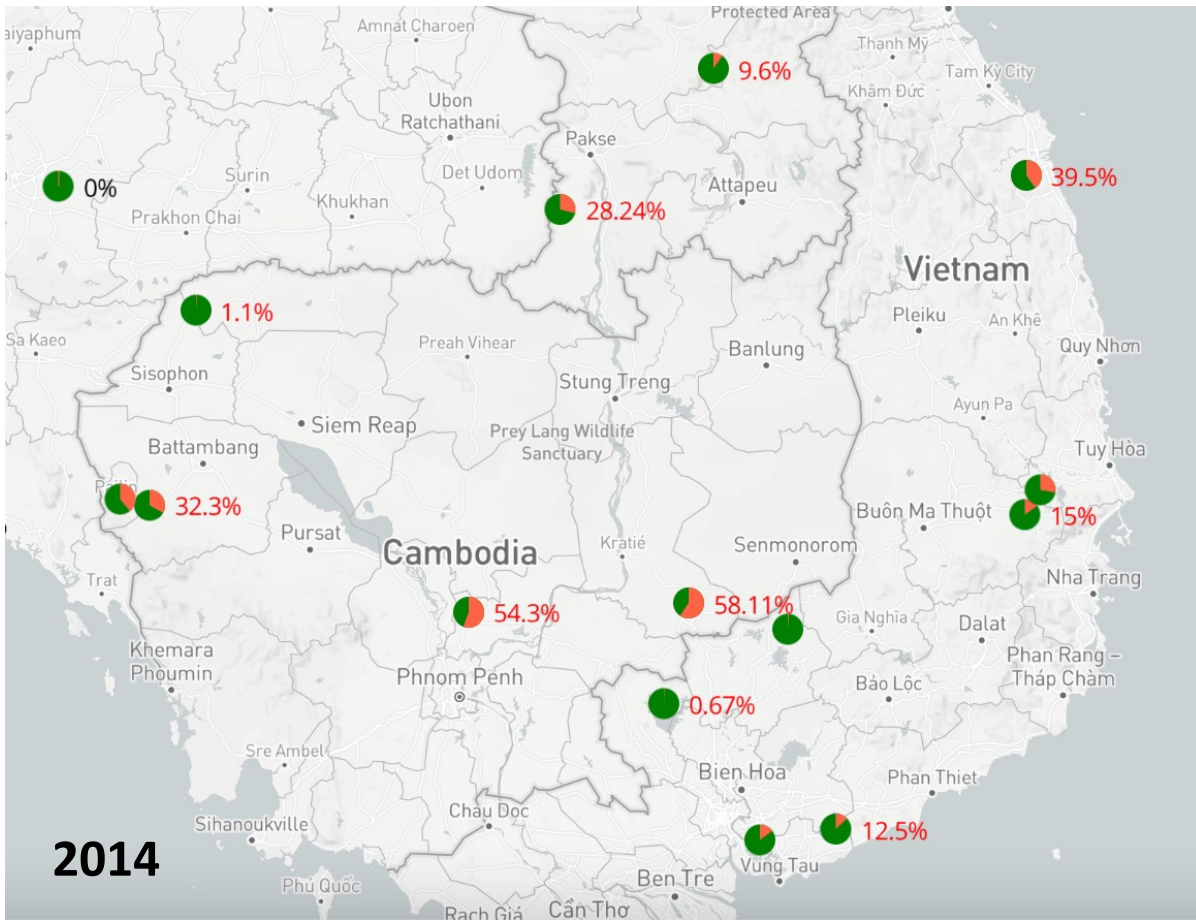


Cassava Witches' Broom Disease

- Cassava Witches' Broom Disease was reported in Cambodia in 2009 followed by Cassava Mosaic Disease in 2015.



Incidence maps (Province level): CWBD



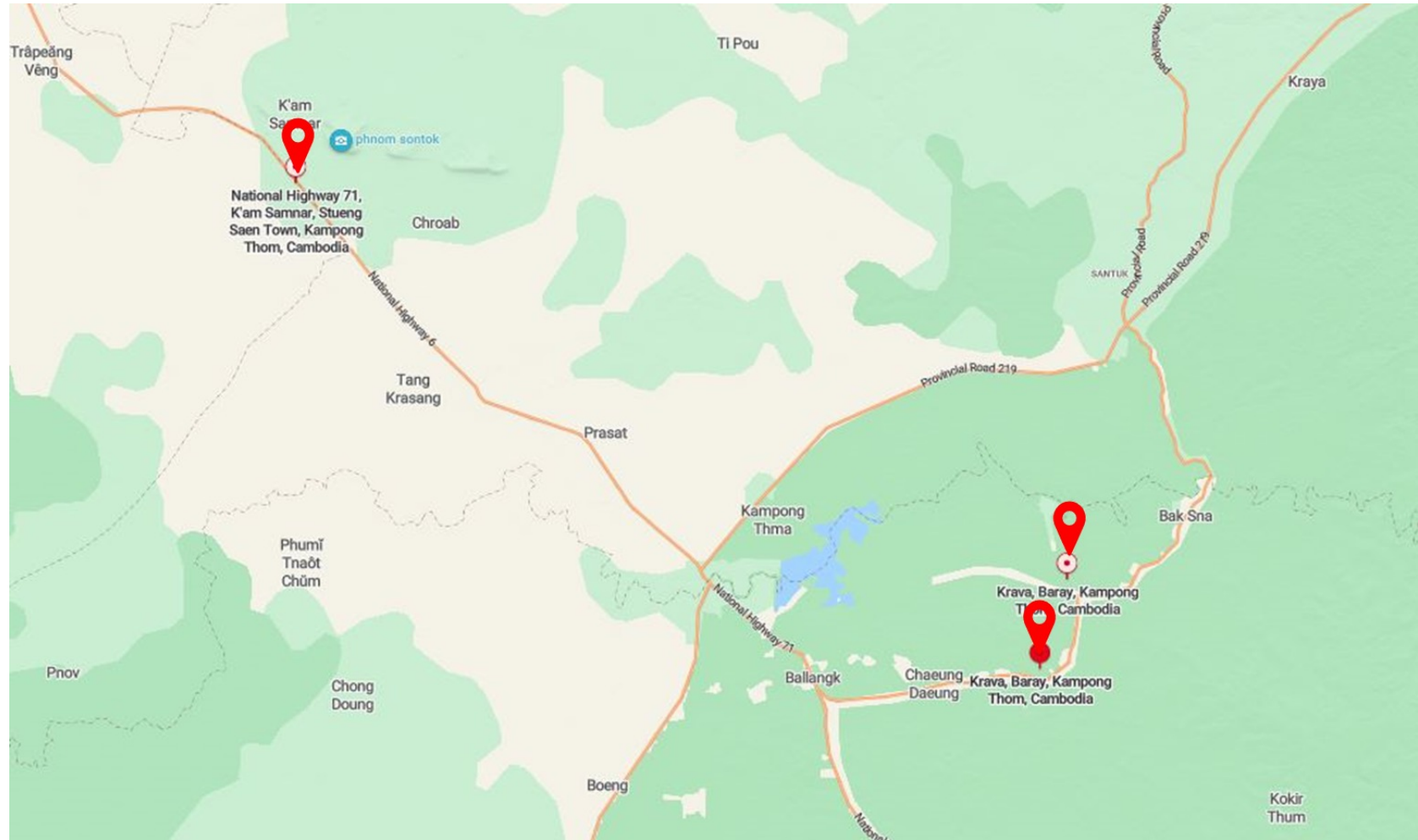
A photograph of a cassava field. In the foreground, a cassava plant is shown with several leaves that are yellowed and some are wilting or falling off, indicating a disease. The background shows a larger field of cassava plants under a clear sky.

3. Cassava pests and disease surveillance updates 2023

Focus: **CWBD**

Cambodia samples for fungus identification in CWBD infected plants

180 samples
from 3 fields



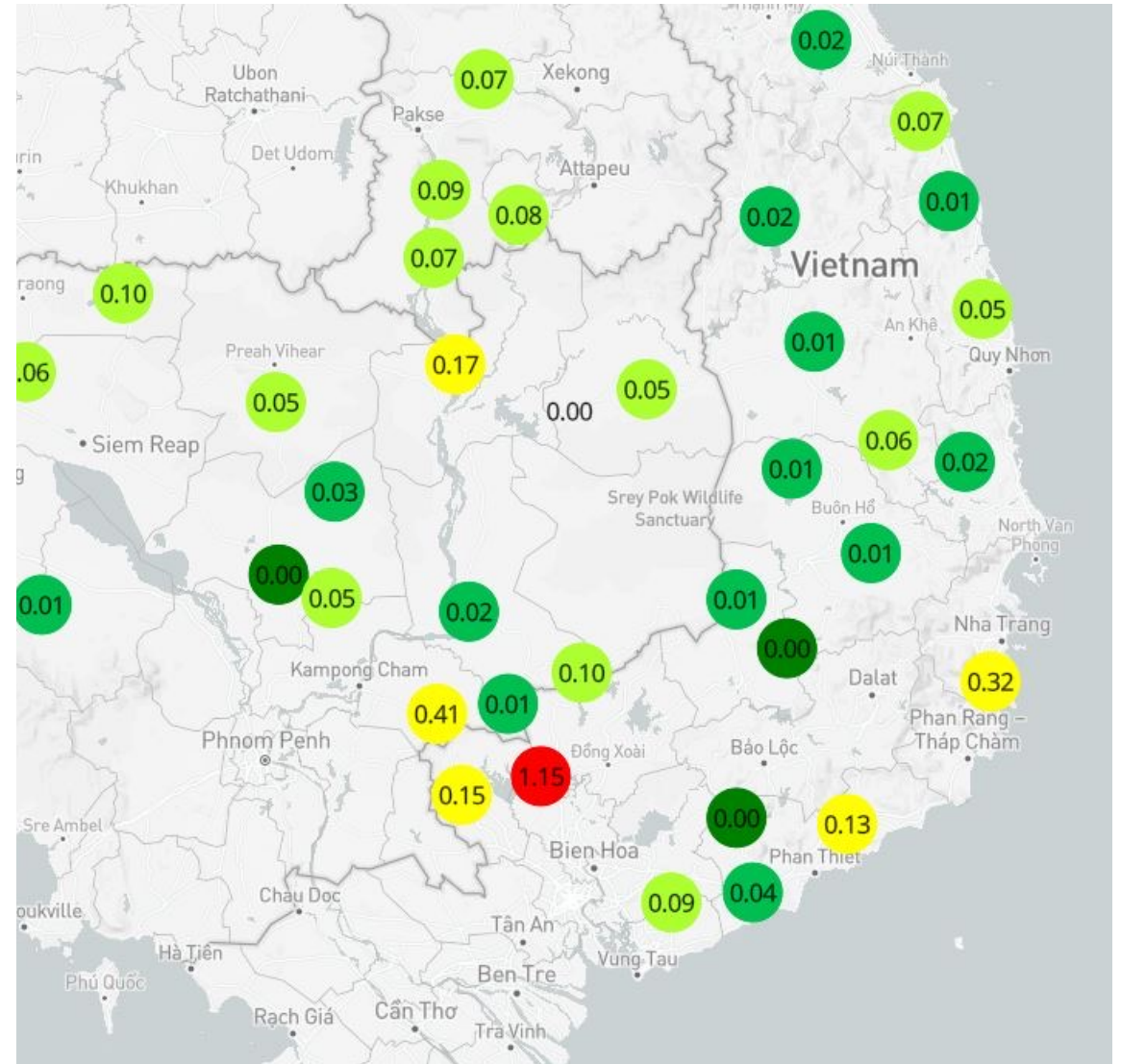
PCR-based incidence

Field ID	No of samples	No of positives	Incidence (%)
1	60	6	10
2	60	18	30
3	60	30	50
Total	180	54	30

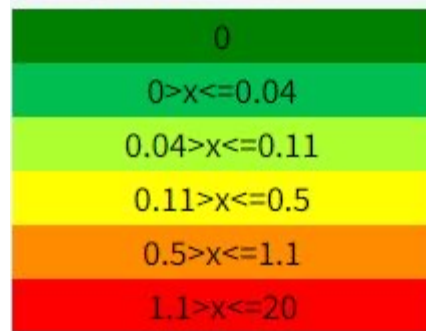
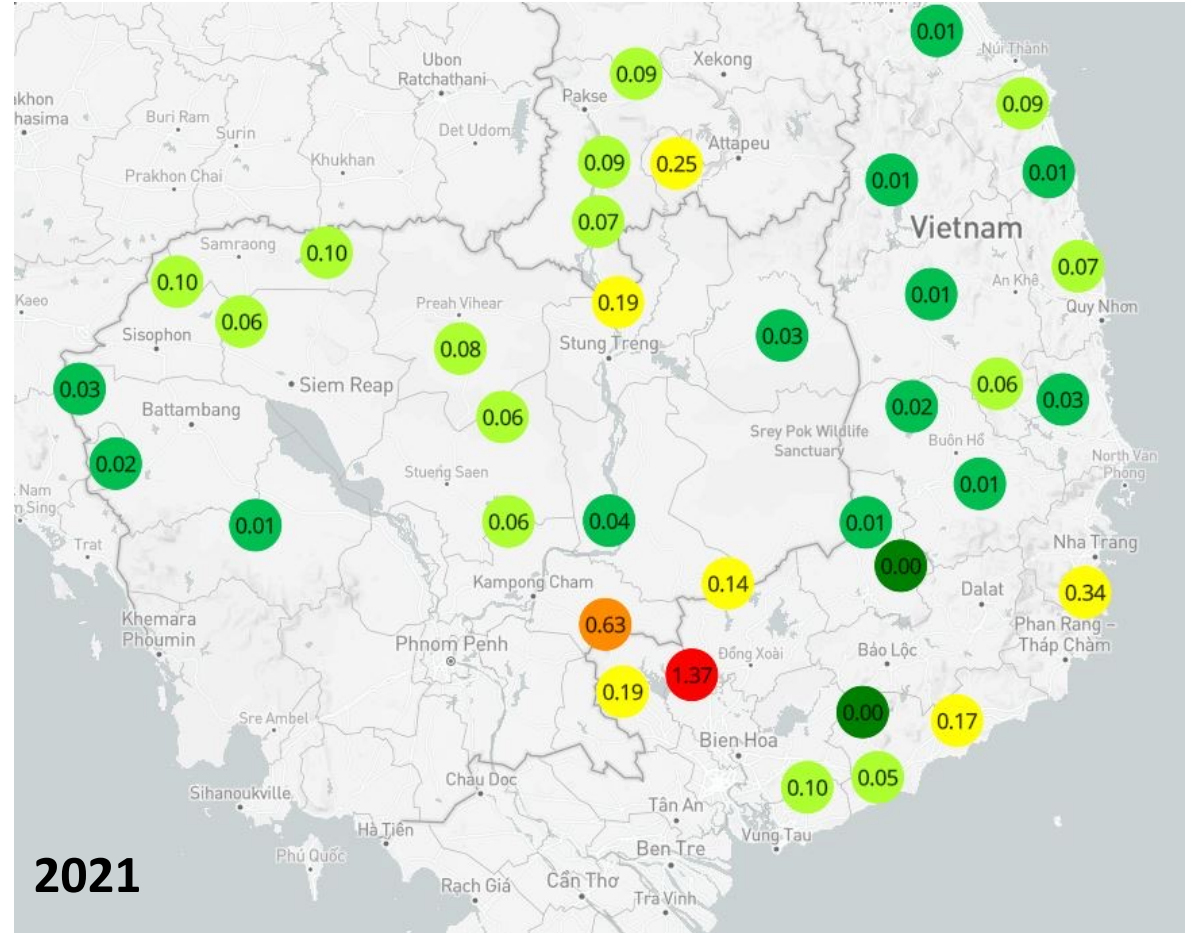
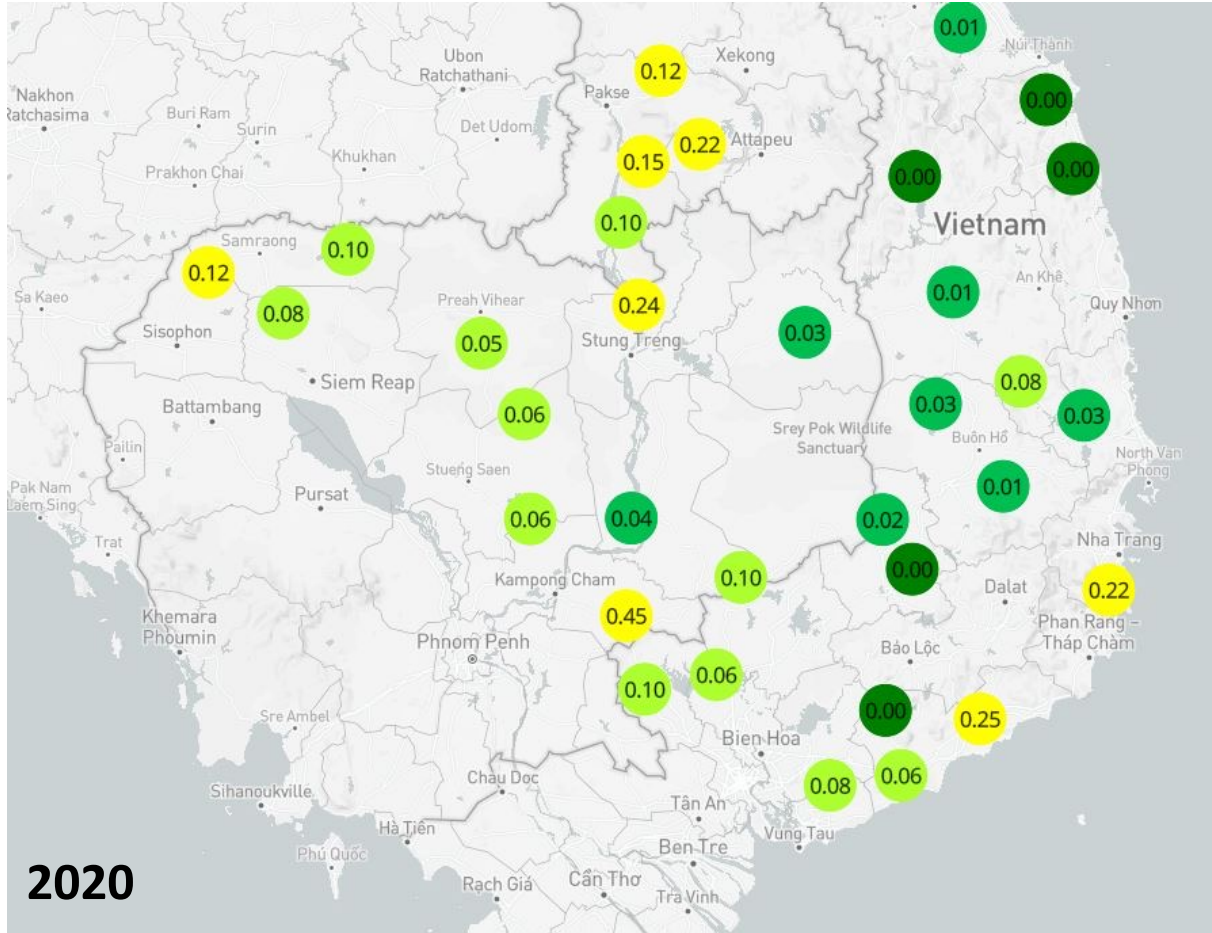
- Association of *Ceratobasidium* with Cassava Witches' broom disease

Whiteflies (WF)

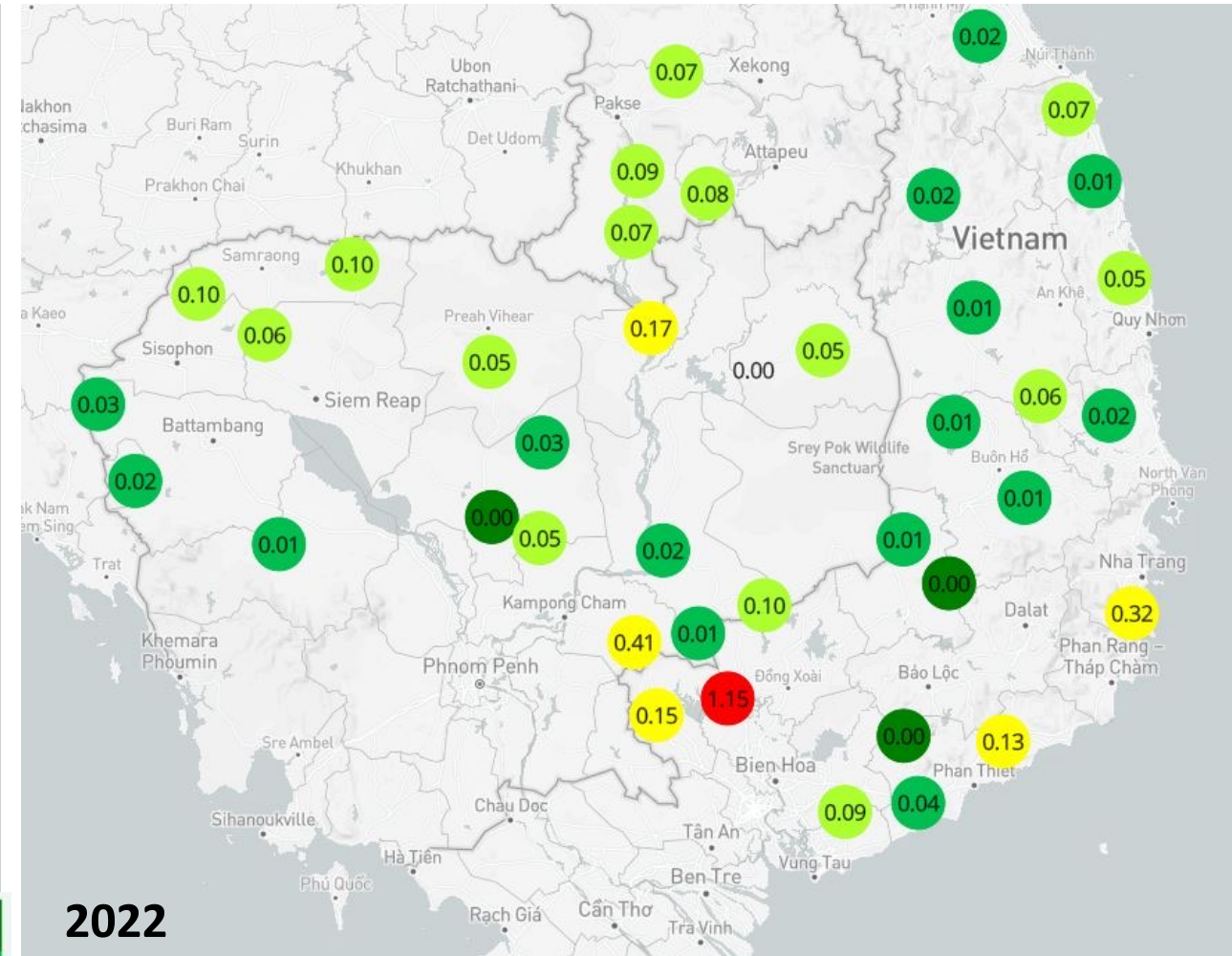
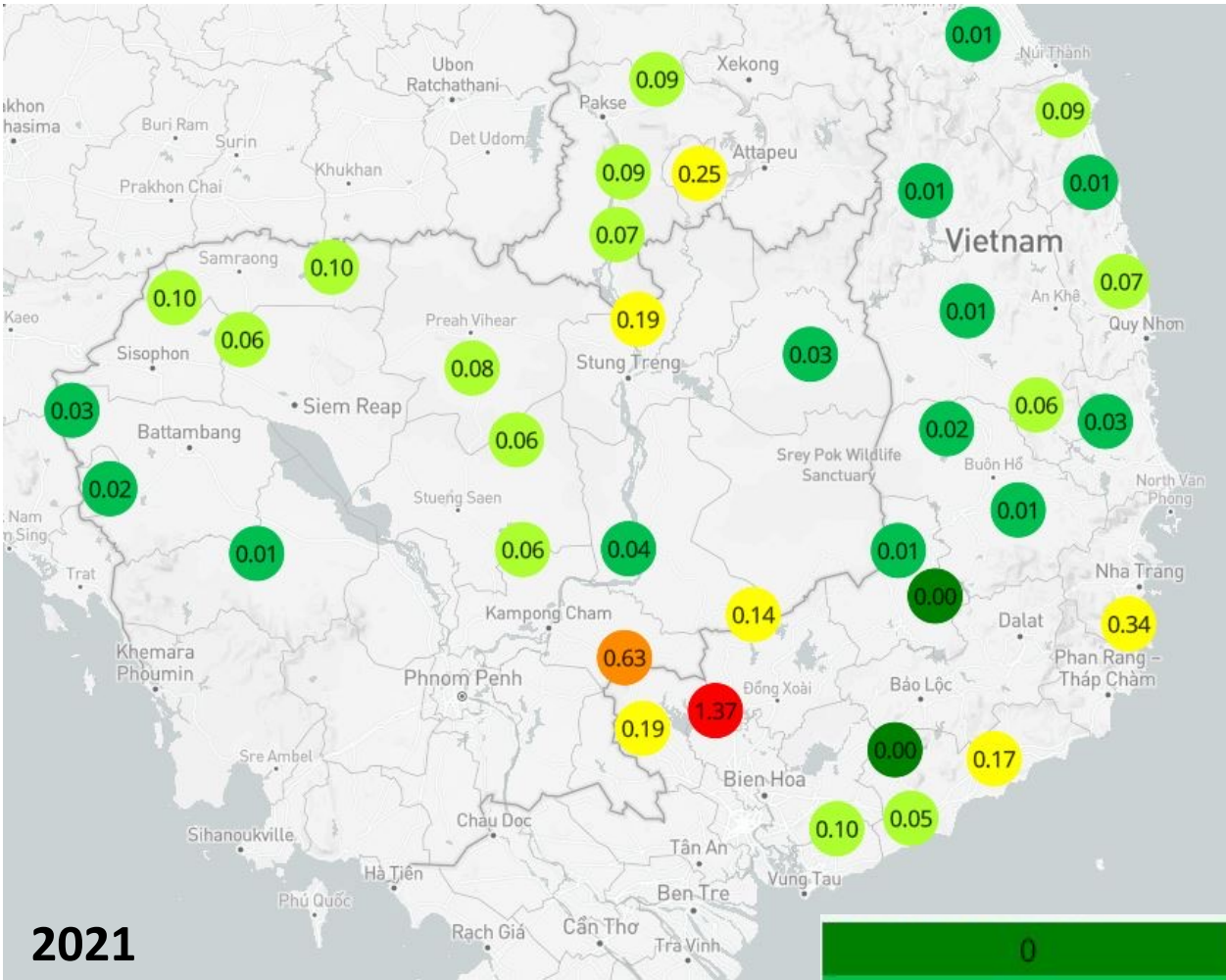
- Three consecutive years. Using a standard protocol.
- 4,500 leaves evaluated in 2020 and 3,060 in 2021 and 1,860 in 2022.



WF relative abundance (Adults/leaf/plant)



WF relative abundance (Adults/leaf/plant)



4. Exploratory analysis of pest and disease data from the experiments at Chamka Leu, Cambodia, 2022-2023



1a. Effect of growth stage, seed type, and fertilizer application on whitefly population

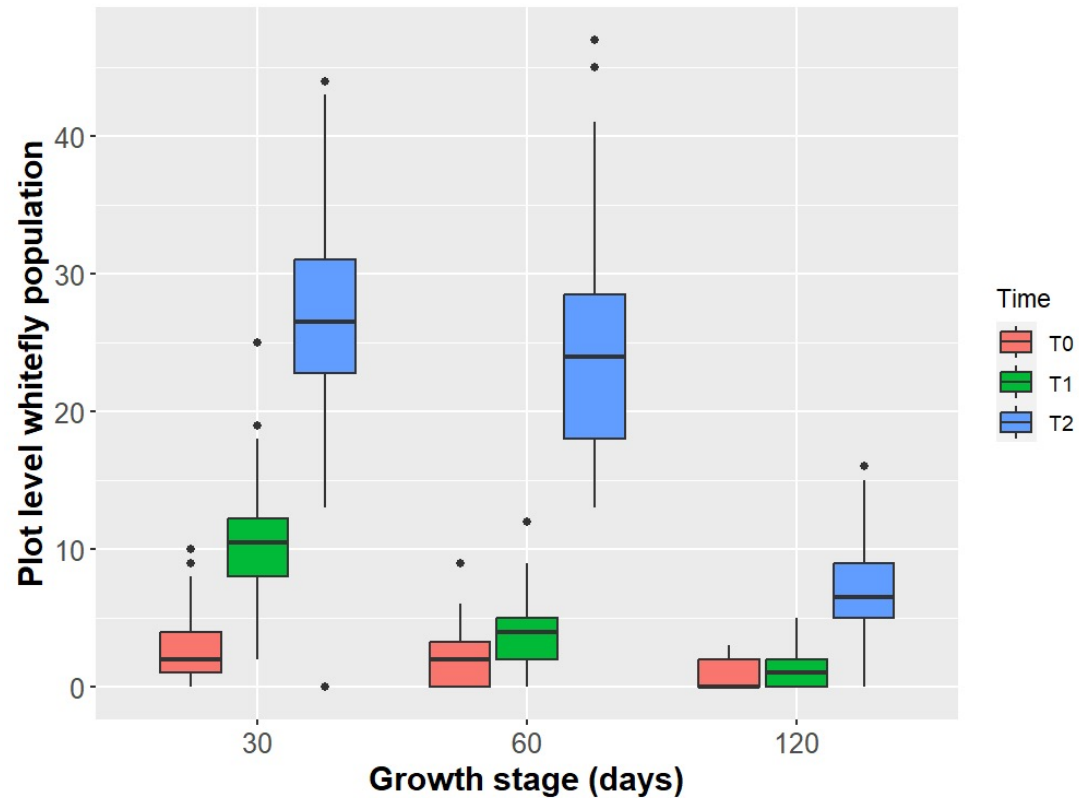


Figure 1. Whitefly (*Bemesia tabaci*) visitation at different growth stages. Counts of whiteflies settled on the first fully expanded leaf per plant, denoted as T₀, and on yellow traps where counts were recorded after 12 hours (T₁) and 10 days (T₂) were recorded. To represent the traditional method that was previously used in this project to monitor whitefly dynamics in Laos, Cambodia, and Vietnam. Whitefly field visitation was evaluated at 30, 60, and 120 post-planting. The data suggests that more whiteflies visit cassava plants earlier in the season. The number of whiteflies trapped significantly varied between the three different trapping intervals with the highest number of recorded insects at 10 days post-trapping. Whitefly visitations reduced as the season progressed. There was no significant difference in whitefly counts between different seed types i.e. (positive section 18, Clean KU50, Clean Rayong 11, positive selection KU50, CWBD-infected Rayong 5, and CWBD-infected KU50. This is the first record of high whitefly visitation in cassava in SEA.

1b. Effect of Growth stage, seed type, and fertilizer application on CWBD incidence

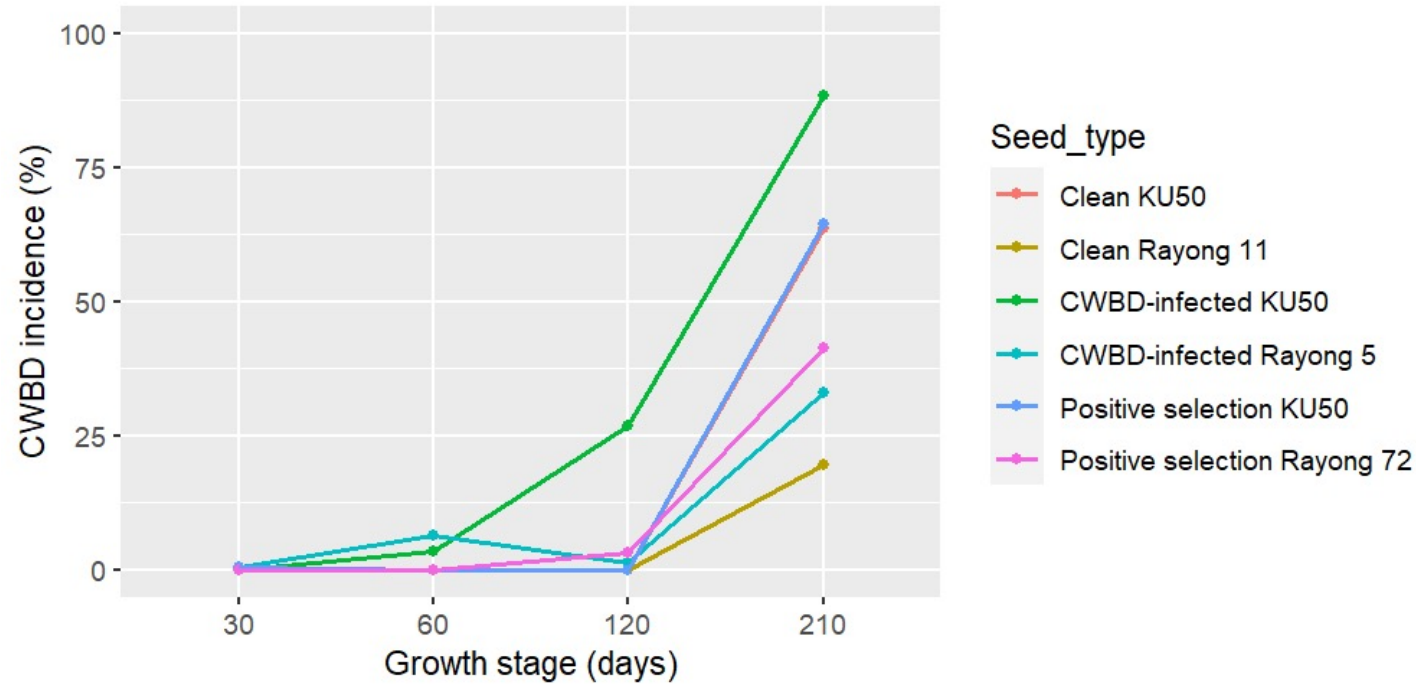


Figure 2. The shape of CWBD pressure in different cassava seed types. CWBD infection on each plant in different plots was visually scored and recorded at four different time intervals i.e., 30-, 60-, 120-, and 210-day post-planting (dpp) during the season. By and large, CWBD increased as the season progressed. The highest incidence was recorded in plots where stakes infected with CWBD were planted and it was lowest in plots of clean Rayong 11. There was no difference in CWBD incidence in the different seed types of KU50. Tentatively, these findings suggests that the best time to survey CWBD is 60 dpp onwards and CWBD occurrence peaks at the end of the season.

1c. Effect of growth stage, seed type, and fertilizer application on CMD incidence

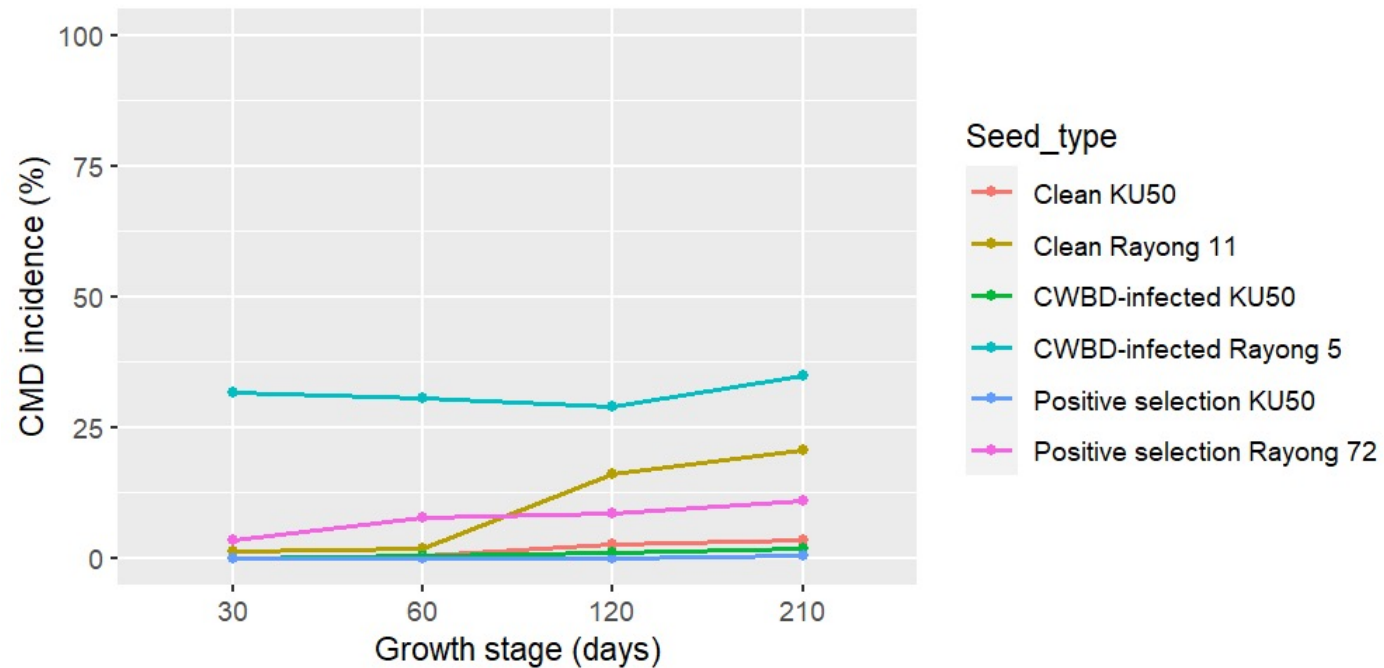


Figure 3. Progression of cassava mosaic disease differs in six different seed types over the cassava growing season. A similar protocol as CWBD was followed to measure CMD incidence at four-time intervals. In some of the seed types (CWBD-infected Rayong 11 and positive selection Rayong 72), **infected plants showed up within the first 30 days of planting.** The rate of increase in diseased plants was generally low throughout the season, except in clean Rayong 11. CMD incidence was lower than 10 % in KU50, irrespective of seed type.



Thank you!