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Establishing sustainable solutions to cassava diseases in mainland Southeast Asia Agronomy and systems (Objective 4)

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Cassava Program retreat

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CGIAR

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Develop and evaluate economically sustainable cassava seed system models for the rapid dissemination of new varieties and clean planting material to farmers in different value chains and production contexts

- **Achievement and lessen learnt**

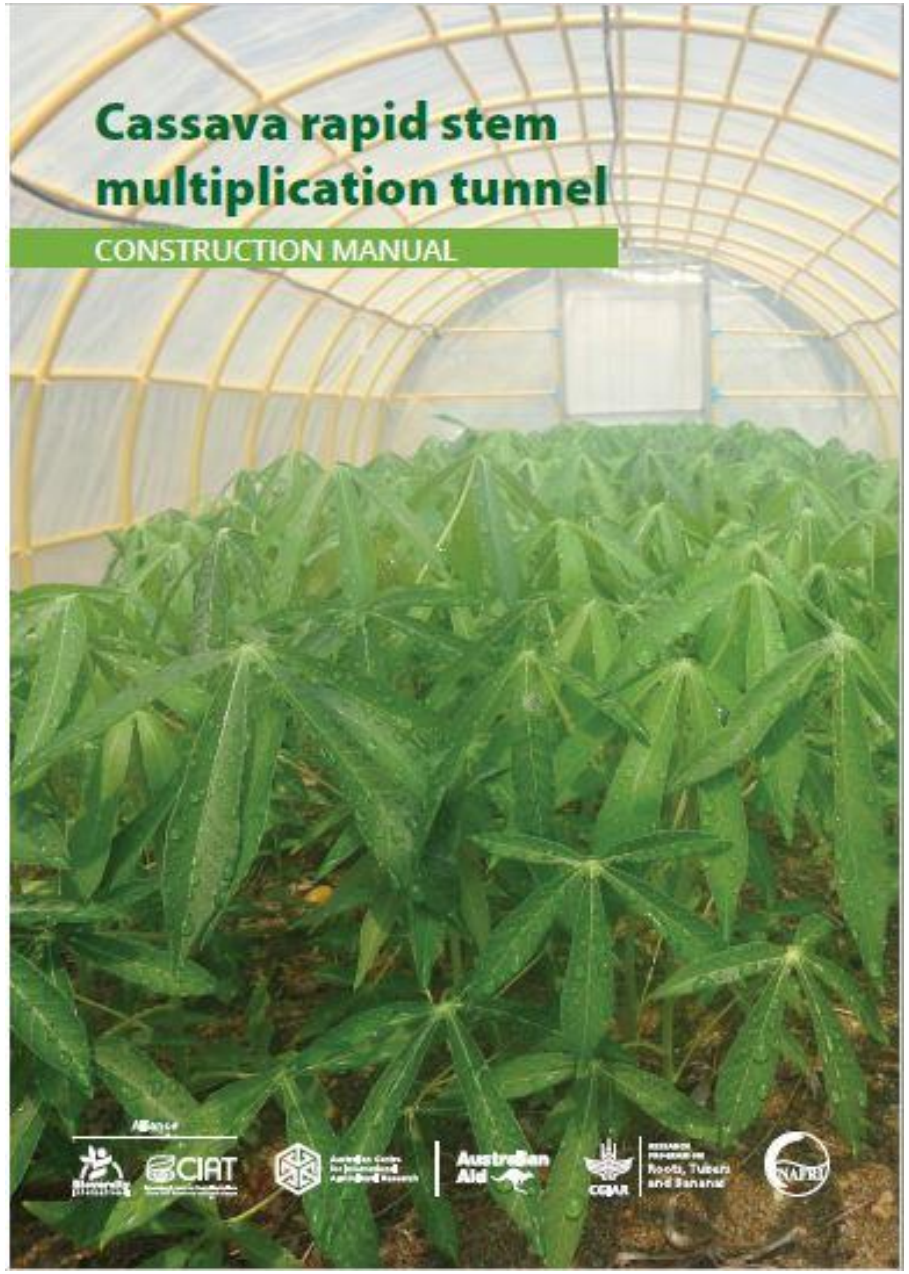
CMD

CWBD

Activity 4.1
Developing communication products for effective field level management of cassava diseases (i.e. CMD, CWBD)

- **Publication & distribution of brochures, video cds, posters:**

- **Training materials developed for use within the region:**



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Name	Description	Type (Link)
Cassava rapid stem multiplication tunnel construction manual	A step-by-step guide for constructing cassava multiplication tunnels (English and Khemer version)	Manual (Link)
Tool description sheet to experimental auctions of vegetatively propagated seed	Tool description sheet for experimental auctions of RTB seed.	Manual (Link 1)
Experimental auctions. RTB Seed System Toolbox Course: 26, 28, 29 July 2021.	A training presentation supporting the use of the experimental auction tool.	Presentation (Link 1)
Building cassava rapid multiplication tunnels	A training video on how to build cassava rapid multiplication tunnels. (Lao language version)	Video (Link 1)
Cassava mosaic disease (CMD in Lao PDR)	A farmer training video about farmer about the newly arrived cassava mosaic disease, focusing on Lao PDR. (English version)	Video (Link 1)
A farmer training video about cassava witches broom in Southeast Asia, focusing on Lao PDR. (English version)	A farmer training video about cassava witches broom in Southeast Asia, focusing on Lao PDR. (English version)	Video (Link 1)
Managing cassava witches broom disease (CWBD)	A farmer training video about cassava witches broom in Southeast Asia, focusing on Lao PDR. (English version)	Video (Link 1)

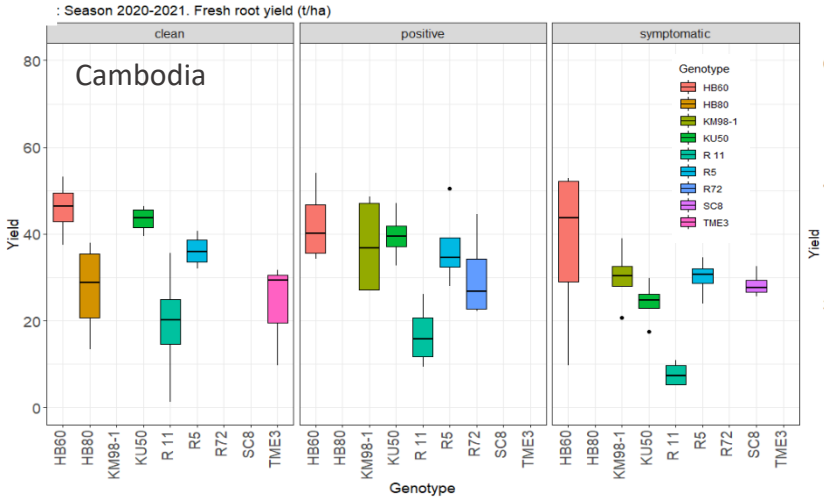
Activity 4.2

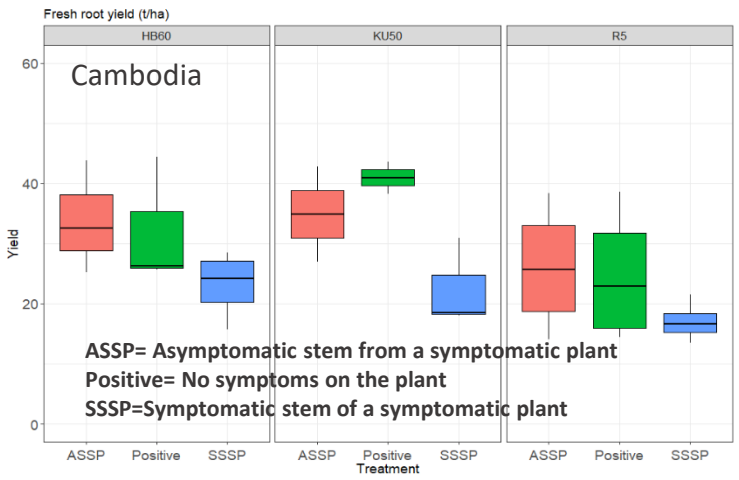
Evaluation and on-farm demonstration of CMD resistant exotic cassava varieties from IITA (Africa) against clean available SEA varieties

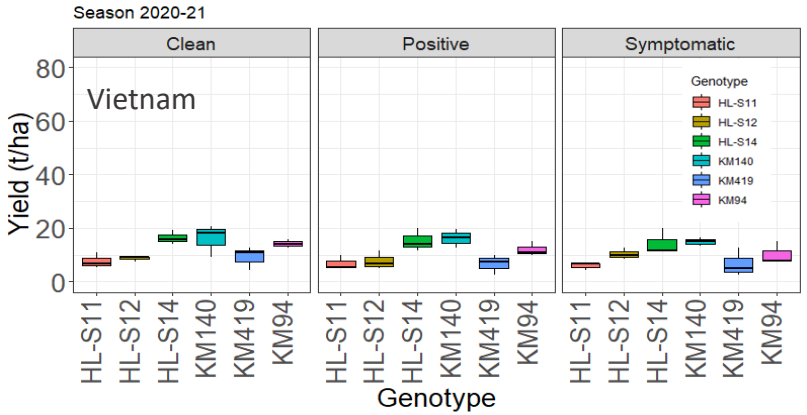
Country	Location	Disease	Variety	Treatments	Lesson learnt
Cambodia	Chamkar Leu Up-land farm (GDA station)	CMD CMD & CWBD	KU50, Rayong11, SC8, HuayBong60, KM98-1, Rayong 5 KU50 and Rayong 5	Clean stems, positive selection stems and diseased stems	Variation in disease susceptibility was observed among different varieties
Laos	Naphokh, NAFRI research station	CWBD	Rayong11, KU50	Positive selection stems and diseased stems With and with out fertilise	Fertiliser have positive effect on yield even when plants were infected
Vietnam	Tay Ninh, Province	CMD	KM94, KM140, KM419, HLS11, HLS 14 and HLS 12	Clean stems, Positive selection stems and diseased stems	Clean planting material yield higher even at high disease pressure-though it was very low

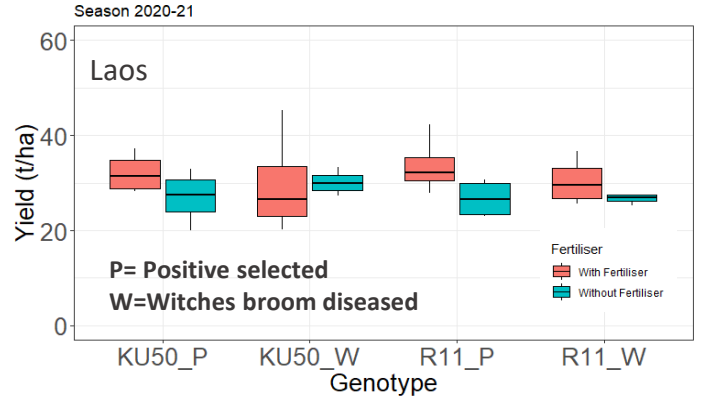
Variation in disease susceptibility was observed among different varieties

- **Early infection yielded lower**
- **At moderate disease pressure KU50 consistently produced reasonable yield**
- **Clean planting material yielded 2- to 3-fold higher yields than diseased planting material higher**
- **Asymptomatic stem of a symptomatic plant can be used at extreme situations**
- **At high disease pressure most variety responded similarly (in Vietnam)**









Current advice: Start with clean planting material-KU50, Rayong72, HB60
Avoid: Rayong11, Variety89, HL-S11, SC8

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CMD resistant cassava varieties identified on-farm from local and exotic germplasm from IITA

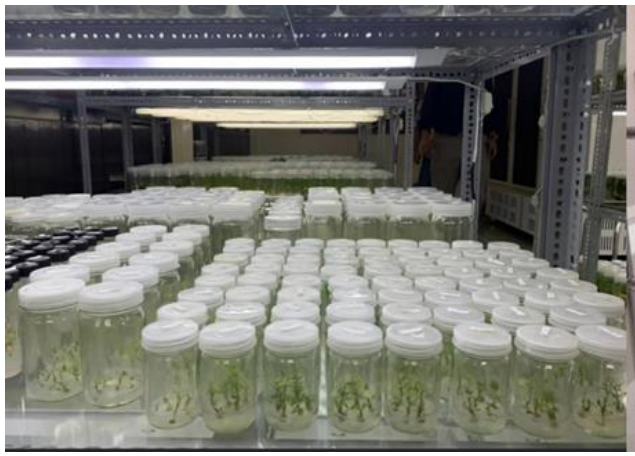
- TMEB419
- IITA-TMS-IBA980581
- IITA-TMS-IBA980505
- IITA-TMS-IBA972205
- IITA-TMS-IBA920057

Activity 4.3 Evaluation and comparison of rapid multiplication innovations in SEA context

- Desktop review of cost and output
- Setting up viable technologies SAH and Jiffy pots in collaboration with National partners in Vietnam and Laos; compare and modify accordingly
- Capacity building for the rapid multiplication technology in the region

Steps of rapid multiplication

Mother plant for tunnel



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Two node stem-cutting horizontally placed in the sand bed

Approximately 35 plant (two long stem each plant) give about 700 two node cuttings

Viable sprout are with 5 to 6 nodes, average height of KU50 sprouts are couple cm taller compared to Rayoung11

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Transplanting in the field

Interest in tunnel systems from private stake holders

- Khousap Company Bachiang district from Champasak provience

Laos – NAFRI, Napok Vientiane

Laos – Khonsup Import-Export, Champasak

Productivity of tunnels

Variety	Number of seedlings per season per tunnel	No of viable sprout in each cutting	No of days to get new plantlets	No of days to transplant to field (from Tunnel)	Number of plants in the field	Transplantation field Success rate (%)
KU50	3840	768 ± 74	[a]50 ± 4.6	[b]96 ± 15	*2690	100
Rayong11	5040	840 ± 123	[a]49 ± 3.0	[b]95 ± 4	4210	100

* Lost one batch to mealybugs, a= delayed by 7 day due to unavailability of substrate, b= delayed by 10 to 15 days due to delayed in irrigation system set up.

Multiplication rate from mother plants is 6-10x under traditional field multiplication
In tunnel multiplication it is 100-125x over the course of a season

Activity 4.3 Evaluation and comparison of rapid multiplication innovations in SEA context (setting up viable technology)

	Laos	Cambodia	Vietnam	Lesson learnt
In vitro multiplication	Upgraded the facility, and Virtual training was organized for staff	Upgraded the facility, and Virtual training was organized for staff		
Tunnel system	Six Tunnels at NAFRI, Vientiane	One big tunnel at CARDI Co-funded by CAVAC Four tunnles GDA Chamkar Leu Up-land farm (ACIAR fund)	One each for demonstration purposes at NUV and AGI Four at HLARC for multiplication and clean seed dissemination	Regular monitoring is essential. Controlling humidity and temperature is crucial. Different design may need for different climatic conditions
Scaling up	Ten Tunnels *were* operational in Khousap Company at Pakson Six Tunnels at Lao cassava Association (LCA) at Loangram	Four tunnels at Stung Treng Four tunnels at Bantey MeanChey	Four at DaK Lak Four at Tay Ning	Focus may change at any time. Reliable partner is essential

Activity 4.4

Optimize agronomic practices (variety, density, fertilizer) for the economic production of both cassava roots and clean planting material

Planting Density Trial

Objective: To determine the optimum planting distance for seed production (i.e. comparing tunnel plant let and traditional planting)

Country	Location	Variety	Treatments Planting density/fertilizer	Lesson learnt
Cambodia	Chamkar Leu Up-land farm (GDA station)	KU50	10,000, 20,000 and 13,333 plants ha^{-1} X different fertiliser	On going
Laos	Naphokh, NAFRI research station	Rayong11	10,000, 20,000 and 13,333 plants ha^{-1} X different fertiliser	Yield was not significantly different between tunnel grown plant let and traditional planted crop
Vietnam	Hungloc Agricultural research center	HL 442 (VN19_442)	10,000, 20,408 and 12,500 plants ha^{-1} X different fertiliser	On going

Harvesting Date Trial

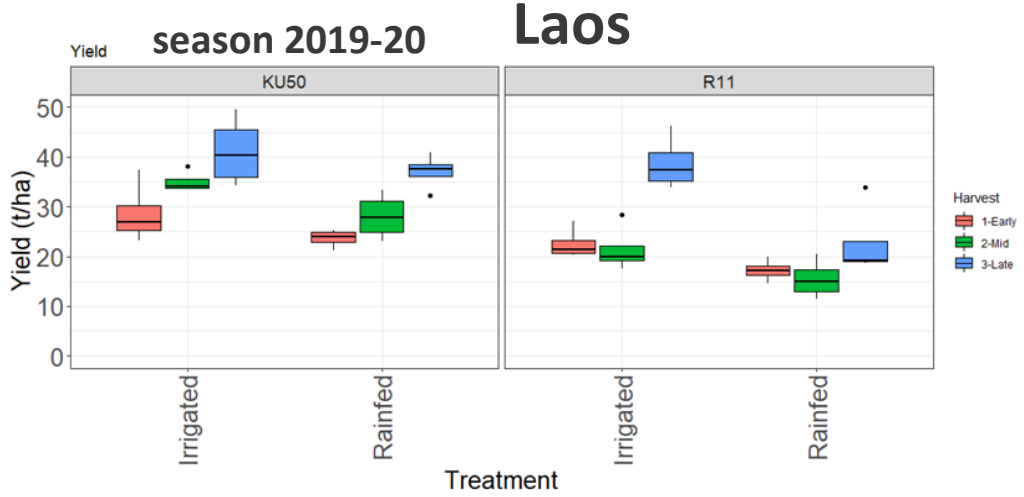
Objective: To determine the effect of time of planting and time of harvesting on the growth and yield of different cassava varieties and thus contribute to a better understanding of sustainable cassava production systems in specific agro-ecological areas.

Country	Location	Variety	Treatments	Lesson learnt
Cambodia	Chamkar Leu Up-land farm (GDA station)	KU50	Rainfed, Hravest after 6, 8 and 10 months	Longer duration crop yielded highest
Laos	Naphokh, NAFRI research station	Rayong11, KU50	Rainfed and with irrigation, Plant at 3 different time (Jan, Mar, May) and harvest after 10 months	Late planting may have lower yield
Vietnam	Hungloc Agricultural research center	KM94, D7	Rainfed and with irrigation, Plant at different time and harvest after 10 months	Dry season planting can lead to crop failure

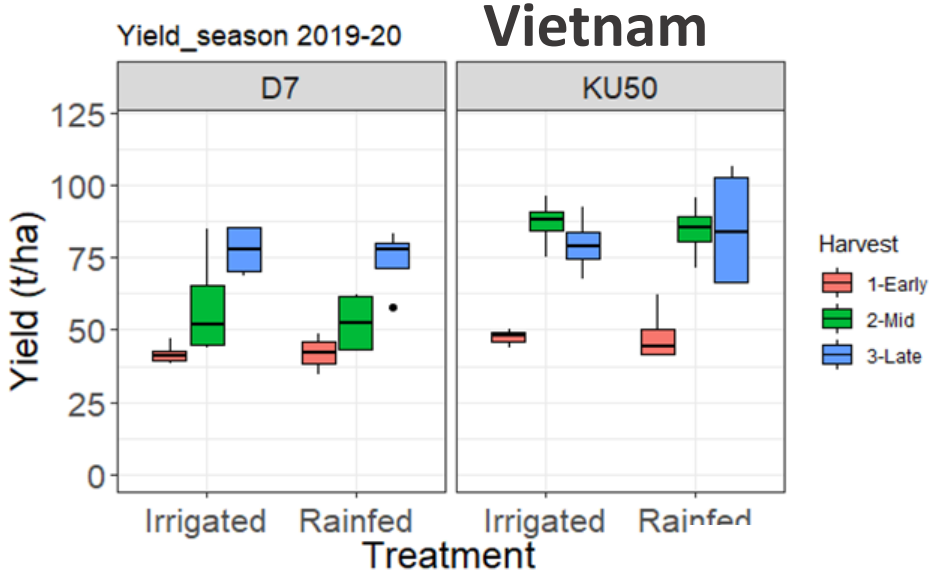
Summary results

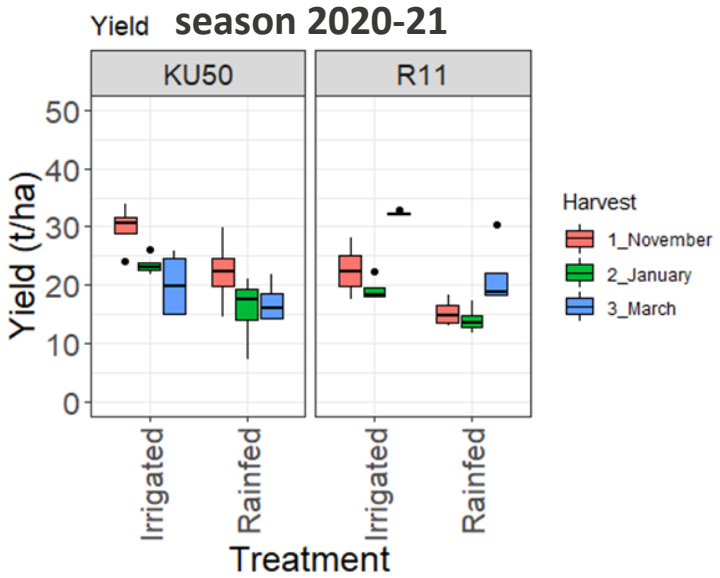
Longer duration crop yielded highest

Laos

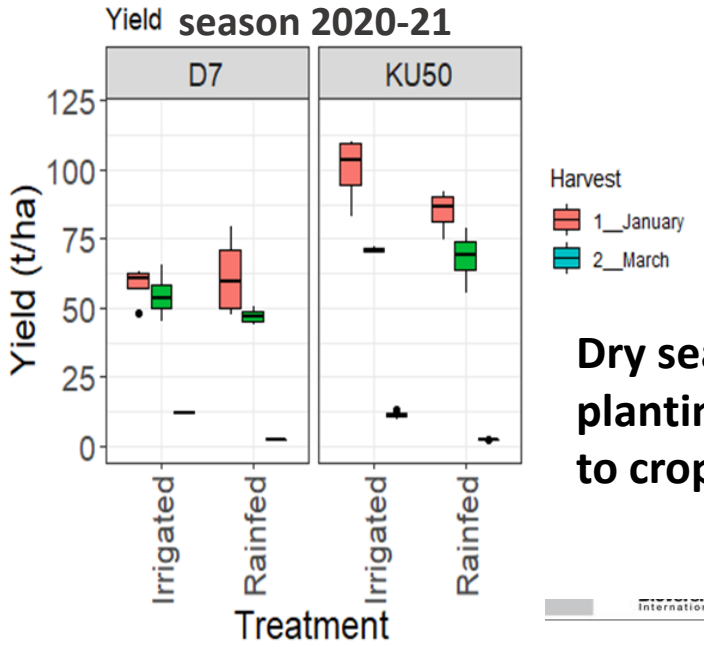


Vietnam





Late planting may have lower yield



Dry season planting can lead to crop failure

Objective 5:
Evaluate the impact of soil fertility and management practices on the prevalence, incidence, and severity of cassava disease. Develop and evaluate alternative cropping-system options relevant for different biophysical, social and market contexts that mitigate the impact of disease and improve the overall sustainability of smallholder cassava production.

Sunhemp a quick growing leguminous crop cultivated for green manure

Significant outputs

Journal Publication

Susceptibility of Cassava Varieties to Disease Caused by Sri Lankan Cassava Mosaic Virus and Impacts on Yield by Use of Asymptomatic and Virus-Free Planting Material

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Abstract: Cassava (*Manihot esculenta* Crantz) is a rainfed, smallholder-produced crop in mainland Southeast Asia, and is currently facing a serious challenge posed by the introduction of cassava mosaic disease (CMD). This study assessed the susceptibility of popular Asian varieties to CMD, yield penalties associated with the disease, and the efficacy of selecting clean or asymptomatic plants as seed for the following season. Field experiments evaluated agronomic management practices (i.e., fertilizer application, use of symptomatic and asymptomatic seed stakes) in Cambodia with six to

Rapid multiplication technology (tunnel multiplication) of disease-free planting material is on going in all three countries with national partners
Field day and workshop in Cambodia

Safe transfer of germplasm between partners

Rapid multiplication technology (tunnel multiplication) of disease-free planting material is on going in all three countries with national partners


Ms. Nhạn Phạm Thị, Mr. Hoa, Mr. Tung Nguyen Ba and Mr Hung Ngoc Nguyen


Ms. Nhạn Phạm Thị (HLARC) and Ms. Thuy, Cu Thi Le


Banteay Meanchey, Cambodia (with PDAFF)

Scaling out through private companies and development partners
Visits by dignitaries

Cross boarder cooperation - disease-free planting material transfer

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Rapid cassava seed multiplication, clean seed production and CMD resistant varieties field day and workshop in Cambodia

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Stakeholder meeting for Greater Mekong Cassava Seed Systems





Australian Government
Australian Centre for
International Agricultural Research


RESEARCH
PROGRAM ON
Roots, Tubers
and Bananas
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Since 1967 Science to cultivate change

Thank you!

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