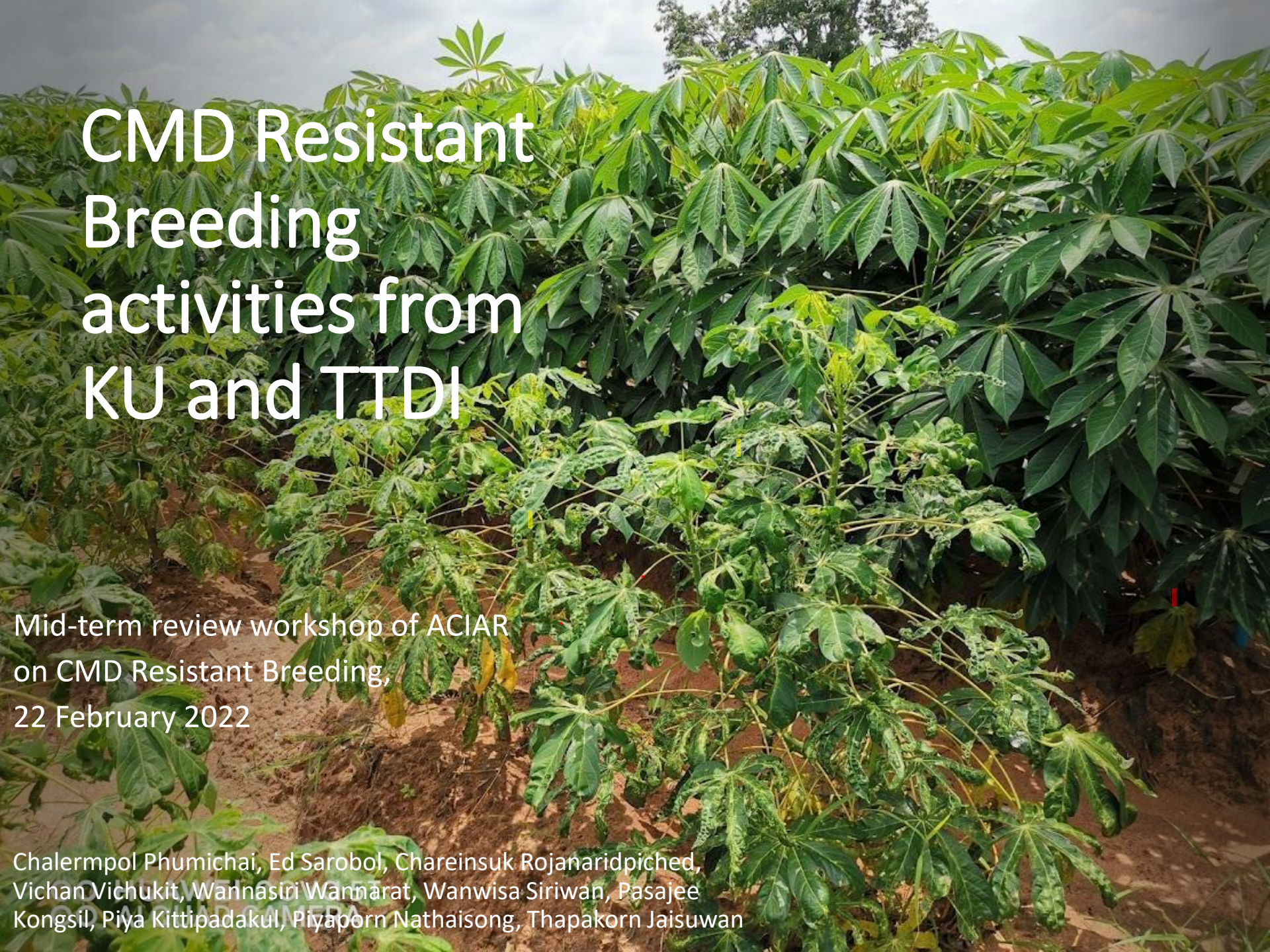




CMD Resistant Breeding activities from KU and TTDI

Mid-term review workshop of ACIAR
on CMD Resistant Breeding,
22 February 2022

Chalermpol Phumichai, Ed Sarobol, Chareinsuk Rojanaridpiched,
Vichan Vichukit, Wannasiri Wannarat, Wanwisa Siriwan, Pasajee
Kongsil, Piya Kittipadakul, Piyaorn Nathaisong, Thapakorn Jaisuwan

Cassava team



Breeding



Ed Sarobol



Chalernpol Phumichai



Piya Kittipadakul



Pasajee Kongsil



Virology

Wanwisa Siriwan



Tissue culture and seed multiplication

Wannasiri Wannarat



Vichan Vichukit



Chareinsuk Rojanaridpiched



- **2015 : First report CMD outbreak in Ratanakiri province, Cambodia.**
Wang *et al.* (2016)
- **2017 : First outbreak in Tay Ninh province, Vietnam**
Hoat et al.(2017)

<https://www.pinterest.com/pin/340725528040857318/>

CMD outbreak in southeast Asia

Sri Lankan cassava mosaic virus (SLCMV)

- Sources of resistance to CMD available from CIAT, TME3 and C33 were introduced to Thailand on March **2013**

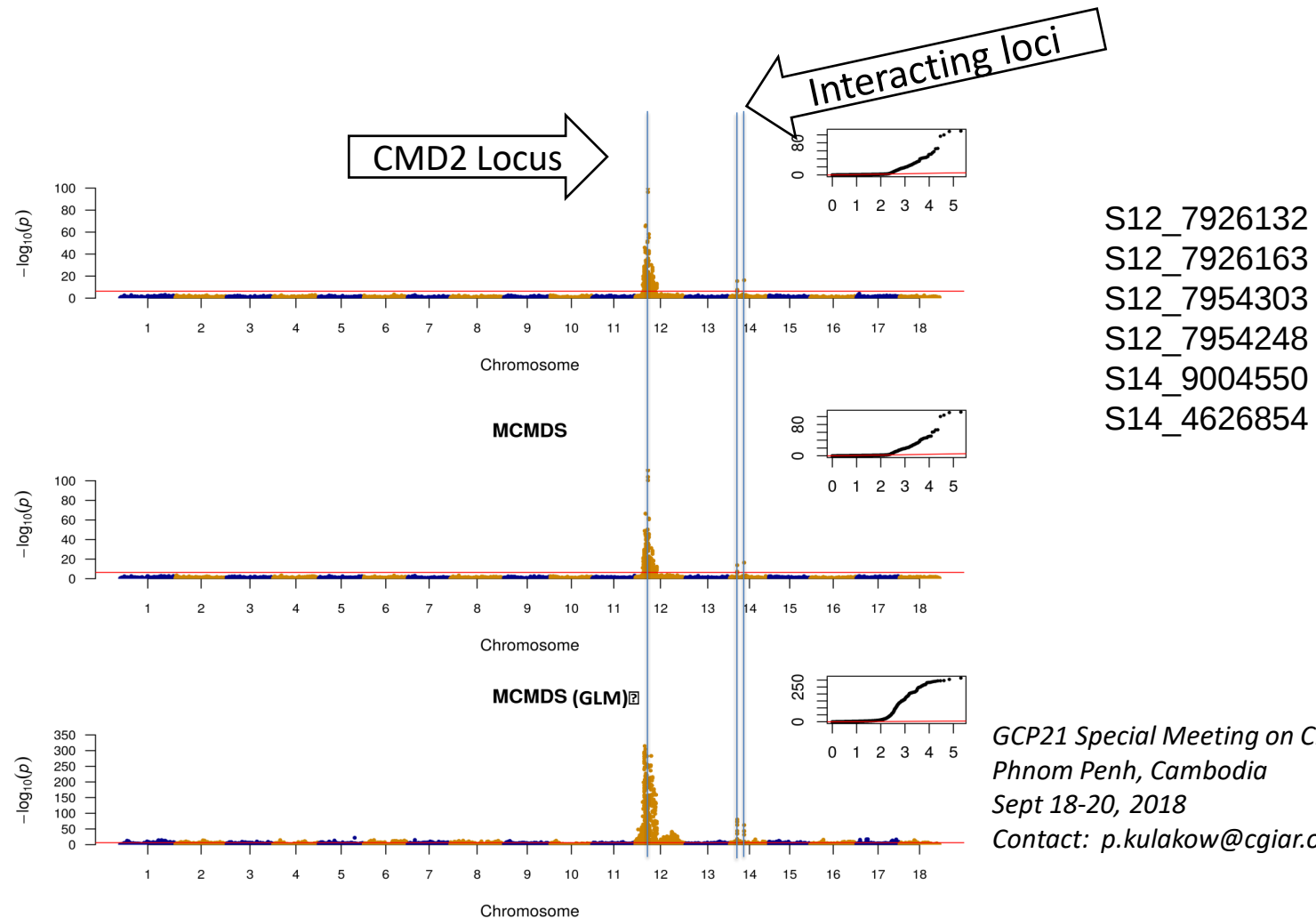


1st crossing between TME3 C33 with Thai varieties

(2014-2016)



Code	Female X Male	Seeds
MKUC57-29	MECU72(OP)	59
MKUC58-76	M72 x HB80	9
MKUC58-77	C33 x HB60	6
MKUC58-78	C33 x #60	3
MKUC58-79	M72(OP)	74
MKUC58-80	C33(OP)	42
MKUC59-123	HB80 x TME3	6
MKUC59-174	C33 x KU50	18
MKUC59-175	C33 x HB80	6
MKUC59-176	C33 x R9	18
MKUC59-177	C33 (OP)	41
MKUC59-179	TME3 (OP)	11
Total		293



*GCP21 Special Meeting on CMD in Asia
Phnom Penh, Cambodia
Sept 18-20, 2018
Contact: p.kulakow@cgiar.org*

Selection of CMD2 resistance alleles using markers in the High Throughput Genotyping Platform

C33

TME3

Three CMD markers on chromosomes 12 and 14 were used for the selection.
(Ismail Rabbi et al. 2020)

DNA	snpME0021	snpME0022	snpME0025
123-1	T:G	G:A	A:G
179-3	T:G	G:A	A:G
179-4	T:G	G:A	A:G
179-5	T:G	G:A	A:G
179-8	T:G	G:A	A:G
TME3	T:G	G:A	A:G
C33	T:G	G:A	A:G

179-5

123-1

179-8

179-4

Five selected breeding lines using snpME0021 on chr12 comparing with TME3, C33 for yield trial in spreading CMD field at Sa Kaeo province harvested at 10-month 2020/2021

Variety/line	Disease incidence (%)	Yield (t/h)	% SC	
			PCR(+)	PCR(-)
MKUC 59-123-1	100	20	-	-
MKUC 59-179-3	100	24	17.7	-
MKUC 59-179-4	0	33	-	18.1
MKUC 59-179-8	93	25	18	-
C33	0	12	15	-
MKUC 59-179-5	98	20.7	17.2	-
TME3	56	21.6	11.6	15.8
C33	0	17	-	14
HB80	74	37.3	17.9	21.9

Disease incidence and yield comparison between commercial varieties and C33 for general yield trial in spreading CMD field at Sa Kaeo province during 2019/2020-2020/2021

No.	Variety	Disease incidence 9 m (%)			Yield (t/h)
		2019/2020	2020/2021		
1	KU50	20	17	18.5	23.9
2	HB60	21	29	25	24.3
3	R1	39	43	41	16.5
4	R72	-	54	54	23.8
5	MKUC 57-7-21	55	56	55.5	23.1
6	HB80	53	74	63.5	22.4
7	HB90	68	74	71	25.1
7	TME3	69	56	62.5	12.6
8	# 89	72	81	76.5	24.4
9	R11	88	97	92.5	13.9
10	C33	-	0	0	10.7

Yield, percentage of starch content and disease incidence between cassava varieties

- ^{1/} Mean of yield for 9 year (2013-2021) from 74 field trial on 11 provinces
- ^{2/} Mean of yield for 4 year (2018-2021) on fertile soil field
- ^{3/} Mean of SC (%) ^{1/} from 74 field trial
- ^{4/} Disease incidence in two years (2020-2021)
- ^{5/} Mean of yield for 2 year (2020-2021) from 7 field trial on 3 provinces
- ^{6/} Mean of yield for 4 year (2020-2021) on fertile soil field
- ^{7/} Mean of SC (%) (2020-2021) from 4 field trial on 3 provinces

Variety	Yield ^{1/} (t/h)	Yield in fertile soil ^{2/} (t/h)	SC (%) ^{3/}	Disease incidence (%) ^{4/}
HB 100	35.11	67.12	24.0	55
HB 90	33.51	56.60	25.6	71
HB 80	31.46	51.10	25.3	63
KU 50	31.15	36.68	23.4	18
HB 60	29.68	35.03	23.2	25
R 1	22.18	26.37	17.6	41
TME3	20.36 ^{5/}	28.11 ^{6/}	19.9 ^{5/}	63
C33	9.64 ^{7/}	10.68 ^{6/}	15.9 ^{7/}	0



Some Resistant lines were identified in field trial

Breeding for CMD resistance

- CMD resistance source
 - TME3 and C33
 - 5 IITA variety
 - 32 CITAT clones (AR and CR lines)
 - Seeds from Hawii (1194 seedlings)
 - Seeds from CIAT (GS)

IITA-TMS-IBA972205



IITA-TMS-IBA980581



IITA-TMS-IBA980505



IITA varietal trial at TDI (2019)

Harvested on May 2021

IITA-TMS-IBA920057



	Yield (kg/rai)	Yield (t/h)	%SC	HI
972205 (Tissue)	3911	24.4	13.9	0.4
980581 (Tissue)	3573	22.3	14.4	0.34
920057 (Tissue)	2546	15.9	14	0.34
980505 (Tissue)	2555	15.9	10.7	0.32
HB90 (Cutting)	-	-	23	-

IITA varietal trial at TDI (2019)

Harvested on Nov 2021



	% root rot	Yield (kg/rai)	Yield (t/h)	%SC	HI
TMEB419 (Tissue)	34.8	3893.3	24.3	23.3	0.4
980581 (Tissue)	38.6	4426.7	27.7	16	0.34
920057 (Tissue)	41	1866.7	11.7	25.7	0.3
980505 (Tissue)	21	4462.2	27.9	13.9	0.36
HB90 (Cutting)	0.8	9644.4	60.3	27.9	0.67
KU50 (Cutting)	1	7751.1	48.4	28.1	0.59

32 CIAT clones (2021)

Entry	Genotype	Mother	Father	Purpose	No. Tubes/Bags	No. Plants
1	AR9-12	C-243	CW257-12		2	10
2	AR9-14	C-243	CW257-12		2	10
3	AR11-12	C-243	CW259-43		1	5
4	AR12-11	C-33	CW234-2		2	10
5	AR12-57	C-33	CW234-2		2	10
6	AR14-2	C-33	CW257-10		2	10
7	AR14-3	C-33	CW257-10		2	10
8	AR17-3	C-33	CW258-17		2	10
9	AR17-18	C-33	CW258-17		2	10
10	AR17-23	C-33	CW258-17		2	10
11	AR18-1	C-377	CW257-12		2	10
12	AR23-1	C-39	CW259-43		2	10
13	AR35-1	C-243	CW257-10		2	10
14	AR37-38	C-33	CW259-42		2	10
15	AR37-103	C-33	CW259-42		2	10
16	AR40-3	C-39	CW259-42		2	10
17	AR40-5	C-39	CW259-42		2	10
18	AR40-19	C-39	CW259-42		2	10
19	AR42-3	C-413	CW259-42		2	10
20	AR42-4	C-413	CW259-42		2	10
21	CR13-8	COL 1734	C-33		2	10
22	CR24-3	CM7951-5	C-18		2	10
23	CR24-16	CM7951-5	C-18		2	10
24	CR25-4	CM7951-5	C-33		2	10
25	CR27-20	CM7951-5	C-243		2	10
26	CR52A-2	C-243	SM1219-9		2	10
27	CR52A-4	C-243	SM1219-9		2	10
28	CR60B-10	C-18	TAI 8		2	10
29	CR61A-1	TAI 8	C-33		2	10
30	CR100-2	OW 181-2	C-377		2	10
31	CR100-5	OW 181-2	C-377		2	10
32	CR100-9	OW 181-2	C-377		2	10
					63	315





3,765 cassava seeds from Hawaii, 1,213 germinated (32.2%),
1,194 seedlings

Breeding for CMD resistance

TME3 C33 and five IITA varieties were provided in cutting and plantlets and given to DOA in 2020



TTDI



Transforming African Agriculture



CIAT

International Center for Tropical Agriculture
Since 1967 Science to cultivate change

CMD resistance materials

- 1) C33
- 2) IITA-TMS-IBA980505
- 3) IITA-TMS-IBA972205
- 4) IITA-TMS-IBA980581
- 5) IITA-TMS-IBA920057
- 6) TMEB419

x

Commercial varieties



- Plant type, HI, Yield (Seedling Stage)
- CMD markers screening (Single row trial)

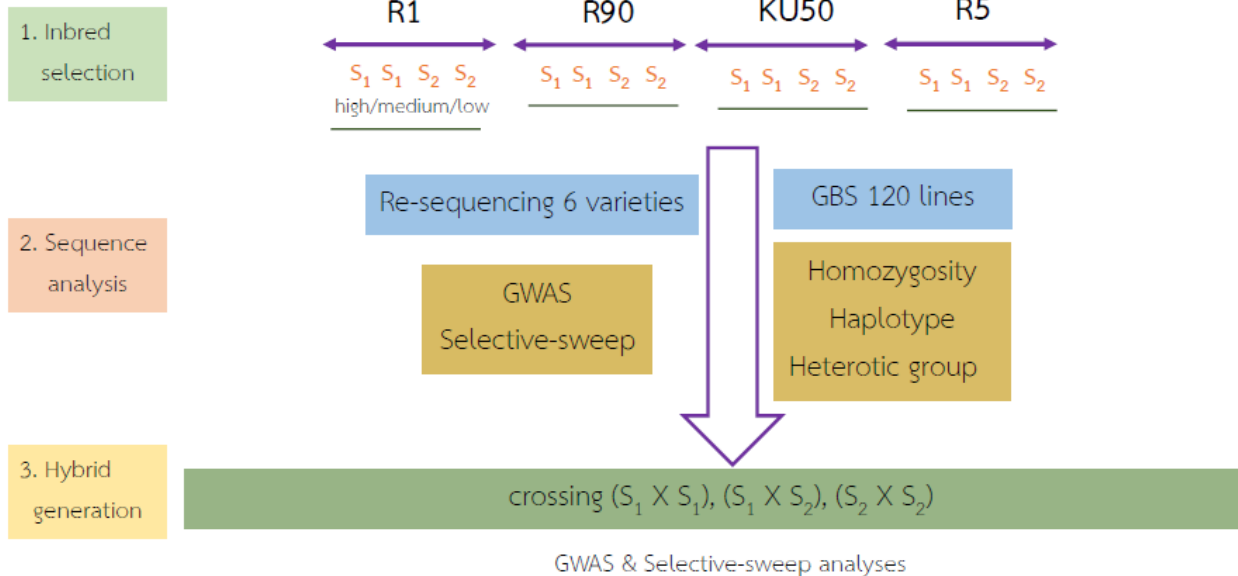
1st crossing, TME3 and C33 (550 single row, 2019-2021)

2nd crossing, IITA, C33 (7154 seedling, 2020-2021)

Development of next generation cassava breeding platform using inbreds, heterosis hybrids and genome technology



Yield trials focus on root yield and starch content



Acknowledgements



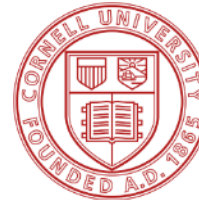
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RESEARCH
PROGRAM ON
Roots, Tubers
and Bananas



Australian Government
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International Agricultural Research



Thank You