# Establishing sustainable solutions to cassava diseases in mainland Southeast Asia

## Mid term Review - Hung Loc Agricultural Research Center (HLARC)

***Objective 2:***
***Enhance the capacity and collaboration between breeding programs in mainland Southeast Asia to develop new product profiles for commercially viable cassava varieties by identifying and incorporating known and novel sources of resistance to Cassava Mosaic Disease (CMD) and Cassava Witches Broom Disease (CWBD) into national breeding programs:***

Alliance

Bioversity International

CIAT
International Center for Tropical Agriculture
Since 1967 Science to cultivate change

TRUNG TAM NGHIEN CUU NONG NGHIEP HUNG LOC

- Activity 1: Evaluation of botanical seeds imported from Hawaii (NextGen project)
- Activity 2: Multi-environmental evaluation of CMD Resistant clones from CIAT, IITA and Vietnam local varieties.
- Activity 3:  Develop varieties with CMD resistance -- Establishment of crossing nursery and evaluation of F1

# Activity 1: Evaluation of botanical seeds imported from Hawaii in 2020-2021

- We got 4.964 seeds from Hawaii in **Aug- 2020**

Average germination:
24% soil pot

639 survival plants

- Asymptomatic
- Erect plant type
- No root rot

Harvesting after 10 months

175 clones were selected in **Aug-2021**

**Hawaii seeds**

# Activity 1: Evaluation of botanical seeds imported from Hawaii in 2021-2022

**Design**: Unreplicated Design with Diagonal Checks

| | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **8** | 200 | 199 | 198 | 197 | 196 | 195 | 194 | 193 | 192 | 191 | 190 | 189 | 188 | 187 | 186 | 185 | 184 | 183 | 182 | 181 | 180 | 179 | 178 | 177 | 176 |
| **7** | 151 | 152 | 153 | 154 | 155 | 156 | 157 | 158 | 159 | 160 | 161 | 162 | 163 | 164 | 165 | 166 | 167 | 168 | 169 | 170 | 171 | 172 | 173 | 174 | 175 |
| **6** | 150 | 149 | 148 | 147 | 146 | 145 | 144 | 143 | 142 | 141 | 140 | 139 | 138 | 137 | 136 | 135 | 134 | 133 | 132 | 131 | 130 | 129 | 128 | 127 | 126 |
| **5** | 101 | 102 | 103 | 104 | 105 | 106 | 107 | 108 | 109 | 110 | 111 | 112 | 113 | 114 | 115 | 116 | 117 | 118 | 119 | 120 | 121 | 122 | 123 | 124 | 125 |
| **4** | 100 | 99 | 98 | 97 | 96 | 95 | 94 | 93 | 92 | 91 | 90 | 89 | 88 | 87 | 86 | 85 | 84 | 83 | 82 | 81 | 80 | 79 | 78 | 77 | 76 |
| **3** | 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 | 61 | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 | 71 | 72 | 73 | 74 | 75 |
| **2** | 50 | 49 | 48 | 47 | 46 | 45 | 44 | 43 | 42 | 41 | 40 | 39 | 38 | 37 | 36 | 35 | 34 | 33 | 32 | 31 | 30 | 29 | 28 | 27 | 26 |
| **1** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 |
| | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **13** | **14** | **15** | **16** | **17** | **18** | **19** | **20** | **21** | **22** | **23** | **24** | **25** |

- #rows: 8; # of collums: 25

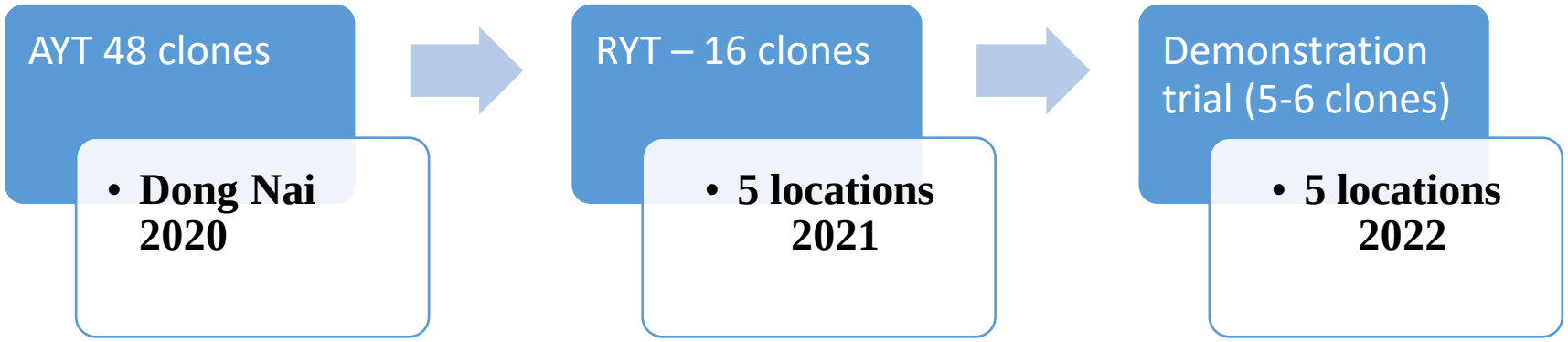
# Activity 1: Evaluation of botanical seeds imported from Hawaii in 2020-2021

- **Design**: Unreplicated Design with Diagonal Checks
- #rows: 8; # of columns: 25
- Number of Hawaii varieties: 175 clones
- Number of control varieties: 5 (S: KM94, HL-S12; R: TMEB419, VN19-1050, HN5)
- Singer row: 7 plants
- Planting density: 1m x 1m
- **Fertilizer** according to the formula 160 – 80 – 160
- Planting date: Aug 14th, 2021

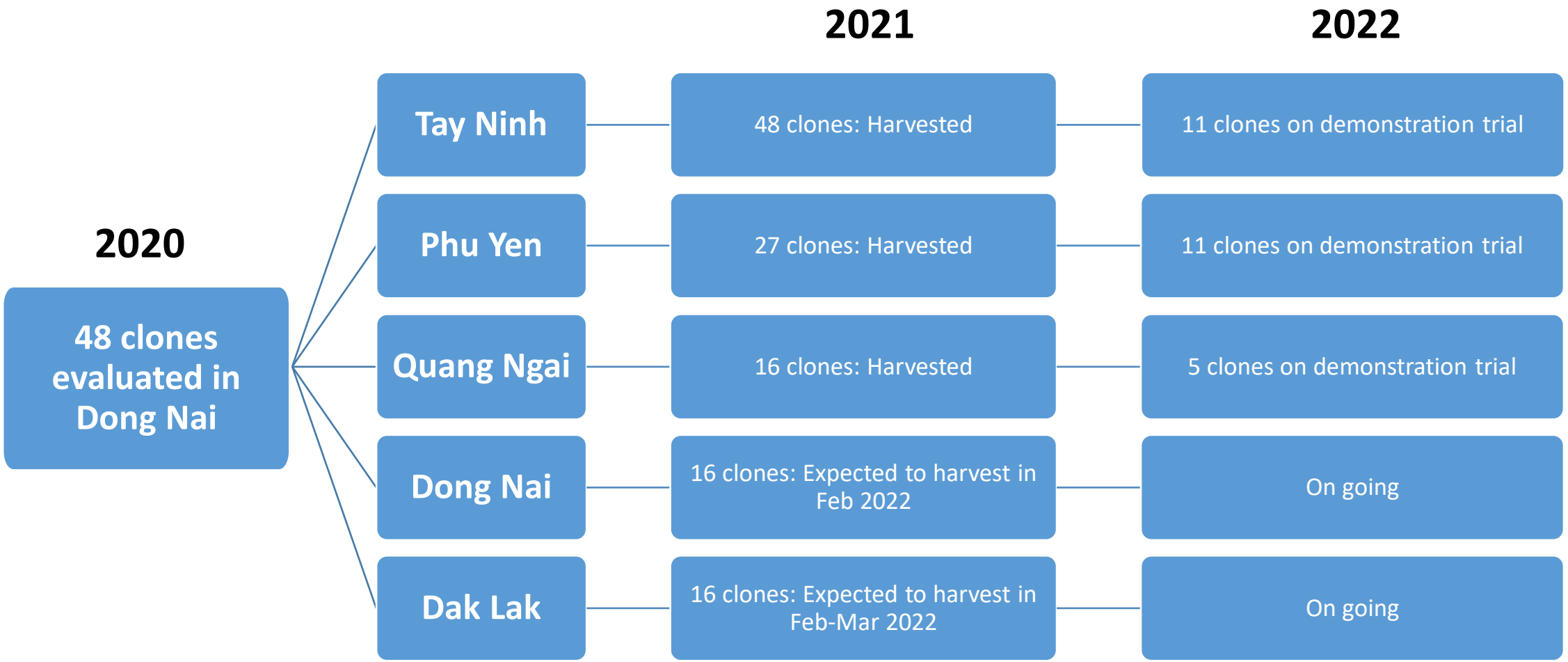
- # Survivors after 5 months: 161 varieties
- # CMD-infected varieties 5 MAP: 12 varieties;
- All **HL-S12** (susceptible) plots showed CMD symptom.

- Cassava 5 months after planting
- The cassava plants is growing and developing well. Continue to follow and evaluate based on plant type, root yield, starch content, CMD score, then we are going to select promising lines when at harvest in August 2022 for yield.

## Activity 2: Multi-environmental evaluation of CMD Resistant clones from CIAT, IITA and Vietnam local varieties



# Multi-environmental evaluation of CMD Resistant clones



## Information about Advanced Yield Trials in Dong Nai in 2020

**Materials**: clones from IITA5 and CIAT, and elite varieties

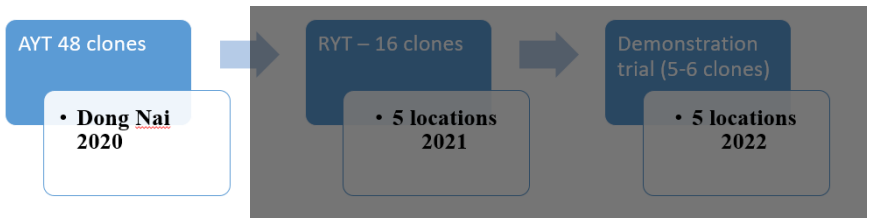
**Source of stem cuttings**, Tay Ninh (7 months)

**Spread row**: HL-S11 -- susceptible

**Trial design**, row-column design with 3 reps

Control varieties: KM94, HL-S11, KM140, KM419, KM505 – elite varieties

**Plot size**, 20 plants per plot, 4 rows, harvesting the central 6 plants for yield




## The best genotypes based on average performance of Dong Nai in 2020-2021

| Name CODE | Genotypes | Plant Type | Main stem height | First branching height | Germination rate (%) | Yield | Starch |
|---|---|---|---|---|---|---|---|
| C42 | AR35-1 | 3 | 370 | 203 | 0.96 | 24.22 | 26.68 |
| C48 | AR42-4 | 3 | 393 | 305 | 0.95 | 20.51 | 27.98 |
| **C97** | **AR9-48** | **4** | **369** | **294** | **0.93** | **28.11** | **26.18** |
| C74 | CR13-8 | 3 | 369 | 192 | 0.97 | 27.61 | 27.78 |
| C36 | CR24-16 | 4 | 354 | 354 | 1.00 | 23.06 | 28.44 |
| C21 | CR25-4 | 4 | 372 | 342 | 0.98 | 20.47 | 27.22 |
| C80 | CR27-20 | 3 | 315 | 170 | 0.96 | 26.45 | 28.51 |
| HN2 | IBA920057 | 3 | 385 | 323 | 0.98 | 22.34 | 24.35 |
| HN5 | IBA980581 | 4 | 361 | 202 | 0.97 | 28.22 | 24.56 |
| **HN1** | **TMEB419** | **4** | **356** | **285** | **0.93** | **34.64** | **28.27** |
|  | VN19-254 | 4 | 323 | 323 | 0.98 | 32.89 | 25.25 |
| Control | KM140 | 4 | 252 | 215 | 1.00 | 24.40 | 24.30 |
| **Control** | **KM94** | **4** | **335** | **240** | **1.00** | **27.07** | **29.13** |
| Control | KM419 | 4 | 240 | 206 | 1.00 | 11.67 | 26.63 |
| Control | KM505 | 4 | 330 | 285 | 0.85 | 15.88 | 27.55 |
| **Control** | **HLS11** | **4** | **272** | **272** | **1.00** | **17.05** | **29.78** |

# Regional Yield Trials in 5 locations in 2021-2022

**Materials**: 16 clones from IITA5 and CIAT, and elite varieties

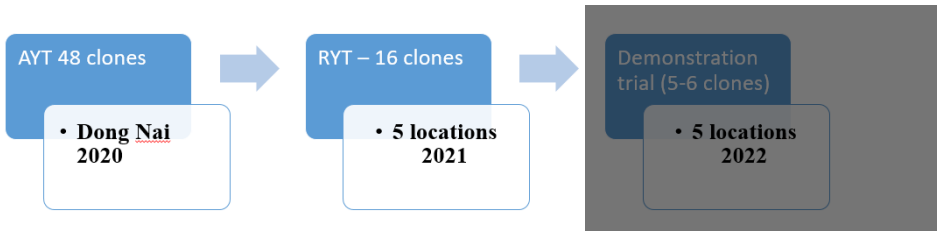
**Source of stem cuttings**, Dong Nai

**Spread row**: HL-S11  -- susceptible

**Trial design**, row-column design with 3 reps

Control varieties: KM94, KM140, KM419, KM505 – elite varieties

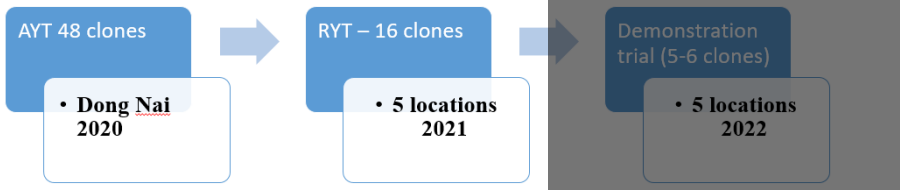
**Plot size**, 20 plants per plot, 4 rows, harvesting the central 6 plants for yield




Design example in Dong Nai 2021-2022

| No | Name | REP1 | REP2 | REP3 |
|---|---|---|---|---|
| 1 | CR24-16 | 14 | 24 | 35 |
| 2 | CR13-8 | 15 | 28 | 38 |
| 3 | AR35-1 | 11 | 32 | 33 |
| 4 | CR25-4 | 10 | 27 | 40 |
| 5 | AR9-48 | 9 | 30 | 39 |
| 6 | CR27-20 | 3 | 25 | 36 |
| 7 | AR42-4 | 7 | 29 | 42 |
| 8 | AR18-1 | 16 | 23 | 46 |
| 9 | TMEB419 | 13 | 19 | 44 |
| 10 | IBA972205 | 12 | 31 | 37 |
| 11 | IBA980581 | 4 | 26 | 41 |
| 12 | VN19-442 | 2 | 20 | 45 |
| 13 | KM94 | 5 | 18 | 47 |
| 14 | KM505 | 6 | 21 | 48 |
| 15 | KM419 | 1 | 22 | 43 |
| 16 | CR52A-4 | 8 | 17 | 34 |

# 1. Regional Yield in Trial Tay Ninh 2021




Selected clones

CR25-4
CR24-16
**TMEB419**
AR9-48
VN19-1050
VN19-773

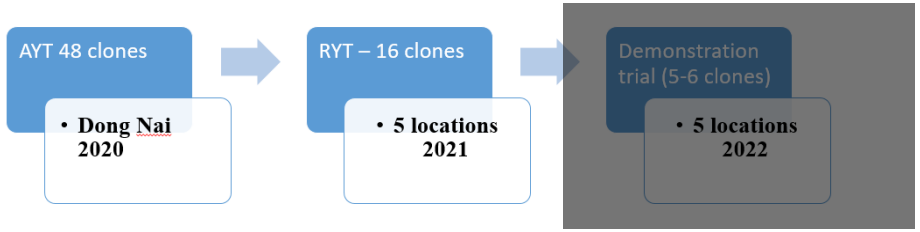
# 2. Regional Yield in Trials Phu Yen 2021



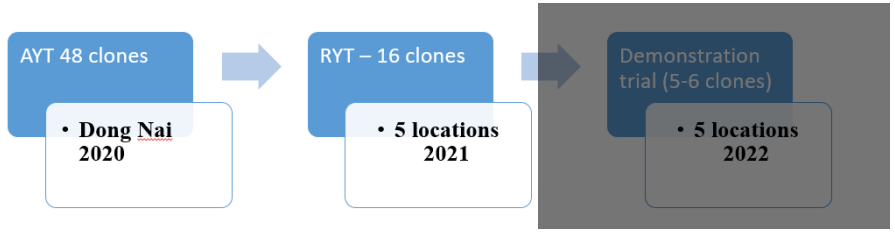


Selected clones

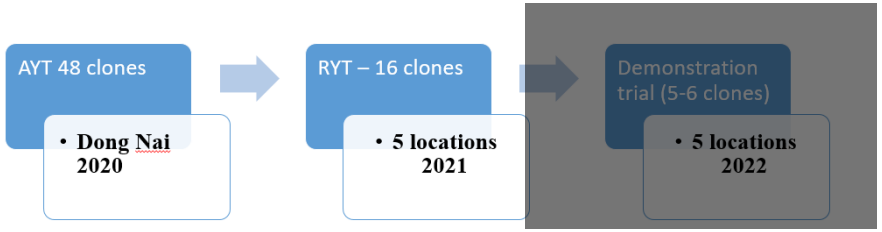
CR25-4
CR24-16
TMEB419
AR35-1
CR13-8
IBA920057



# 3. Regional Yield in Trial Quang Ngai 2021

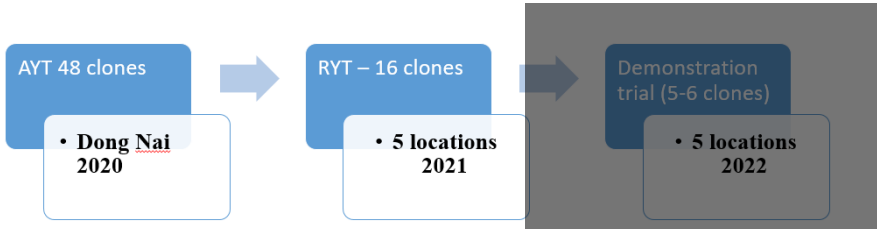



# 4. Regional Yield in Trial Dak Lak 2021



# 5. Regional Yield in Trial Dong Nai 2021

- Planting date: April 22, 2021
- Dong Nai Province: 16 clones (3 IITA, 9 CIAT, 4 Vietnam
- Expected to be harvesting in February, 2022



# ➢ Activity 2: Multi-environmental evaluation of CMD Resistant clones from CIAT And IITA in 2021-2022

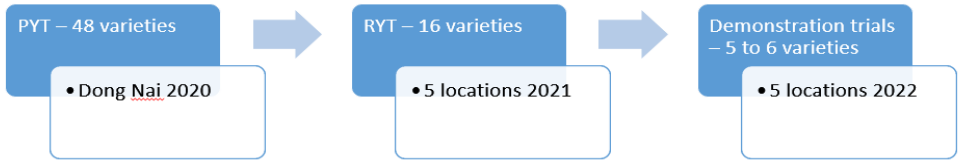
## 1. Demonstration Tay Ninh 2022


We continue to plant these promising varieties on large areas to evaluate:

- 6 promising lines
  - CR25-4
  - AR9-48
  - CR24-16
  - TMEB419
  - VN1050
  - VN773
- 5 control varieties
  - KM94
  - KM505
  - KM419
  - HN3
  - HN5
- Planting date: 27/11/2021

# 1. Demonstration Phu Yen 2022

- Planting date: Jan 16, 2022
- 6 promising lines
  - CR25-4
  - AR35-1
  - CR24-16
  - TMEB419
  - CR13-8
  - IBA920057
- 5 control varieties
  - KM94
  - KM505
  - KM140
  - HN3
  - HN5

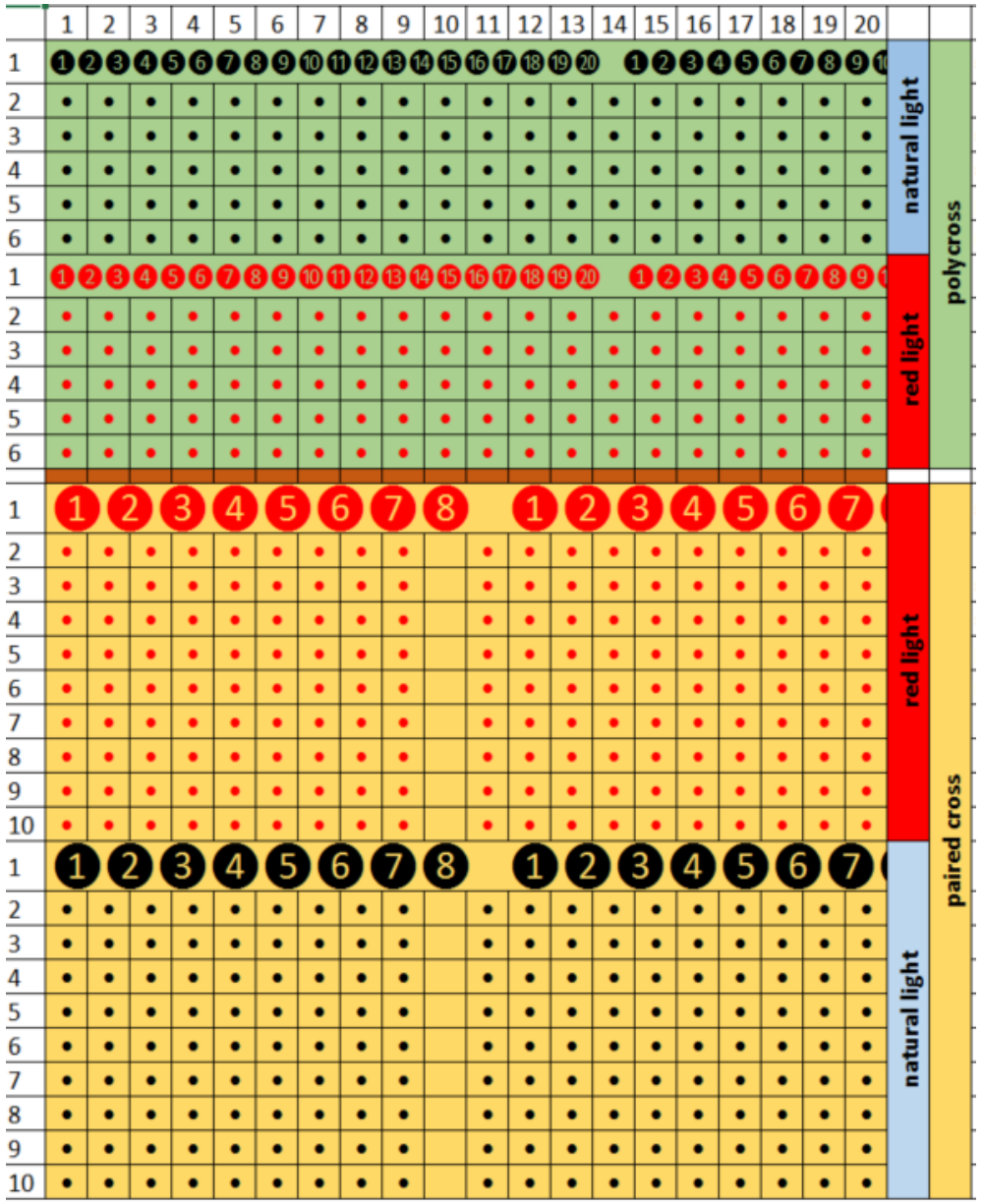


# Activity 3: Develop varieties with CMD resistance

**Design of crossing nursery in Lam Dong 2020**

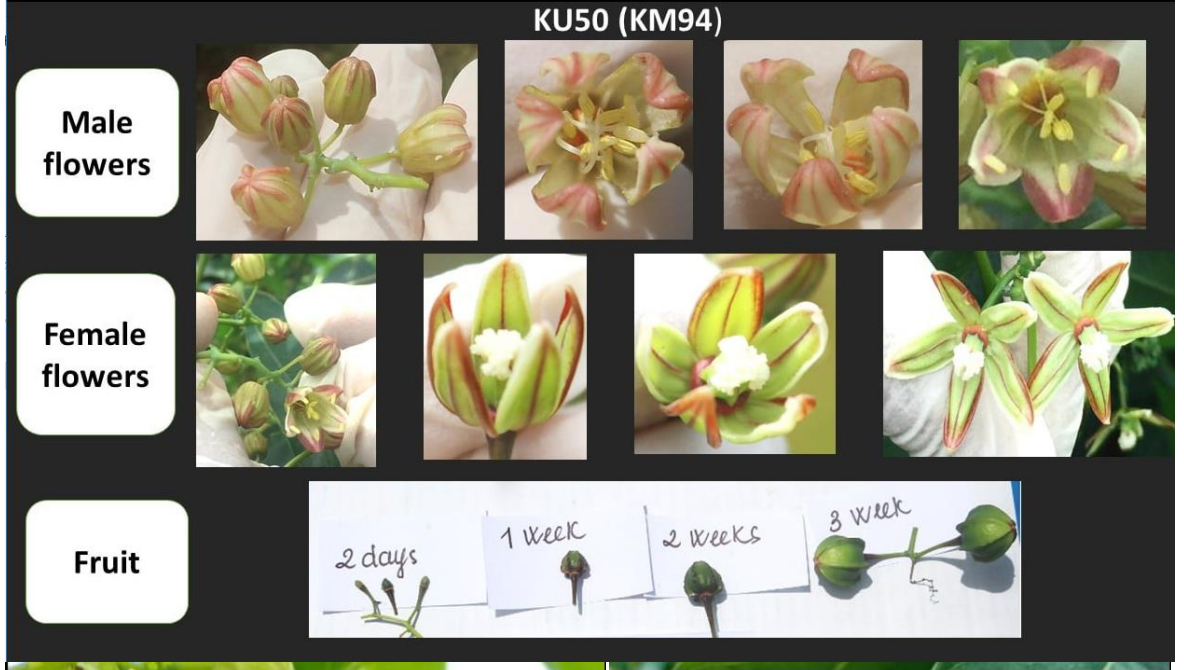
**Progenitor for crossing nursery**: 40 clones

+ CMD resistance: 20 clones (invitro plants)
+ Vietnamese varieties: 20 clones (stem cutting)
+ Planting density: 0.8m x 0.8m in polycross
  2m x 1.6 m in paired cross

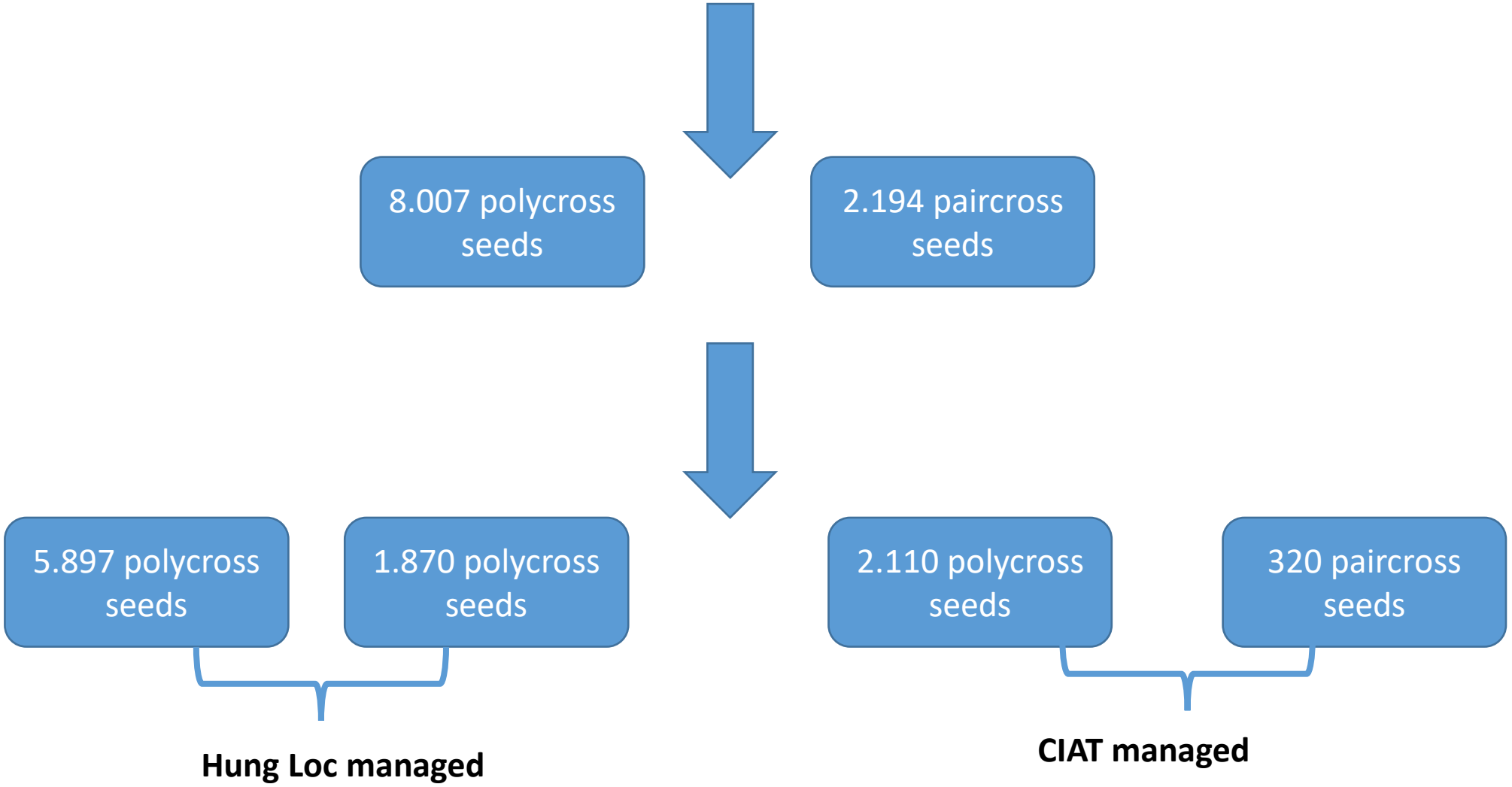


Planting → flowing → Crossing → Harvesting

June | Sept | Oct - Dec | Dec-Feb




# 2020 crossing nursery in Lam Dong



# Activity 3: Develop varieties with CMD resistance

| # | Parent Name | Origin | Advanced traits |
|---|---|---|---|
| 1 | TMEB419 | IITA | Erect type, high starch, yield, Resistance CMD |
| 2 | CR25-4 | CIAT | Resistance CMD |
| 3 | IBA972205 | IITA | Resistance CMD |
| 4 | AR9-48 | CIAT | Resistance CMD |
| 5 | CR27-20 | CIAT | Resistance CMD |
| 6 | IBA980581 | IITA | Resistance CMD |
| 7 | AR35-1 | CIAT | Resistance CMD |
| 8 | CR24-16 | CIAT | Resistance CMD |
| 9 | Rayong72 | Thailand | High starch, yield |
| 10 | HL-S11 | Hung Loc | High starch |
| 11 | KM419 | NL University | High starch |
| 12 | KM140 | Hung Loc | High yield |
| 13 | Rayong11 | Thailand | High starch |
| 14 | KM60 | CIAT | High starch |
| 15 | VN19-442 | Landraces | Tolerance CMD |
| 16 | VN19-1050 | Landraces | Tolerance CMD |
| 17 | HL-S12 | Hung Loc | High yield |
| 18 | KM94 | Thailand | High starch, yield |
| 19 | VN19-3113 | Landraces | High yield |
| 20 | VN19-773 | Landraces | Tolerance CMD |
| 21 | HL-S14 | Hung Loc | High starch, yield |
| 22 | VN19-1556 | Landraces | Tolerance CMD |

# Activity 3: Crossing Nursery in Lam Dong in 2021

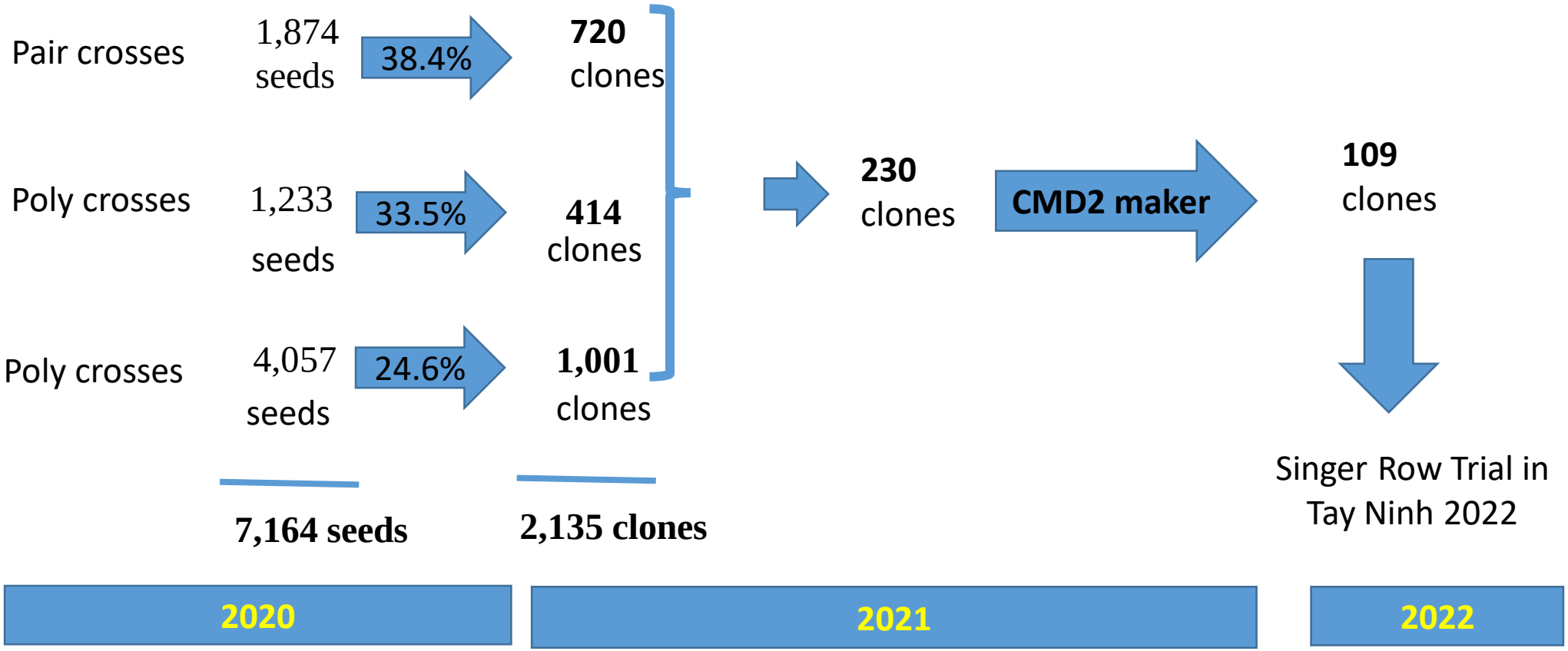
| Planting | flowing | Crossing | Harvesting |
|---|---|---|---|
| June | Sept | Oct - Dec | Dec-Feb |


# Activity 3: Crossing Nursery in Lam Dong in 2021

- After 2 times (periods) of pollinations, 2,272 fruits (**6,816 seeds**) had been produced from the parents.
- More than 3,000 fruits (**9,000 seeds**) from half-sib crosses will be harvested in end of this month.

# Activity: Evaluate the seeds harvested from crossing nursery (2021)

**Location: Dong Nai**



# Key Achievements

- Evaluated and selected 175 clones from 4.964 seed imported from Hawaii.
- Collected 10.201 seeds in 2020, shared to CIAT 2.430 seeds and managed 7.767 seeds
- Evaluate the seeds harvested from crossing nursery in 2020, determined 109 clones that can resistance to CMD, confirmed by marker.
- Co-released one resistant variety (TMEB419) with AGI.
- Elites Vietnam, IITA and CIAT genotypes have been evaluated to 5 locations, selected 5 best clones (TMEB419, AR35-1, CR24-16, CR25-4, CR13-8) to demonstration at larger area.

# Planning for 2022

- ❑ Collection seeds in crossing nursery in Lam Dong in 2021.
- ❑ Evaluation the seeds harvested from crossing nursery in 2021 in Dong Nai.
- ❑ Focus on crossing activities in Lam Dong to making more seeds
- ❑ Test flowering inducing by controlling nutrients from soils and using chemicals and red-lights system under conditions of Dong Nai at Hung Loc station (60 meter above sea level).
- ❑ Evaluation 109 clones at 2 locations (Tay Ninh, Dong Nai).
- ❑ Collect materials that can resistant CWB to use for crossing nursery.

# Thank for your listening !