# HARC Coffee Research Update

HSPA 1895
HARC 1996
Private non-profit
501(c)(3)

**May 21, 2022**

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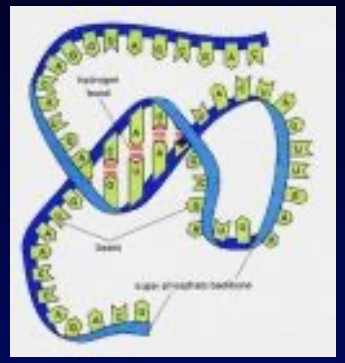
**Hawaii Agriculture Research Center**

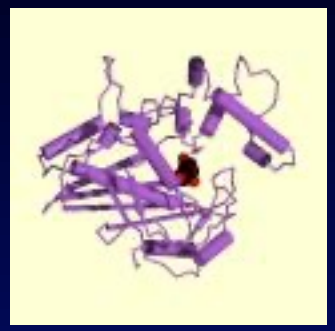
# From DNA to Whole Trees

Environment

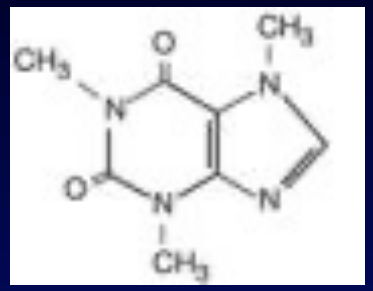
**DNA**
Genomics



**RNA**
Gene expression



**Protein**
Enzymes
metabolism



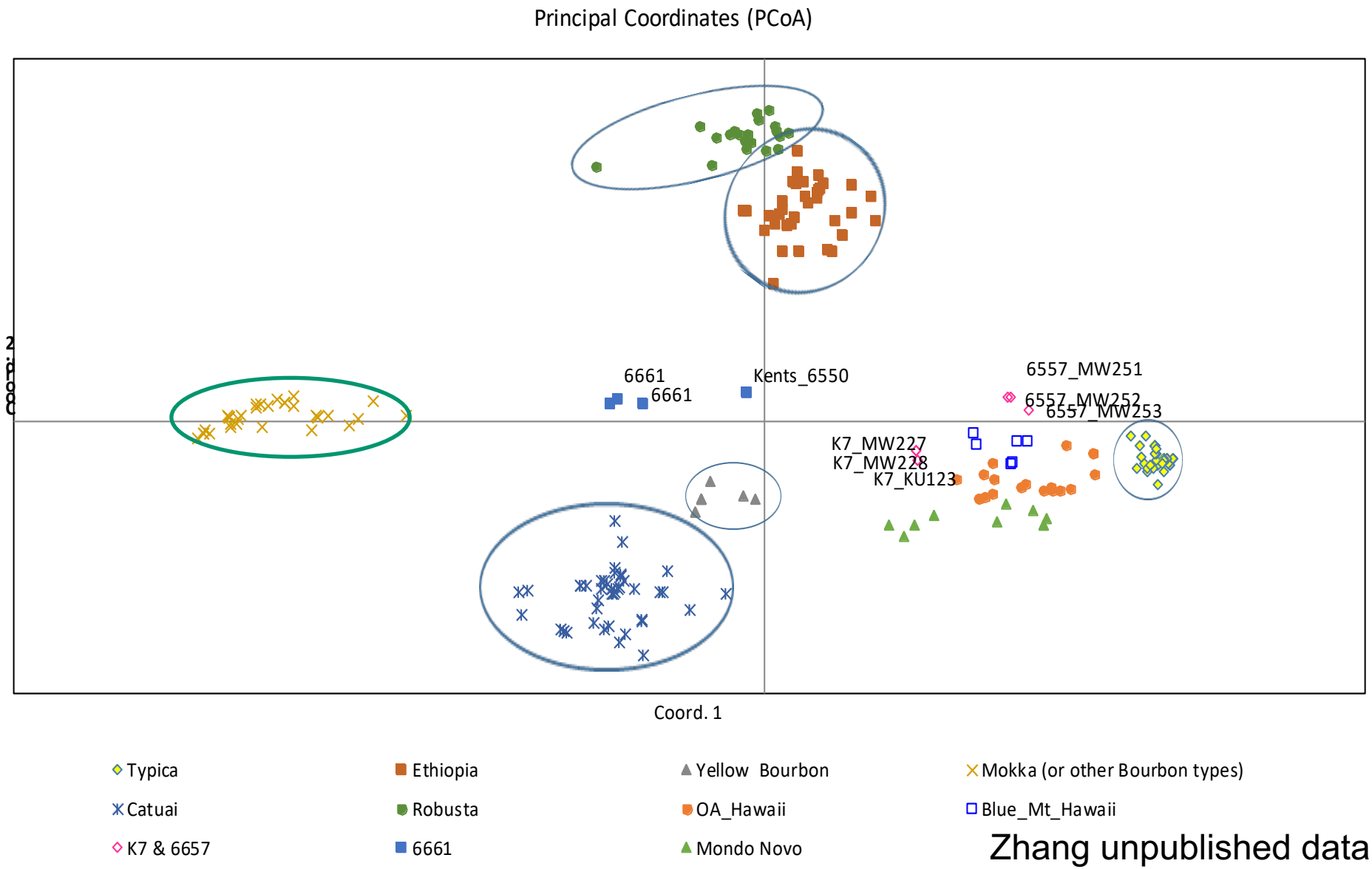

**Product**
Chemistry

**Whole trees**
Germplasm transfer
Breeding/selection

# Coffee Germplasm Transfer to PBARC

- 2020 – 2021
  - 83 genotypes
  - 5568 seeds
- 2022
  - 58 genotypes
  - 232 self-pollination

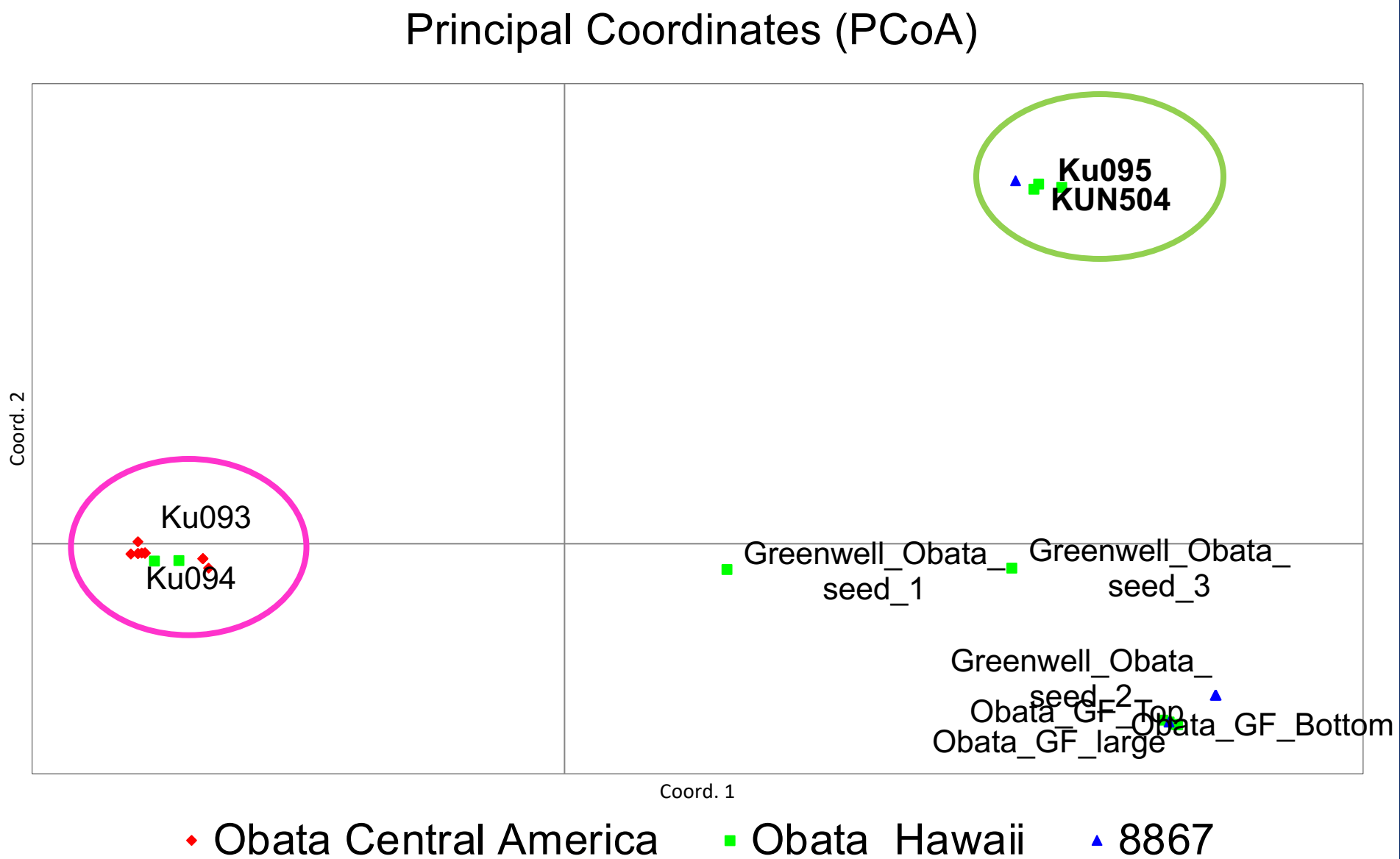
# Genotyping of HARC Core Collection




Zhang unpublished data

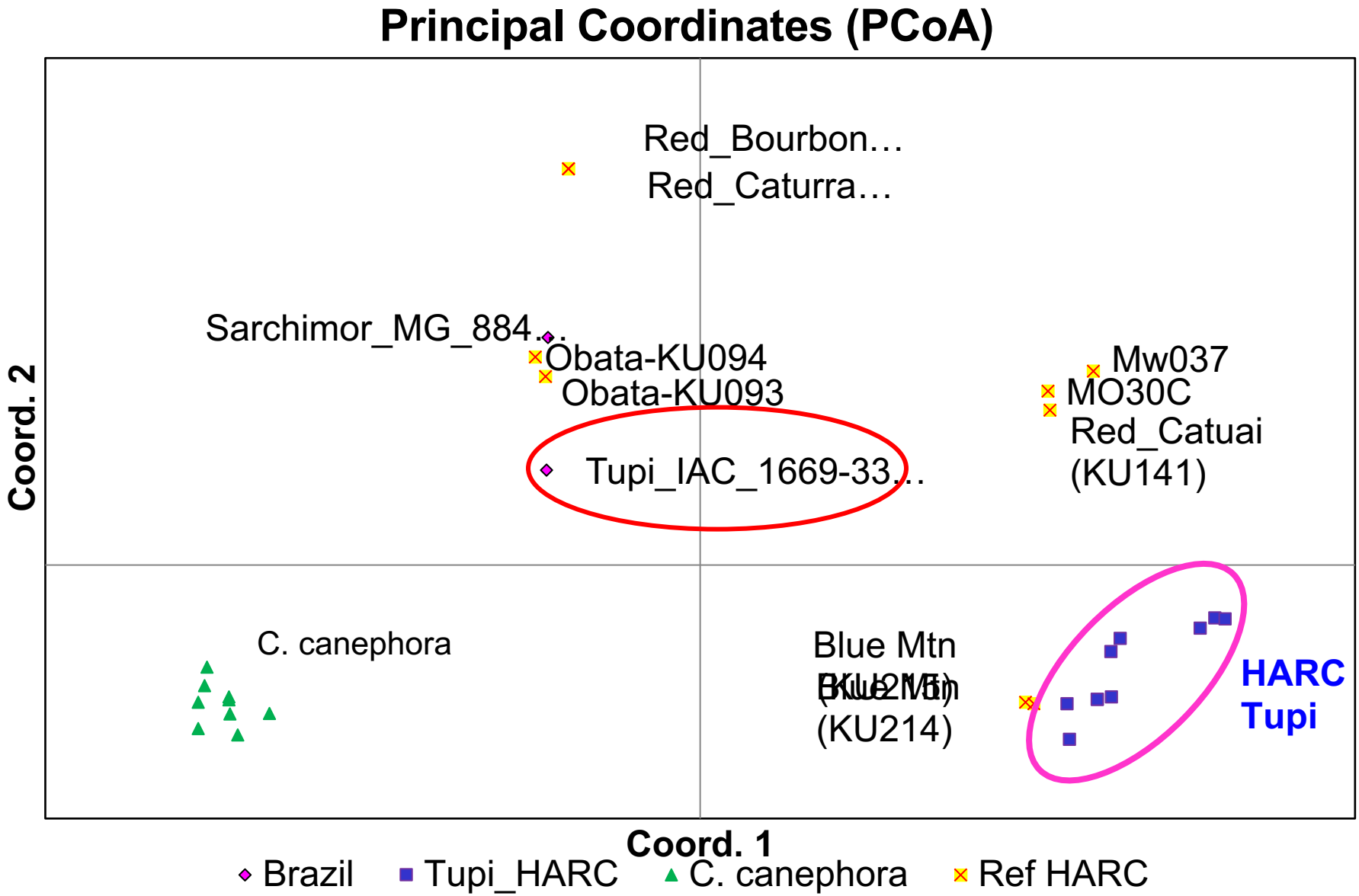
# Genotyping of Obata

Zhang unpublished data



# Genotyping of "Tupi"

Zhang unpublished data

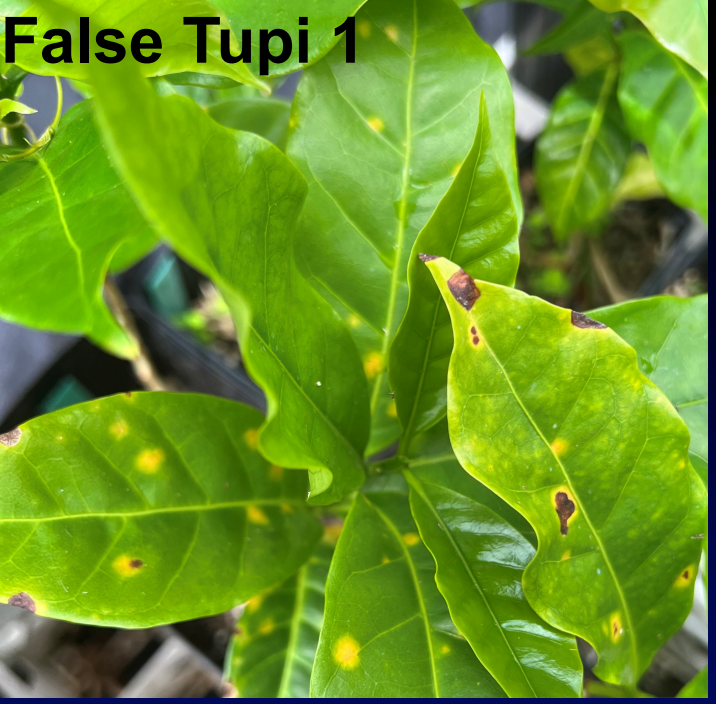


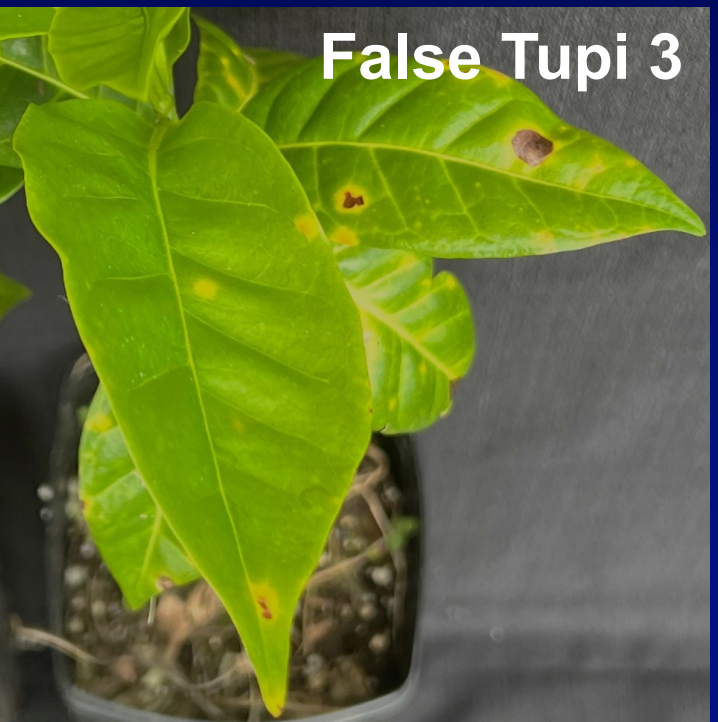
# Genotyping of “Tupi”

Ty: Typica Et: Ethiopian YB: Yellow Bourbon RB: Red Bourbon RC: Red Catuai
Rob: Robusta and other spp

| Accessions | Genotype | Assesment | Ty | Et | YB | RB | RC | Rob etc | SL 28 | 6661 etc | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Tupi-3 | | ? | 0.532 | 0.088 | 0.002 | 0.001 | 0.364 | 0.008 | 0.003 | 0.003 | 1 |
| Tupi-2 | | ? | 0.441 | 0.151 | 0.002 | 0.001 | 0.369 | 0.028 | 0.007 | 0.002 | 1 |
| Tupi-2 | | ? | 0.448 | 0.130 | 0.002 | 0.001 | 0.367 | 0.044 | 0.006 | 0.002 | 1 |
| MundoNovo | | Catuai x Typica | 0.612 | 0.001 | 0.001 | 0.001 | 0.381 | 0.001 | 0.002 | 0.001 | 1 |
| MundoNovo | | Catuai x Typica | 0.614 | 0.001 | 0.001 | 0.001 | 0.380 | 0.001 | 0.003 | 0.001 | 1 |
| Icatu_precoce _IAC_3282 | | Catuai x Typica | 0.490 | 0.002 | 0.006 | 0.002 | 0.494 | 0.001 | 0.003 | 0.002 | 1 |
| Icatu2941 | | Icatu | 0.355 | 0.018 | 0.014 | 0.050 | 0.418 | 0.140 | 0.002 | 0.003 | 1 |

Zhang unpublished data



# Natural CLR infection of False Tupi in Maunawili

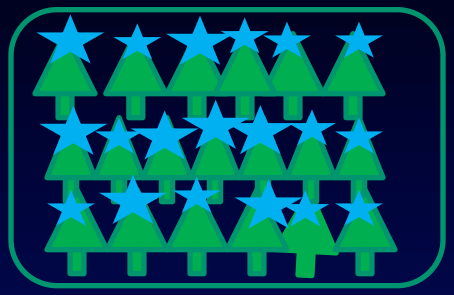
# SCRI Proposal

## Developing an efficient breeding pipeline for producing CLR-resistant coffee cultivars and maintain unique quality

Ming-Li Wang (HARC)
Tracie Matsumoto (PBARC)
Lisa Keith (PBARC)
Dapeng Zhang (ARS)
Qingyi Yu (TA&M)
Andrea Kawabata (UH)

1999 F1: Catimor x KO34

2021

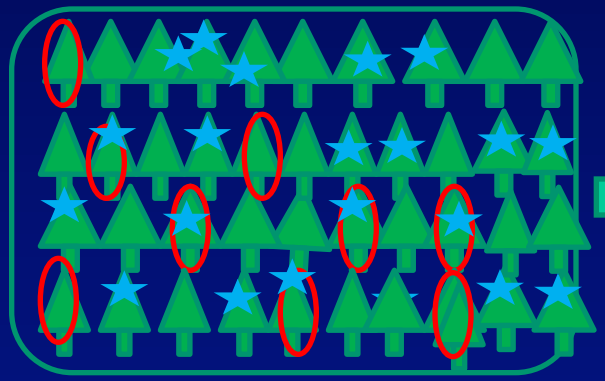


Rust Resistance

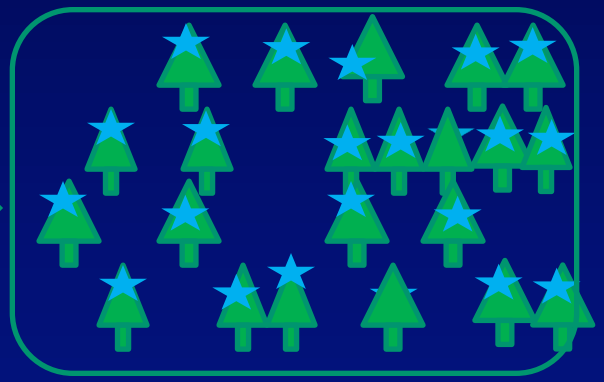
Cupping Quality

Self pollinated F1 trees

2022 Germination of F2 (seeds of F1)

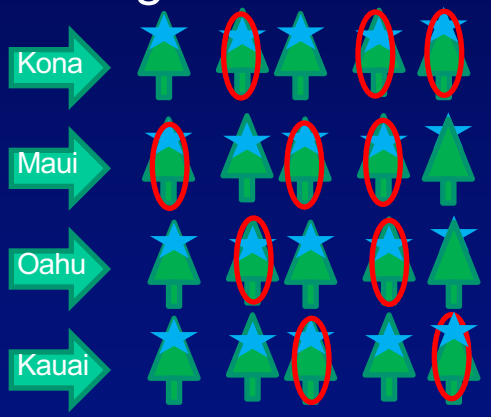


CLR leaf assay



Select only CLR resistant seedlings

Transplanting to:




Select trees with cupping quality and rust resistance

Nagai

# F2 of Catimor Crosses

| Cross number 99- | Group | Female parents | Male parents | Number of seeds or plants | Status |
|---|---|---|---|---|---|
| 20 | Mokka | T5175 | MA2-7 | 152 | Field-grown mature plants |
| 81 | Typica | T8667 | Blue Mt. | 139 | Germinating |
| 91 | Typica | T8667 | BMT | 149 | Germinating |
| 11 | Mokka | T5175 | Mokka | 50 | Germinating |
| 88 | Red Catuai | T5175 | MA10 | 108 | Germinating |
| 98 | Red Catuai | T8667 | MA10 | 229 | Germinating |
| 110 | Red Catuai | KA19 | T8667 | 102 | Germinating |
| 14 | Yellow Catuai | T8667 | KA18 | 52 | Germinating |
| 21 | Yellow Catuai | KA17 | T5175 | 14 | Germinating |
| 93 | Others | T8667 | OA11C | 44 | Germinating |
| 90 | Others | T5175 | OA12 | 27 | Germinating |

# Germinating F2

# Self-pollination of F1 in 2022

| Cross number 99- | Group | Female parents | Male parent | Number of branches bagged in 2022 |
|---|---|---|---|---|
| 81 | Typica | T8667 | Typica (Blue Mt) | 18 |
| 91 | Typica | T8667 | Typica (BMT) | 19 |
| 11 | Mokka | T5175 | Mokka | 14 |
| 88 | Red Catuai | T5175 | MA10 | 21 |
| 98 | Red Catuai | T8667 | MA10 | 19 |
| 110 | Red Catuai | KA19 | T8667 | 21 |
| 14 | Yellow Catuai | T8667 | KA18 | 14 |
| 21 | Yellow Catuai | KA17 | T5175 | 18 |
| 93 | Others | T8667 | OA11C | 16 |
| 90 | Others | T5175 | OA12 | 15 |
| 38 | Mokka | MA1-12 | T5175 | 1.5 trees |
| 12 | Mokka | T8667 | MK(Maui) | 15 |
| 178 | Typica | KO32 | T5175 | 23 |
| 175 | Typica | T5175 | KO34 | 10 |
| 142 | Yellow Catuai | KA18 | T5175 | 6 |
| 142 | Yellow Catuai | KA18 | T5175 | 6 |

# 2022 Obata Crosses

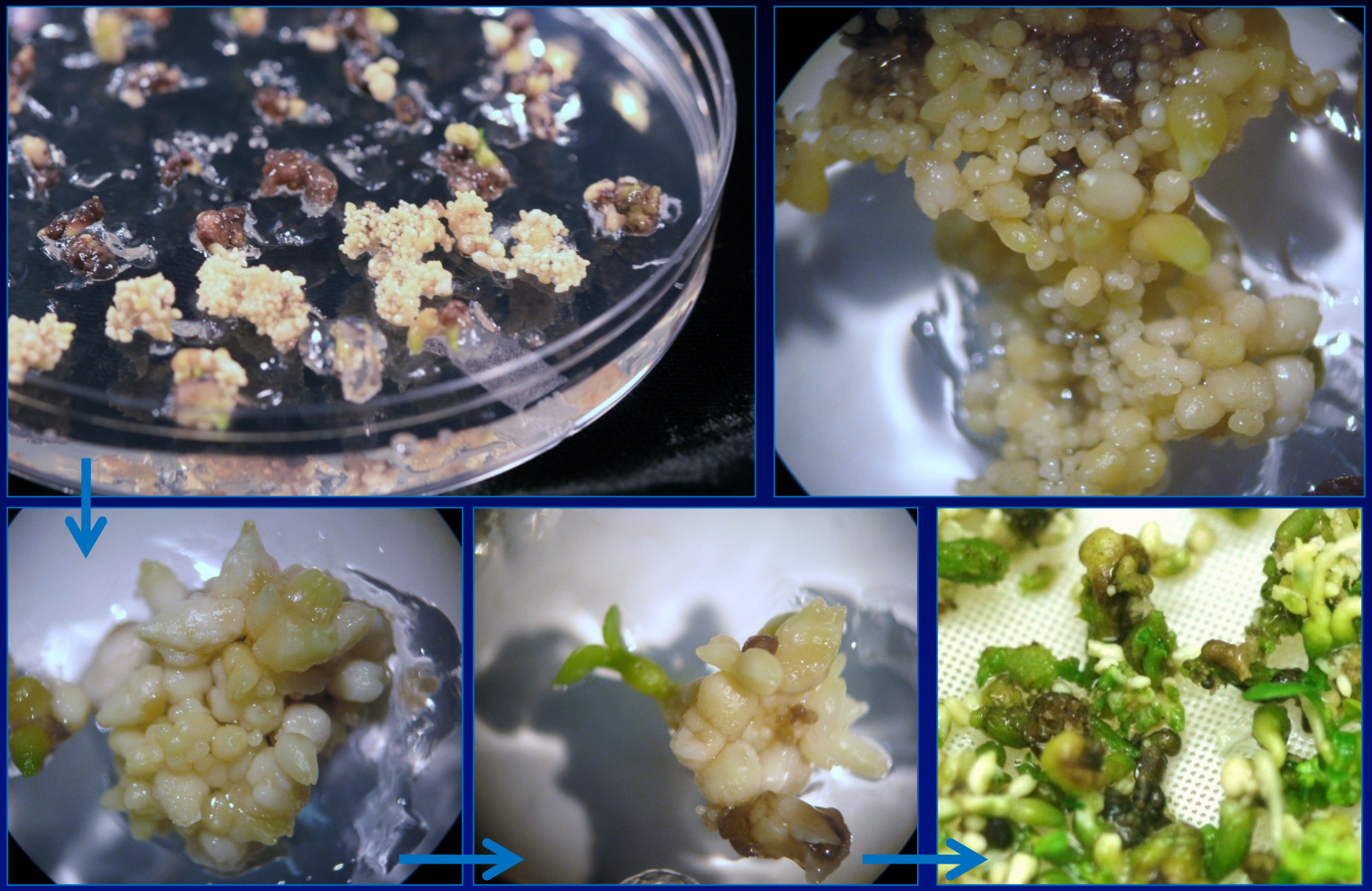
# Summary of 2022 Obata Crosses

| Cross number 22- | Group | Female parent | Male parent | Number of flowers pollinated |
|---|---|---|---|---|
| 258, 259 | Mokka | OA11C | Obata | 28 |
| 254, 255 | Mokka | OA12C | Obata | 35 |
| 252 | Mokka | Obata | MA1-6 | 13 |
| 231-233, 253 | Red Catuai | KA19C | Obata | 149 |
| 234, 242, 251 | Red Catuai | MA10C | Obata | 139 |
| 243-245, 250, 262 | Typica | KO32 | Obata | 88 |
| 246, 247, 260 | Typica | KO33C | Obata | 75 |
| 239-241, 248, 249, 261 | Typica | KO34 | Obata | 73 |
| 235, 238, 256 | Yellow Catuai | KA17C | Obata | 159 |
| 236, 237, 257 | Yellow Catuai | KA18C | Obata | 164 |
| 265 | Ethiopian | ET25B | Obata | 3 |
| 263, 264 | Ethiopian | ET52 | Obata | 23 |

# Somatic Embryogenesis

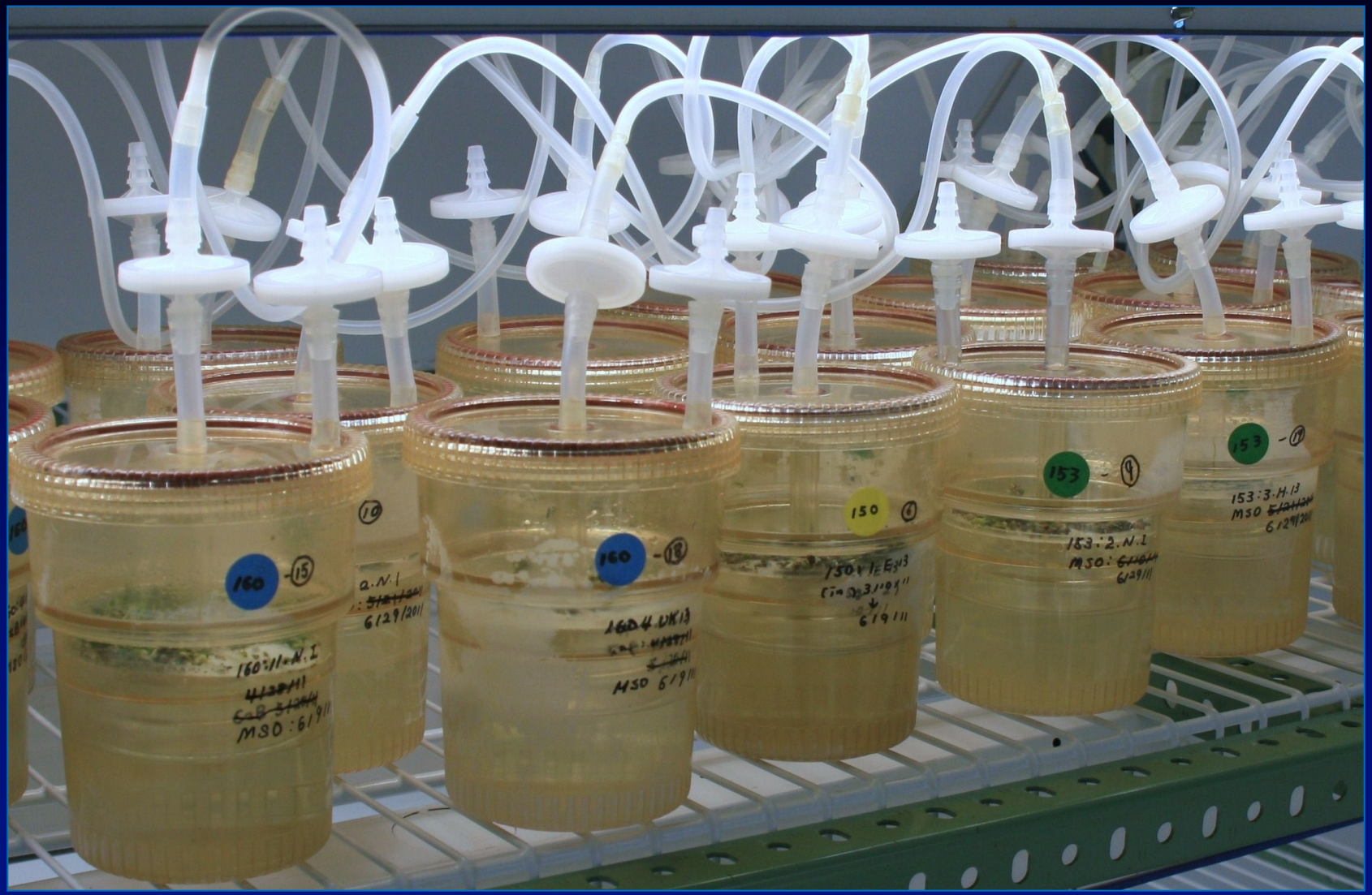
4 weeks

# Arabica Somatic embryos and Plantlets



Nagai

# RITA® Temporally Immersion System




Aoki & Nagai

# RITA® Temporally Immersion System

Aoki & Nagai

# Acclimatization:
# Semi-solid agar medium to soil

Aoki & Nagai

# Soft Wood Cuttings

Sun, Nagai, and Osgood 1998

http://www.harc-hspa.com/uploads/2/6/1/7/26170270/cr2.pdf

- Vertical shoots (12-20 inch) from new growth 2-3 months after stumping
- The 3rd to 5th single node cuttings with a pair of trimmed leaves
- Planting media: vermiculite: perlite=1:1 drenched with1.5% Dithane M45
- Heating pad: 85°F
- Misting: atomizing nozzle with fine droplets

  5 sec every 8 min during the day

  5 sec every12 min at night
- Fungicide: every 2-3 weeks
- Rooted in 2.5 months
- Transplanted into single pot, in mist chamber for 1 month

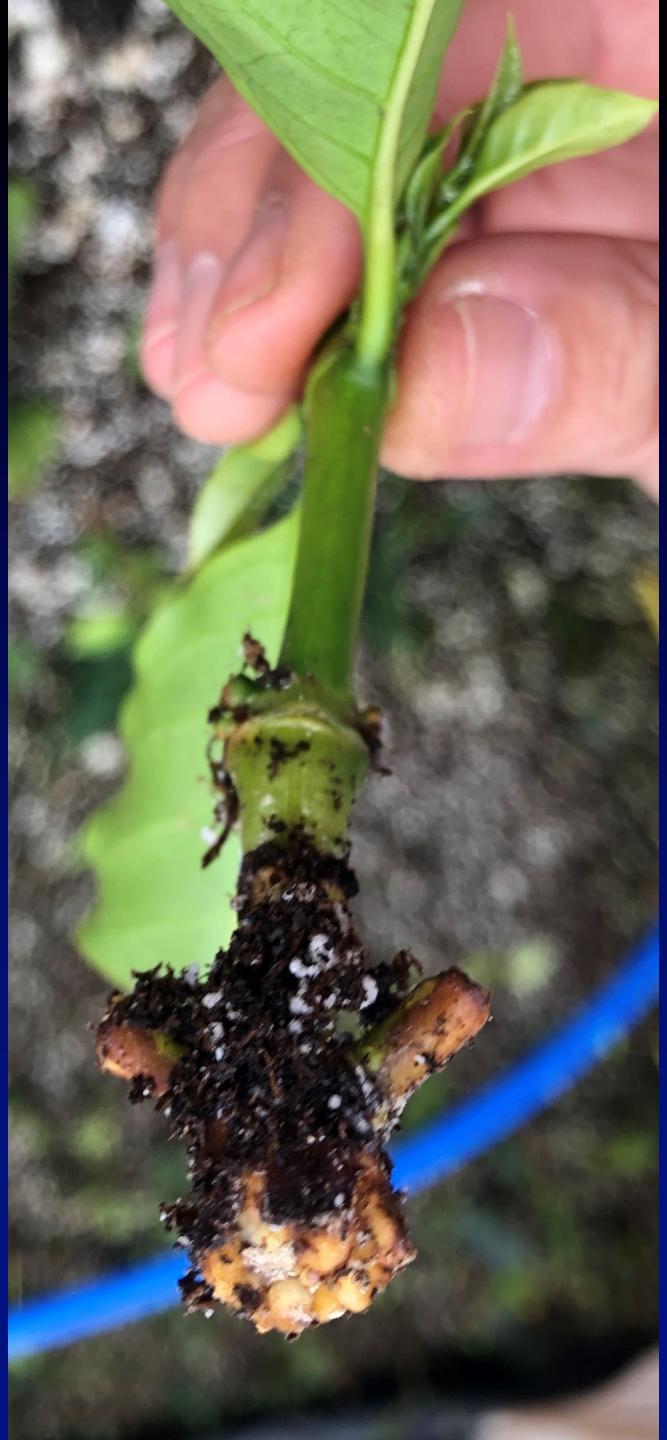
# Rooted single node cuttings

## 2.5 month after planting

| Culivar | % Rooting |
|---|---|
| Catuai | 43-59% |
| Typica | 9-100% |

Sun *et al.* 1998

# Alternative for Mist Chamber



# HARC Coffee Team

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