# Cassava Agronomy Research Activities in Daklak

"Developing value-chain linkages to improve smallholder cassava production systems in Vietnam and Indonesia

**Tay Nguyen University Component**





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**Vientiane, Jan 2018**

**Thank you to the stakeholders participating in Trials, training and the harvest field days**

1. Daklak Provincial Department of Agricultural and Rural Development

2. District agricultural officers and extension staff from 7 communes of Eakar and KrongBong

3. KrongBong and Eakar district leaders

4. Representatives from 7 cassava processing factories located in 5 districts of Daklak

5. Representative from 1 ethanol processing factory in Daknong province cassava traders in KrongBong district

6.60 farmers from KrongBong district

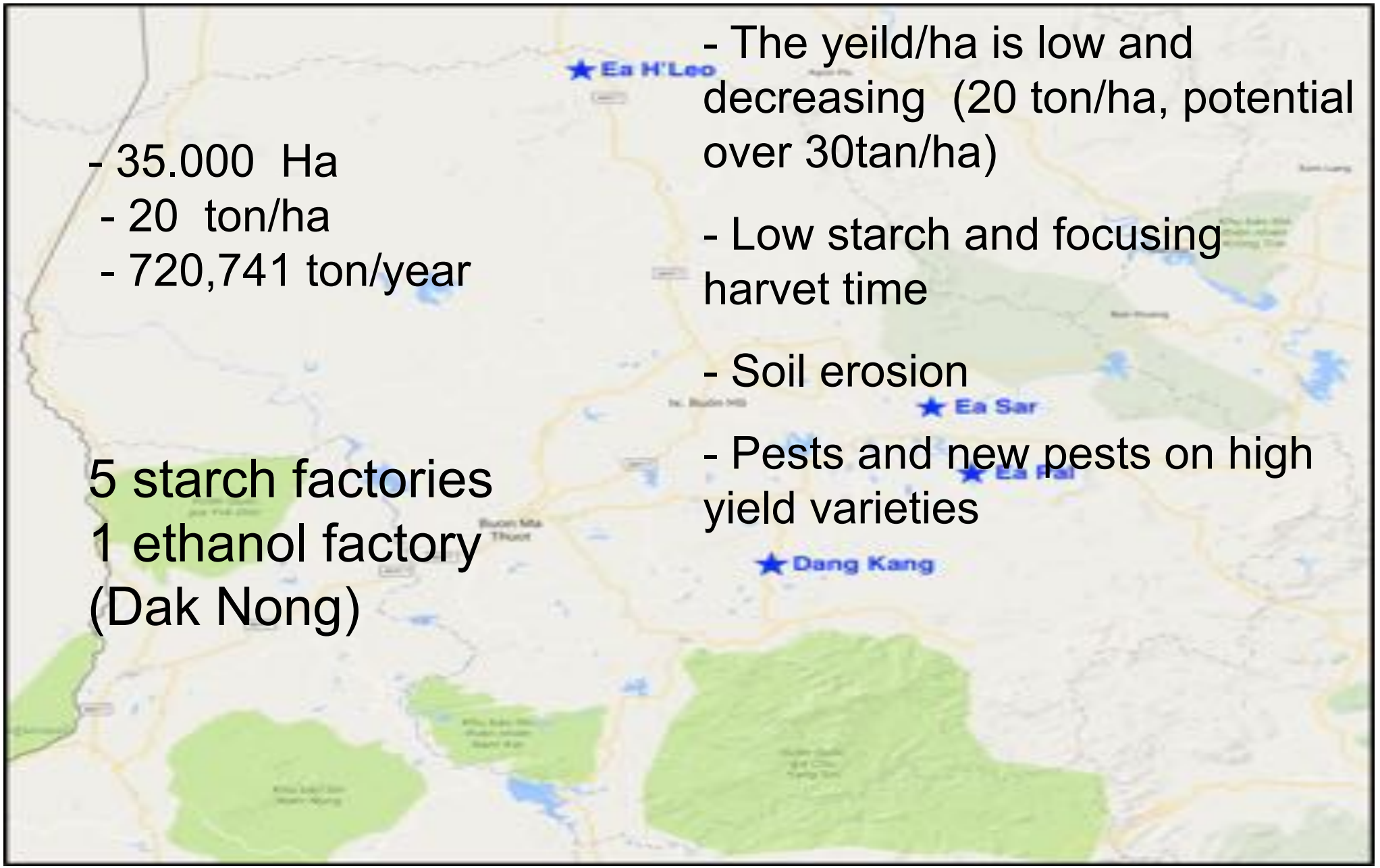
7. farmers from Eakar district

8. students from TNU: undergraduates, Masters and PhD. candidates.

## Outline

* Introduction and objectives
    * Activities implemented
        - Training and Selection of trials
        - Designing of trials
        - Establishment of trials
    * Trial results
        - Variety trial
        - Fertilizer trial
        - Survey pests on cassava
        - Harvesting field days
    * Challenges and constraints
    * Plan for 2018

# Introduction and Objective

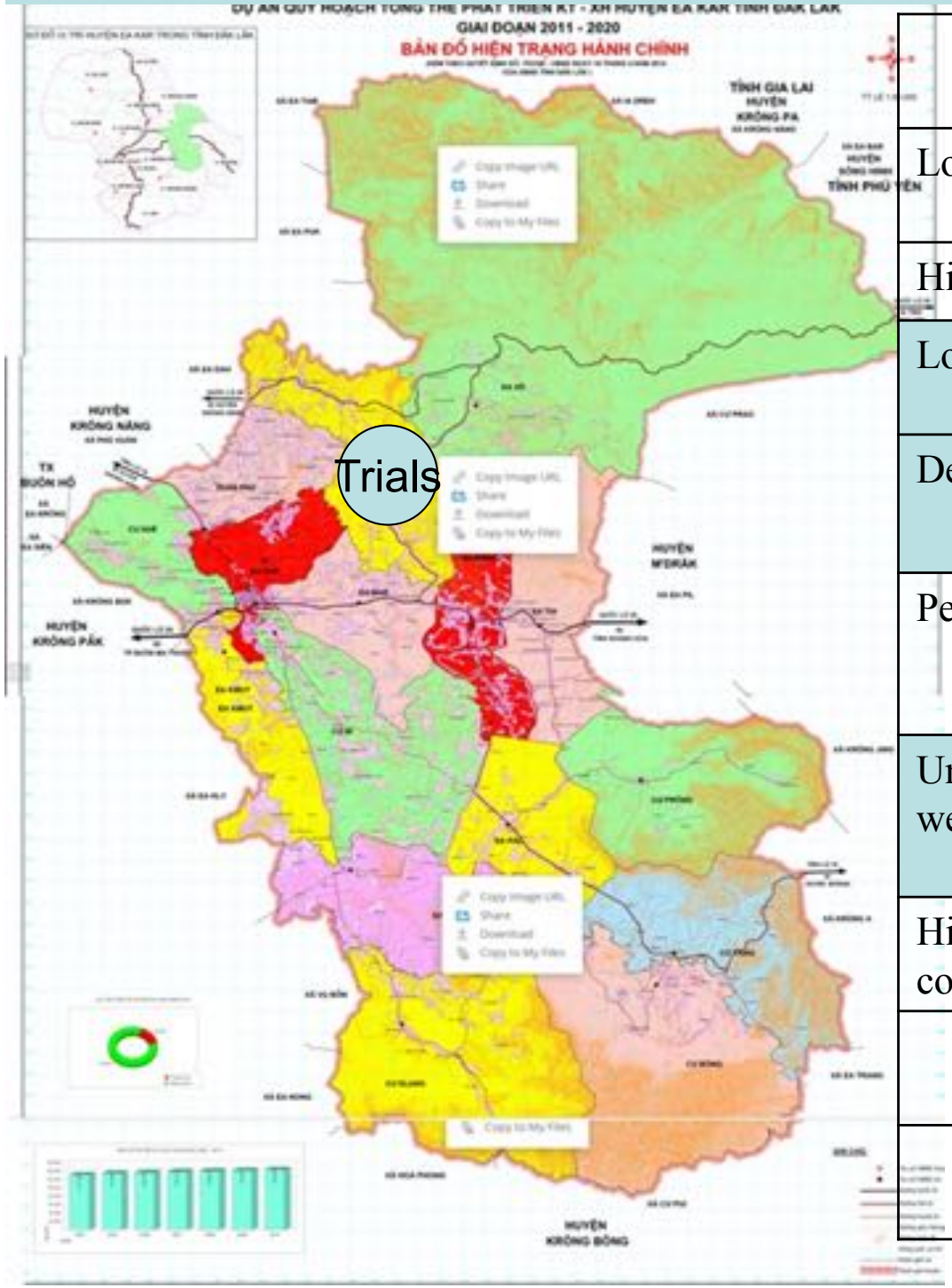



- 35.000 Ha
- 20 ton/ha
- 720,741 ton/year

5 starch factories
1 ethanol factory
(Dak Nong)

- The yeild/ha is low and decreasing (20 ton/ha, potential over 30tan/ha)
- Low starch and focusing harvet time
- Soil erosion
- Pests and new pests on high yield varieties

# Ea Sar Commune, Ea Kar District




| WOMAN | Ranking | MAN | Ranking |
|---|---|---|---|
| Low selling price | 3 | Climate change | 2 |
| High labor cost | 7 | Variety | 4 |
| Low yield | 4 | Labor for harvesting | 6 |
| Degraded soil | 2 | Cultivation techniques | 5 |
| Pest and disease | 6 | Do not sell direct to company | 7 |
| Unfavorable weather | 1 | High investment cost | 8 |
| High investment cost | 5 | Capital | 3 |
| | | Pest and disease | 1 |
| | | Low selling price | |

# Krong Bong District, Cukty, Dang Kang comnune

- **Adoption new of Varieties with high yield**
- **Manage Soil degradation**
- **Pest and disease management**
- Increase economic and profits for all actors along the value chain

→ Increase sustainability of cassava production system

# Activities implemented 2017

# Trials in 2017

| No | TRIALS | Number of varieties | Location | |
|---|---|---|---|---|
| | | | Village | Commune |
| I | **VARIETY TRIALS** | | | |
| | **KrongBong district** | | | |
| | Infertile acrisols | | | |
| 1 | - MARD practice | 7 | Village 5 | CuKty |
| 2 | - Farmer's practice | 6 | Village 5 | CuKty |
| | Ferrasols | | | |
| 3 | - MARD practice | 7 | Cuenam A | Dang Kang |
| 4 | - Farmer's practice | 6 | Ngo B | Hoa Phong |
| | **Eakar district** | | | |
| | Sandy acrisols | | | |
| 5 | - MARD practice | 6 | Village 3 | Easar |
| 6 | - Farmer's practice | 6 | Village 3 | Easar |
| II | **FERTILISER AND PLANT DENSITY TRIALS** | | | |
| | **KrongBong district** | | | |
| 7 | Infertile acrisols | 1 | Village 5 | CuKty |
| 8 | Ferrasols | 1 | Ngo B | Hoa Phong |
| | **Eakar district** | | | |
| 9 | Sandy acrisols | 1 | Village 3 | Easar |

**Variety Evaluation Experiments:** 7 varieties are evaluated in two different type of soils – Acrisols and Ferrasols in Dang Cang commune. Planted in April 2017 and harvested in December 2017.

## Number of evaluated varieties: 7 including:

Treatment 1 (T1): **KM94** control treatment (combination of Rayong 1 x Rayong 90) (control). Expected starch content: 27.4%-29% after 10-12 months
Treatment 2 (T2): **KM419** (BKA900x KM98-5)
Treatment 3 (T3) **KM140**, (KM98-1 x KM3). Expected starch content: 27.2%-29.3% after 7-10 months
Treatment 4 (T4): **Rayong 9 also called KM 21-12**. Expected starch content: 28%-29.1%
Treatment 5 (T5): **KM505**
Treatment 6 (T6): **HL-S10**
Treatment 7 (T7): **HL-S11** (Muted SM937-26 by Co60)

# Implementing cassava variety experiment

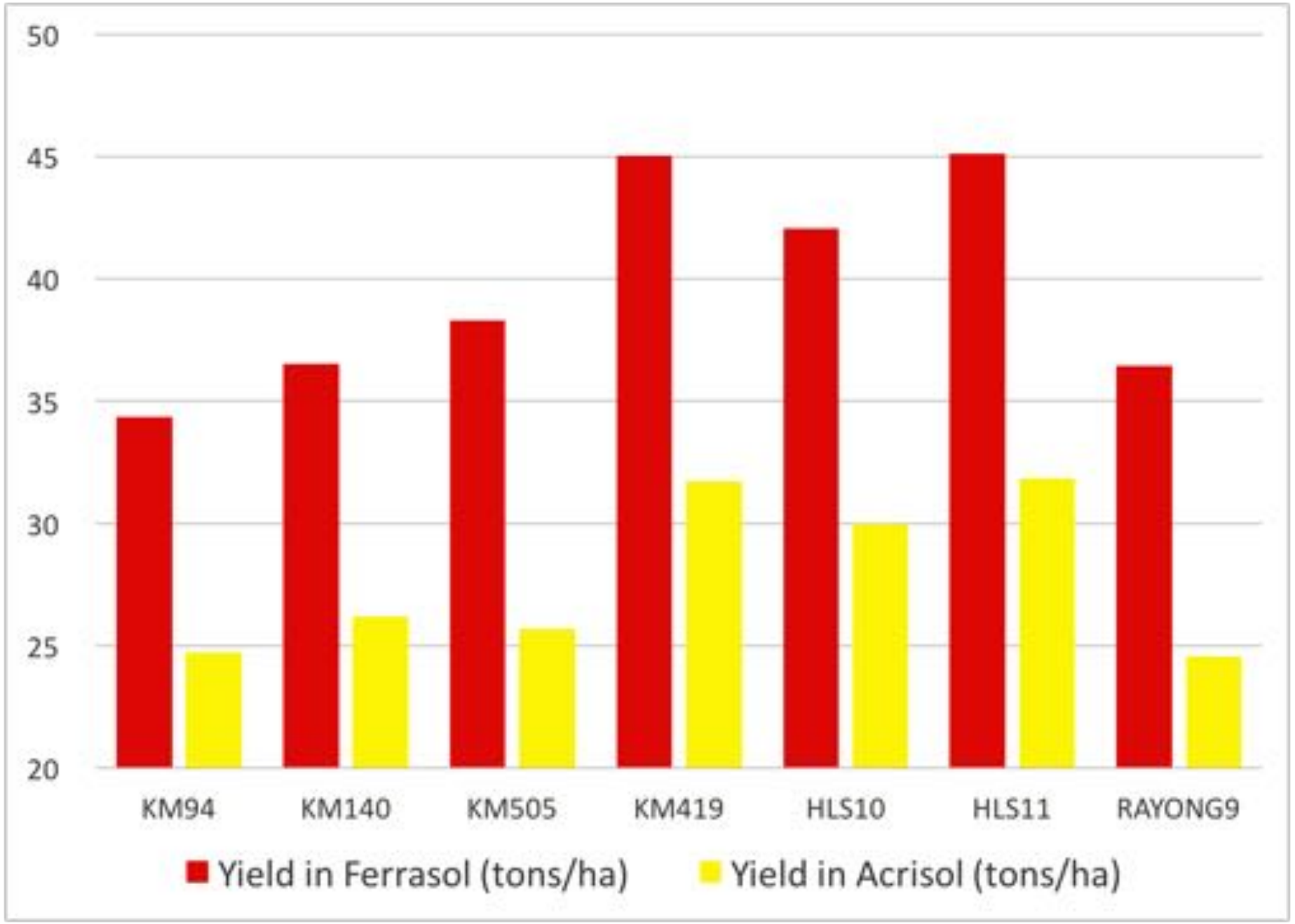
# *Biomass yield and harvest index of evaluated varieties in ferrasol and acrisol soil types*

| Varieties | Ferrasol | | | | | | Acrisol | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | # root per plant (roots) | Weight of root per plant (kg) | Fresh root yield (t ha) | Stem & leaf yield (t ha) | Biomass yield (t ha) | Harvest Index (%) | # root per plant (roots) | Weight of root per plant (kg) | Fresh root yield (t ha) | Stem & leaf yield (t ha) | Biomass yield (t ha) | Harvest Index (%) |
| KM94 (control) | 7.57 | 2.75 | 34.37 | 21.57 | 55.93 | 61.44 | 5.97 | 2.27 | 24.73 | 17.67 | 42.40 | 56.66 |
| KM140 | 8.77 | 2.92 | 36.53 | 21.20 | 57.73 | 63.26 | 6.93 | 2.51 | 26.20 | 18.63 | 44.83 | 58.07 |
| KM505 | 8.00 | 3.06 | 38.30 | 21.53 | 59.83 | 63.82 | 6.67 | 2.39 | 25.67 | 18.77 | 44.43 | 59.33 |
| KM419 | 10.10 | 3.60 | 45.03 | 19.27 | 64.30 | 70.04 | 8.43 | 3.15 | 31.73 | 20.97 | 52.70 | 66.67 |
| HL510 | 8.87 | 3.37 | 42.07 | 21.20 | 63.27 | 66.47 | 7.87 | 2.80 | 30.00 | 19.30 | 49.30 | 60.20 |
| HL511 | 9.10 | 3.61 | 45.13 | 20.33 | 65.47 | 68.94 | 7.83 | 3.01 | 31.83 | 20.77 | 52.60 | 66.03 |
| RAYON09 | 8.70 | 2.91 | 36.43 | 21.97 | 58.40 | 62.38 | 7.37 | 2.42 | 24.57 | 17.80 | 42.37 | 57.61 |

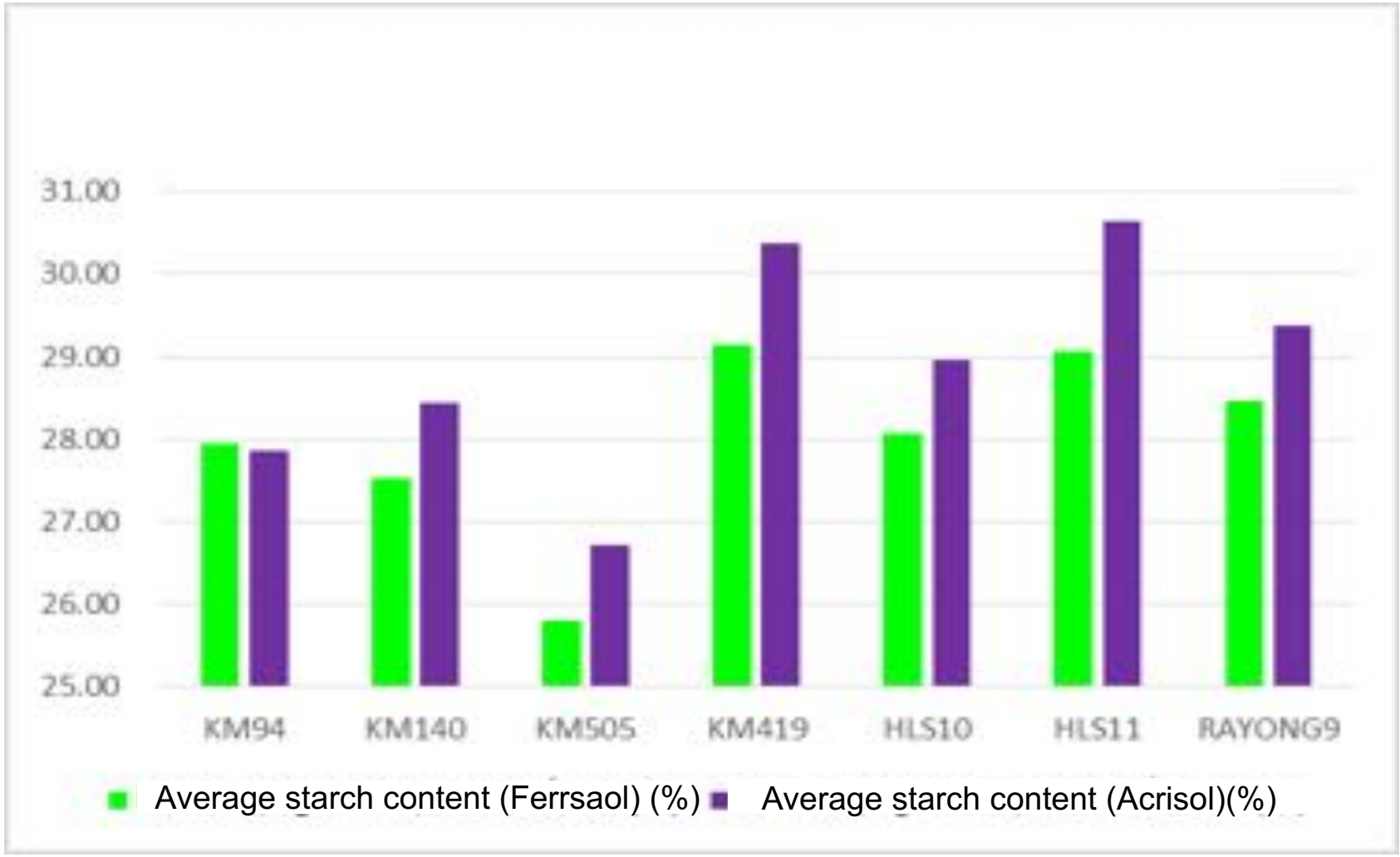
# *Cassava yield of evaluated varieties on ferrasol and acrisol soil types*

| Varieties | Ferrasol | | | | | Acrisol | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Dry matter content (%) | Starch content (%) | Fresh root yield (t/ha) | Dry root yield (t/ha) | Starch yield (t/ha) | Dry matter content (%) | Starch content (%) | Fresh root yield (t/ha) | Dry root yield (t/ha) | Starch yield (t/ha) |
| KM94 (control) | 39,90$^{a}$ | 27,95$^{a}$ | 34,37$^{bc}$ | 15,37$^{ab}$ | 9,60$^{c}$ | 38,90$^{a}$ | 27,85$^{ab}$ | 24,73$^{a}$ | 13,47$^{bc}$ | 6,89$^{ab}$ |
| KM140 | 39,90$^{a}$ | 27,53$^{a}$ | 36,53$^{bc}$ | 17,77$^{ab}$ | 10,07$^{abc}$ | 38,60$^{a}$ | 28,43$^{ab}$ | 26,20$^{a}$ | 14,20$^{abc}$ | 7,45$^{ab}$ |
| KM505 | 41,20$^{a}$ | 25,81$^{a}$ | 38,30$^{abc}$ | 18,53$^{ab}$ | 9,84$^{bc}$ | 40,40$^{a}$ | 26,71$^{b}$ | 25,67$^{a}$ | 14,63$^{abc}$ | 6,85$^{b}$ |
| KM419 | 41,60$^{a}$ | 29,15$^{a}$ | 45,03$^{a}$ | 20,97$^{a}$ | 13,12$^{a}$ | 39,80$^{a}$ | 30,38$^{a}$ | 31,73$^{a}$ | 17,90$^{a}$ | 9,59$^{a}$ |
| HLS10 | 40,20$^{a}$ | 28,06$^{a}$ | 42,07$^{ab}$ | 17,60$^{ab}$ | 11,82$^{ab}$ | 38,70$^{a}$ | 28,96$^{ab}$ | 30,00$^{a}$ | 15,70$^{abc}$ | 8,69$^{ab}$ |
| HLS11 | 42,20$^{a}$ | 29,07$^{a}$ | 45,13$^{a}$ | 19,13$^{a}$ | 13,12$^{a}$ | 40,10$^{a}$ | 30,64$^{a}$ | 31,83$^{a}$ | 17,23$^{ab}$ | 9,74$^{a}$ |
| RAYONG9 | 40,50$^{a}$ | 28,47$^{a}$ | 36,43$^{bc}$ | 17,90$^{ab}$ | 10,37$^{abc}$ | 38,20$^{a}$ | 29,37$^{ab}$ | 24,57$^{a}$ | 15,00$^{abc}$ | 7,21$^{ab}$ |
| CV% | 3,04 | 5,36 | 11,68 | 10,79 | 14,14 | 5,75 | 5,66 | 15,29 | 12,00 | 17,33 |

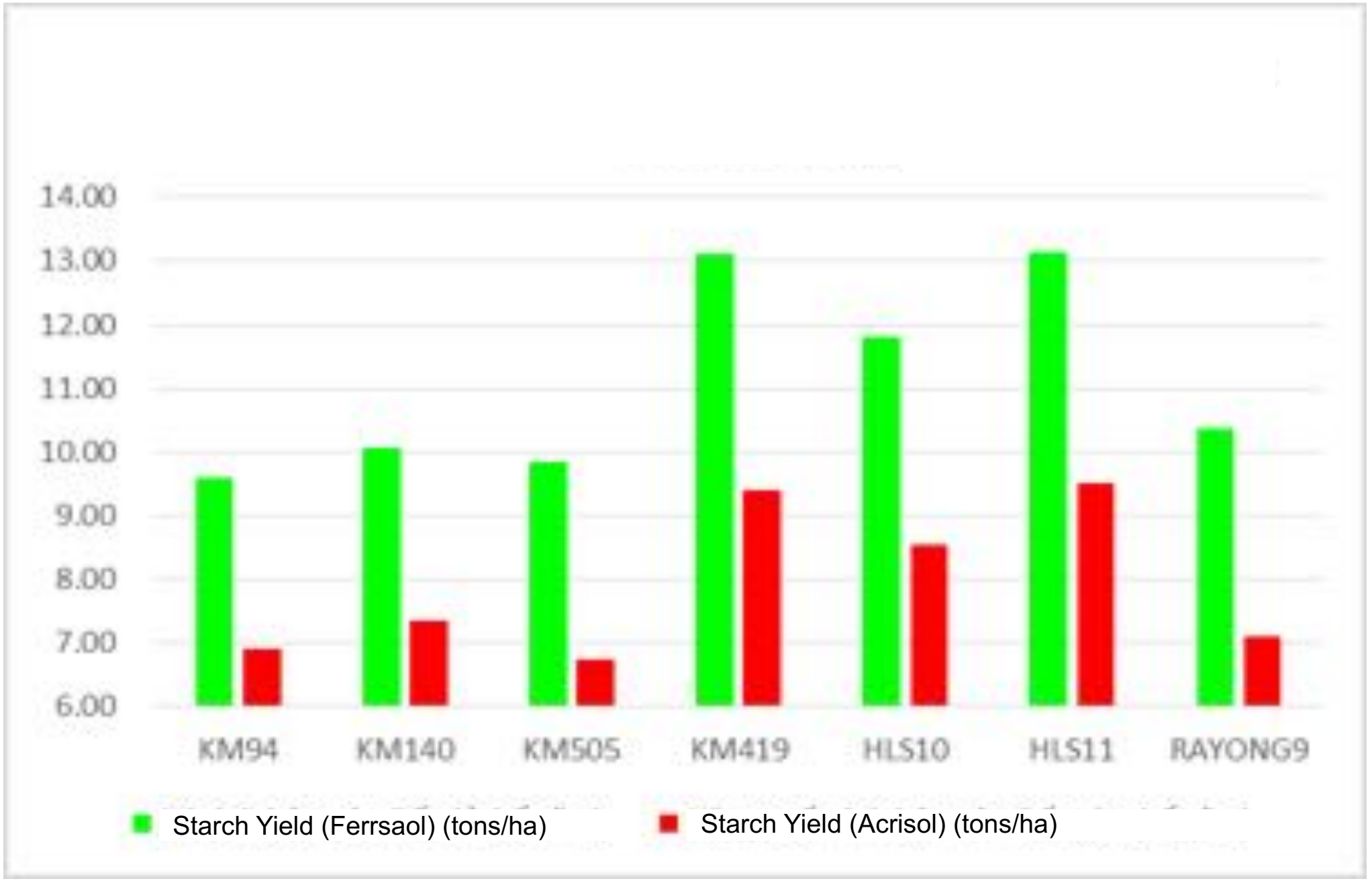
# Variety trials in Krong Bong: Fresh root yields



# Variety trials in Krong Bong: Starch content



# Varieties trials in Krong Bong: Starch yield



# *Possible income gained with evaluated varieties in ferrasol and acrisol soil types*

| Varieties | Ferrasol | | | | | | Acrisol | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Fresh root yield (t/ha) | Starch content (%) | Unit price (mill VND/t) | Gross income (mill VND) | Production cost (mill. VND) | Net income (mill VND) | Fresh root yield (t/ha) | Starch content (%) | Unit price (mill VND/t) | Gross income (mill VND) | Production cost (mill. VND) | Net income (mill VND) |
| KM94 (control) | 34.37 | 27.95 | 1.90 | 65.30 | 27.70 | 37.60 | 24.73 | 27.85 | 1.90 | 46.99 | 27.70 | 19.29 |
| KM140 | 36.53 | 27.53 | 1.90 | 69.41 | 27.70 | 41.71 | 26.20 | 28.43 | 1.90 | 49.78 | 27.70 | 22.08 |
| KM505 | 38.30 | 25.81 | 1.85 | 70.86 | 27.70 | 43.16 | 25.67 | 26.71 | 1.85 | 47.48 | 27.70 | 19.78 |
| KM419 | 45.03 | 29.15 | 1.90 | 85.56 | 27.70 | 57.86 | 31.73 | 30.38 | 1.90 | 60.29 | 27.70 | 32.59 |
| HLS10 | 42.07 | 28.06 | 1.90 | 79.93 | 27.70 | 52.23 | 30.00 | 28.96 | 1.90 | 57.00 | 27.70 | 29.30 |
| HLS11 | 45.13 | 29.07 | 1.90 | 85.75 | 27.70 | 58.05 | 31.83 | 30.64 | 1.90 | 60.48 | 27.70 | 32.78 |
| RAYONG9 | 36.43 | 28.47 | 1.90 | 69.22 | 27.70 | 41.52 | 24.57 | 29.37 | 1.90 | 46.68 | 27.70 | 18.98 |

# New cassava variesty


Rayon: 36/24


HLS10: 42/30


HLS11: 45/31


KM 419: 45/31ton


KM 505: 38/25 ton/ha


KM 140: 36/26 ton/ha

# Fertilizer and density trials on KM 419

# Fertilizer experiment design:

15 treatments including:

-3 density treatments (M1, M2, M3)

- 4 fertilizer treatments (P1, P2, P3, P4) benchmark with MARD's standard

- 2 fertilizer treatments reflect farmer's practice (P0 and P5) (100kg phosphorous fertilizer and 250kg NPK (15-5-20). Details as below:

## Density

**M1: 0,8m x 0,8m (16500/ha)**

**M2: 0,8m x 1m (12500/ha)**

**M3: 1m x 1m (10.000/ha)**

## Fertilizers

**P1** (90N+60P2O5+90K2O) (Benchmark with MARD standard)
**P2** (99N+66P2O5+99K2O): Density remained + 10% fertilizer
**P3** (108N+72P2O5+108K2O): Density remained+20% fertilizer
**P4** 117N+78P2O5+117K2O): Density remained+30% fertilizer
**P5** (100kg phosphate fertilizer + 250kg NPK (15-5-20)
**P0**=(0.8m x 0.8m) x no fertilizer

# Implementing Fertilizer and density experiment on KM 419

# *Fresh root yields in different densities and fertilizer treatments*

| Fertilizer level | 15,625 plants/ha | | | 12,500 plants/ha | | | 10,000 plants/ha | | |
|---|---|---|---|---|---|---|---|---|---|
| | # root per plant (roots) | Weight of root/plant (kg) | Fresh root yield (t/ha) | # root per plant (roots) | Weight of root/plant (kg) | Fresh root yield (t/ha) | # root per plant (roots) | Weight of root/plant (kg) | Fresh root yield (t/ha) |
| 90N-60P$_2$O$_5$-90K$_2$O | 7,63$^{abcd}$ | 2,23$^{defg}$ | 34,77$^{abc}$ | 7,70$^{abc}$ | 3,27$^{abcd}$ | 40,87$^{ab}$ | 8,67$^{ab}$ | 4,13$^{ab}$ | 41,27$^{ab}$ |
| 99N-66P2O5-99K2O | 7,70$^{abc}$ | 2,28$^{cdefg}$ | 35,67$^{abc}$ | 7,97$^{ab}$ | 3,23$^{bcd}$ | 40,37$^{ab}$ | 8,10$^{ab}$ | 4,16$^{ab}$ | 41,57$^{ab}$ |
| 108N-72P2O5-108K2O | 7,70$^{abc}$ | 2,43$^{cdef}$ | 38,00$^{ab}$ | 9,07$^{a}$ | 3,25$^{bcd}$ | 40,60$^{ab}$ | 9,30$^{a}$ | 4,42$^{a}$ | 44,20$^{a}$ |
| 117N-78P2O5-117K2O | 8,40$^{ab}$ | 2,52$^{cdef}$ | 39,40$^{ab}$ | 7,90$^{abc}$ | 3,32$^{bc}$ | 41,24$^{ab}$ | 9,37$^{a}$ | 4,48$^{a}$ | 44,83$^{a}$ |
| No fertilizer | 5,33$^{cde}$ | 1,26$^{g}$ | 19,65$^{d}$ | 4,16$^{e}$ | 2,23$^{defg}$ | 20,44$^{d}$ | 4,11$^{c}$ | 2,08$^{efg}$ | 20,81$^{d}$ |
| Farmers practice | 6,15$^{bcde}$ | 1,71$^{fg}$ | 26,67$^{cd}$ | 4,74$^{de}$ | 2,85$^{cdef}$ | 23,70$^{d}$ | 4,15$^{c}$ | 2,35$^{cdef}$ | 23,49$^{d}$ |

# *Starch content, starch yield and dry root yield in different densities and fertilizer amount (ton/ha)*

| Fertilizer level | 15,625 plants/ha | | | | 12,500 plants/ha | | | | 10,000 plants/ha | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Dry matter content (%) | Starch content (%) | Starch yield (t/ha) | Dry root yield (t/ha) | Dry matter content (%) | Starch content (%) | Starch yield (t/ha) | Dry root yield (t/ha) | Dry matter content (%) | Starch content (%) | Starch yield (t/ha) | Dry root yield (t/ha) |
| 90N-60P2O5-90K2O | 39,07$^{abcd}$ | 28,45$^{abc}$ | 9,89$^{b-e}$ | 16,50$^{cd}$ | 40,84$^{abcd}$ | 30,38$^{abc}$ | 12,40$^{ab}$ | 18,80$^{b-e}$ | 40,19$^{abcd}$ | 30,20$^{abc}$ | 12,51$^{ab}$ | 18,57$^{abc}$ |
| 99N-66P2O5-99K2O | 38,71$^{abcd}$ | 28,87$^{abc}$ | 10,29$^{abcde}$ | 16,80$^{cd}$ | 41,19$^{abcd}$ | 30,27$^{abc}$ | 12,21$^{ab}$ | 19,37$^{abcd}$ | 39,20$^{abcd}$ | 30,75$^{abc}$ | 12,81$^{ab}$ | 18,60$^{abc}$ |
| 108N-72P2O5-108K2O | 39,50$^{abcd}$ | 29,83$^{abc}$ | 11,34$^{abcd}$ | 17,50$^{bcd}$ | 40,51$^{abcd}$ | 31,00$^{abc}$ | 12,59$^{ab}$ | 18,00$^{b-e}$ | 41,58$^{abcd}$ | 30,98$^{abc}$ | 13,72$^{a}$ | 21,50$^{a}$ |
| 117N-78P2O5-117K2O | 39,55$^{abcd}$ | 29,87$^{abc}$ | 11,77$^{abc}$ | 17,00$^{bcd}$ | 41,24$^{abcd}$ | 31,06$^{abc}$ | 12,91$^{ab}$ | 19,37$^{abcd}$ | 43,12$^{ab}$ | 31,26$^{abc}$ | 14,04$^{a}$ | 21,27$^{ab}$ |
| No fertilizer | 40,46$^{abcd}$ | 27,89$^{abc}$ | 5,48$^{f}$ | 9,56$^{f}$ | 40,82$^{abcd}$ | 28,95$^{abc}$ | 5,90$^{f}$ | 10,04$^{f}$ | 42,17$^{abcd}$ | 29,89$^{abc}$ | 6,22$^{ef}$ | 11,74$^{ef}$ |
| Farmers practice | 40,45$^{abcd}$ | 28,35$^{abc}$ | 7,56$^{def}$ | 12,43$^{ef}$ | 38,92$^{abcd}$ | 30,89$^{abc}$ | 7,29$^{def}$ | 12,36$^{ef}$ | 40,86$^{abcd}$ | 31,25$^{abc}$ | 7,40$^{def}$ | 14,36$^{de}$ |

# *Cost and profits analysis of cassava with different treatments of fertilizer and densities*

| Fertilizer level | 15,625 plants/ha | | | | 12,500 plants/ha | | | | 10,000 plants/ha | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Fresh root yield (t/ha) | Gross income (mill VND) | Production costs (mill. VND) | Net income (mill VND) | Fresh root yield (t/ha) | Gross income (mill VND) | Production costs (mill. VND) | Net income (mill VND) | Fresh root yield (t/ha) | Gross income (mill VND) | Production costs (mill. VND) | Net income (mill VND) |
| 90N-60P2O5-90K2O | 34.77 | 66.06 | 28.95 | 37.11 | 40.87 | 77.65 | 27.7 | 49.95 | 41.27 | 78.41 | 26.7 | 51.71 |
| 99N-66P2O5-99K2O | 35.67 | 67.77 | 29.72 | 38.05 | 40.37 | 76.70 | 28.47 | 48.23 | 41.57 | 78.98 | 27.47 | 51.51 |
| 108N-72P2O5-108K2O | 38 | 72.20 | 30.49 | 41.71 | 40.6 | 77.14 | 29.24 | 47.90 | 44.2 | 83.98 | 28.24 | 55.74 |
| 117N-78P2O5-117K2O | 39.4 | 74.86 | 31.26 | 43.60 | 41.5 | 78.85 | 30.01 | 48.84 | 44.83 | 85.18 | 29.01 | 56.17 |
| No fertilizer | 19.65 | 37.34 | 21.23 | 16.11 | 20.44 | 38.84 | 20 | 18.84 | 20.81 | 39.54 | 19 | 20.54 |
| Farmers practice | 26.67 | 50.67 | 24.13 | 26.54 | 25.72 | 48.87 | 22.9 | 25.97 | 23.49 | 44.63 | 21.9 | 22.73 |

# *Effect of density and fertilizer amount on soil physical and chemical factors (thickness 0-30cm)*

| Treatments | Monitored indicators | | | | |
|---|---|---|---|---|---|
| | $N_{ts}$ (%) | $P_2O_{5dt}$ (mg/100g soil) | $K_2O_{dt}$ (mg/100g soil) | $Ca^{2+}$ (ldl/100g soil) | $Mg^{2+}$ (ldl/100g soil) |
| Before trials | 0.12 | 2.49 | 8.38 | 0.73 | 0.09 |
| 90N-60$P_2O_5$-90$K_2O$ | 0.1 | 1.38 | 8.45 | 0.44 | 0.08 |
| 99N-66P2O5-99K2O | 0.11 | 1.46 | 13.47 | 0.44 | 0.09 |
| 108N-72P2O5-108K2O | 0.11 | 1.29 | 10.69 | 0.44 | 0.08 |
| 117N-78P2O5-117K2O | 0.13 | 1.54 | 9.28 | 0.5 | 0.08 |
| No fertilizer | 0.1 | 1.36 | 7.23 | 0.47 | 0.1 |
| Farmers practice | 0.11 | 1.14 | 8.24 | 0.52 | 0.08 |

# Present diseases and insects on cassava at project area

| No | Pest, disease | Causes | Infected parts | Occurring time | Presentated rate |
|---|---|---|---|---|---|
| 1 | Leaf blight | *Xanthomonas axonopodis pv. Manihotis* | Leaf, stem, root, tuber | June – July | **** |
| 2 | Brown spot | *Cercospora heningssi* | Leaf | June – July | **** |
| 3 | Witches broom | *Phytoplasma* | Leaf, stem, root, tuber | May – June and strong development in Jan – March in following year | *** |
| 4 | Anthracnose | *Colletotrichum gloeosporioides f. sp. Manihotis* | Leaf, stem | June – July | *** |
| 5 | CMD | *Cassava mosaic virus* | Leave | June | rare |
| 6 | Pink mealybug | ***Phenacoccus manihoti*** | Leaf, top | Whole season | * |
| 7 | Red mite | ***Tetranychus urticae*** | Leaf, stem | Dry season | ** |

# Red mite on high yield cassava variety in Eakar district

# Symptom of leaves

# Causal factors: Red mites

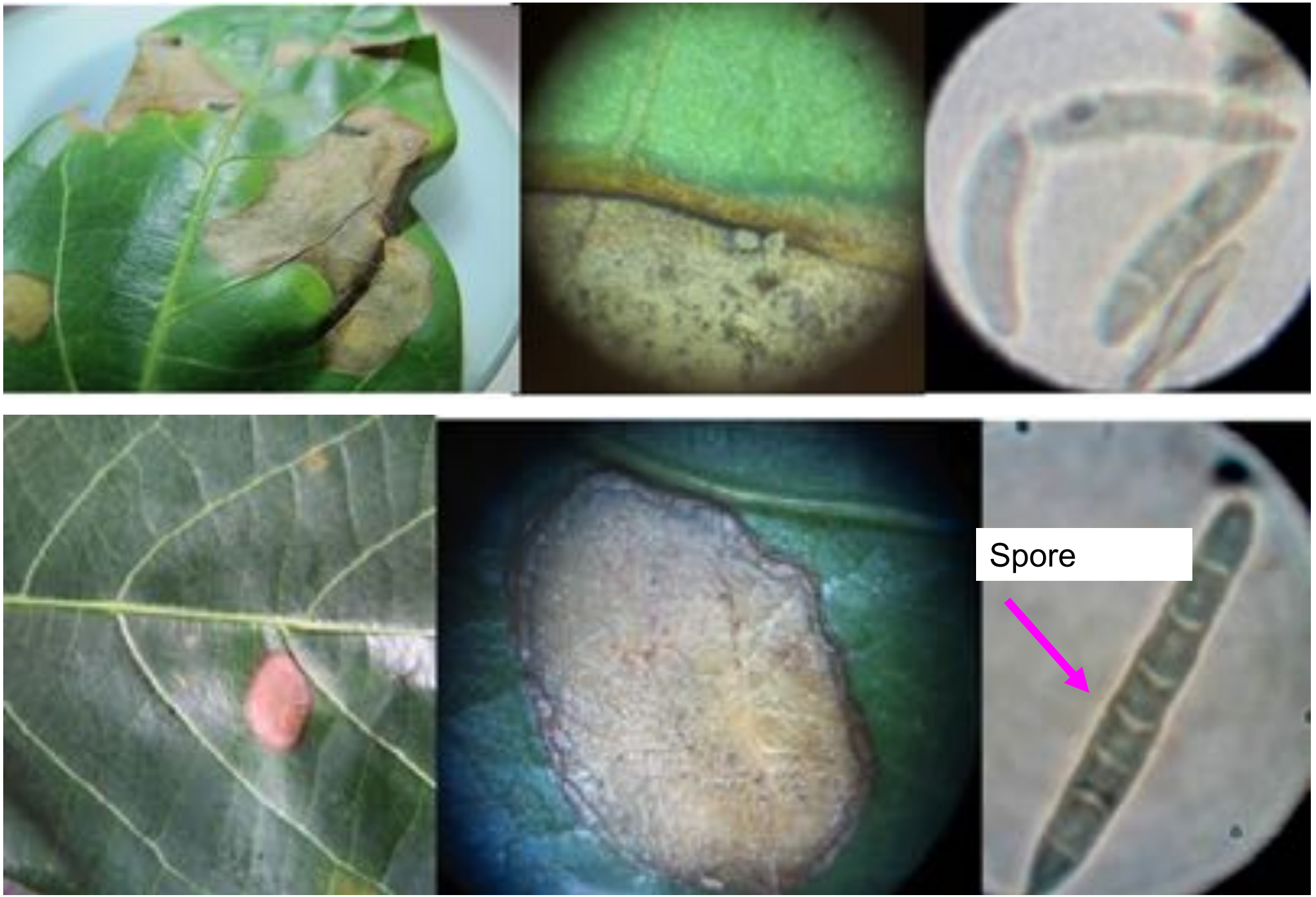
# Bacteria *Xanthomonas on cassava*

HL S11, and HL S10 infected

# Phytoplasma (which broom) on KM 94

# CMV, rarely showed on cassava in Dak Lak

# Leaf spots, Cercospora



## Mealybug

## Brown Mealybug

## White fly

## Worm

# Pink mealybugs

# *Pest and disease prevalence monitored in evaluated varieties*

| Varieties | Pest and disease prevalence (%) | | |
|---|---|---|---|
| | Brown leaf spot | Witches broom disease | Pink mealybugs |
| KM94 (control) | 20 | 16 | 10 |
| KM140 | 15 | 13 | 12 |
| KM505 | 15 | 11 | 11 |
| KM419 | 8 | 5 | 6 |
| HLS10 | 9 | 6 | 7 |
| HLS11 | 10 | 7 | 8 |
| RA YONG9 | 11 | 10 | 8 |

# Harvest field days

-Strong interest from participants in improved varieties evaluated in the trials.

- Questions from farmer participants were about

  - (i) how to get access new varieties and appropriate fertilizers

  - (ii) how to access to clean planting materials

  - (iii) how to identify and maintain planting materials clean for next season.

# Challenges, constraints and Plan for 2018

## Challenges and constraints

- Farmer's knowledge of sustainable cassava production techniques are limited

- Farmers were very interested in variety trials but not very interested in learning about cassava fertilizer trials in the harvest field days in Krong Bong district.

- Farmer's knowledge on pest and disease identification and management is very limited.

- Planting materials are currently shared between farmers

- KM94, the most popular variety which has been adopted widely for more than ten years is highly susceptible to witches broom disease and pink mealybugs

- Other improved varieties are not yet easily accessible by farmers.

# Future plans and partnerships, Opportunities and new ideas for 2018

**Opportunities**

Interest from cassava processing factories in improved technology particularly in new potential varieties can provide a good opportunity for distribution of new varieties and dissemination of appropriate cassava management techniques.

- Strong interest from Daklak DARD in improvement of soil fertility of sandy acrisol soil type is an opportunity to improve farmer's knowledge through the extension system which has network at village level.

# Future plans for policy engagement

- Organize a meeting with Daklak PPC and DARD to present research results from trials conducted this year along with policy recommendation.

- A follow-up meeting can be organized with processing factories and extension agencies, depending on the results of the meeting with PPC and DARD.

# Future plans for engagement with value chain stakeholders for adoption with the same partnership

**1. New Varieties**

Dissemination of new varieties in the value chain in Dak Lak

Linkages of Partners with the small trader/farmer group networks in Ea Kar and through linkages with farmers taking credit from the Krong Bong factory.

Set up variety selection by TNU

**2. More effective fertiliser treatments**.

Development and dissemination of more appropriate fertiliser formulation for cassava production together with fertiliser companies associated and networks of agricultural input supply shops.

Strong interest from Dak Lak DARD in improvement of soil fertility of sandy acrisol soil type is an opportunity to improve farmer's knowledge through the extension system which has network at village level.

**3. Integrated pests managements: Survey, identification, causing and management**

**-** Incraesing pacity of TNU in research in cassave pests

-Training to farmers for pest managemnets

**4. Cassave integrated managemnet**

- Set up trials

# THANKS FOR YOUR ATTENTION