*Boiled potato

Boiled Potato

Key Findings from RTBfoods in Period 2*

Thiago Mendes, CIP, Kenya

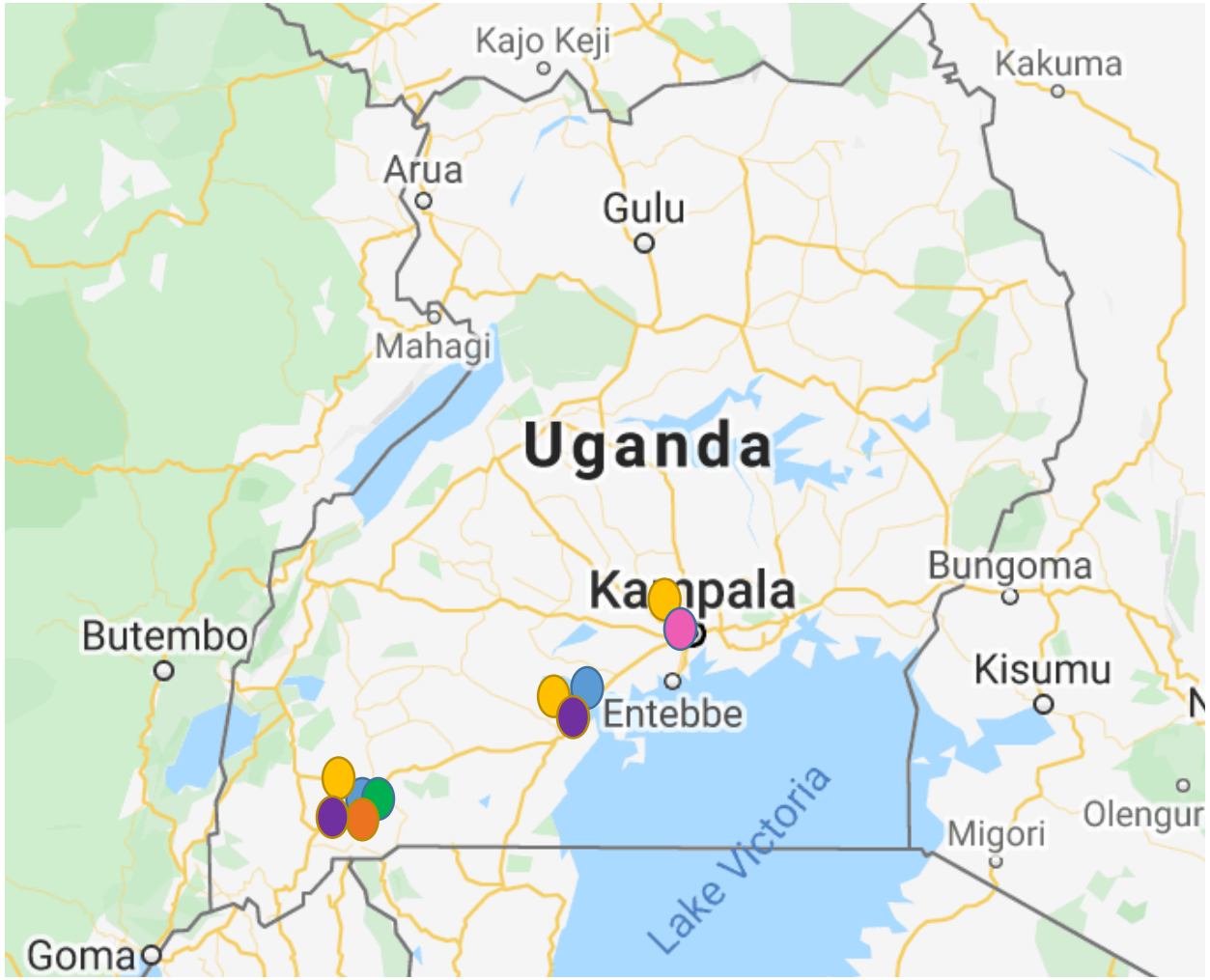
**Other Contributing Scientists (listed on last slides of the presentation)*

RTBfoods 2nd Annual Meeting, Kampala, Uganda, 3-7 Feb. 2020

Countries of Activity Implementation

Topics

- ✓ WP1
  - ✓ Act.3 Surveys
  - ✓ Act.4 Processing Diagnosis
  - ✓ Act.5 Consumer Testing
- ✓ WP2/WP3 Lab
- ✓ WP4 Fields
- ✓ WP5 On-Farm/Advanced Trials



*NAROPOT4
Kabale Central Market

WP1

Main achievements

Gendered Food Mapping/ Preference Surveys

Activity 3 (USAID breeding)

- Reviewed RTB Food tools to align with RTB work on testing G+ breeding tools. It was developed a data collection approaches analysis plan for the qualitative and quantitative data.

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  - 8 Key informant interviews
  - 32 FGDs

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- Data collection
  - 136 Surveys, with farmers, 37 with traders and 19 with Food vendors
  - 8 Key informant interviews
  - 32 FGDs
- Data cleaning and analysis is an ongoing activity
  - Submitted a abstract to the RTB Foods special issue

Main Achievements

- **Activity 4** – *Processing Diagnosis*: Sensorial panel trained and lexicon developed. Activities 4 conducted in December 2019 (in line with the harvesting period) and the report will be submitted in the first quarter of 2020

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- **Activity 5** – *Consumer Testing:* conducted in December 2019 (in line with the harvesting period) and the report will be submitted in the first quarter of 2020
- **Challenges:** Delayed ethical approval meant that activity 4 and 5 could not be done on time. Since data analysis is ongoing and we are yet to conduct activity 4 and 5 we do not have a consolidated product profile.

Description of tools and study sample

Kabale (Highlands) and Rakai (Lowlands)

Event	Men	Women	Men FDGs	Women FGDs	Total
Focus groups discussion with community members: Community ranking, livelihoods and potato varieties			8	8	16
Focus group discussion with community members: specific details about varieties and potato products			8	8	16
Key Informant Interviews	4	4			8
Individual Interviews	74	62			136
Trader Interviews (retailers)	17	20			37
Restaurants and Food vendors	9	10			19

Preferred potato traits

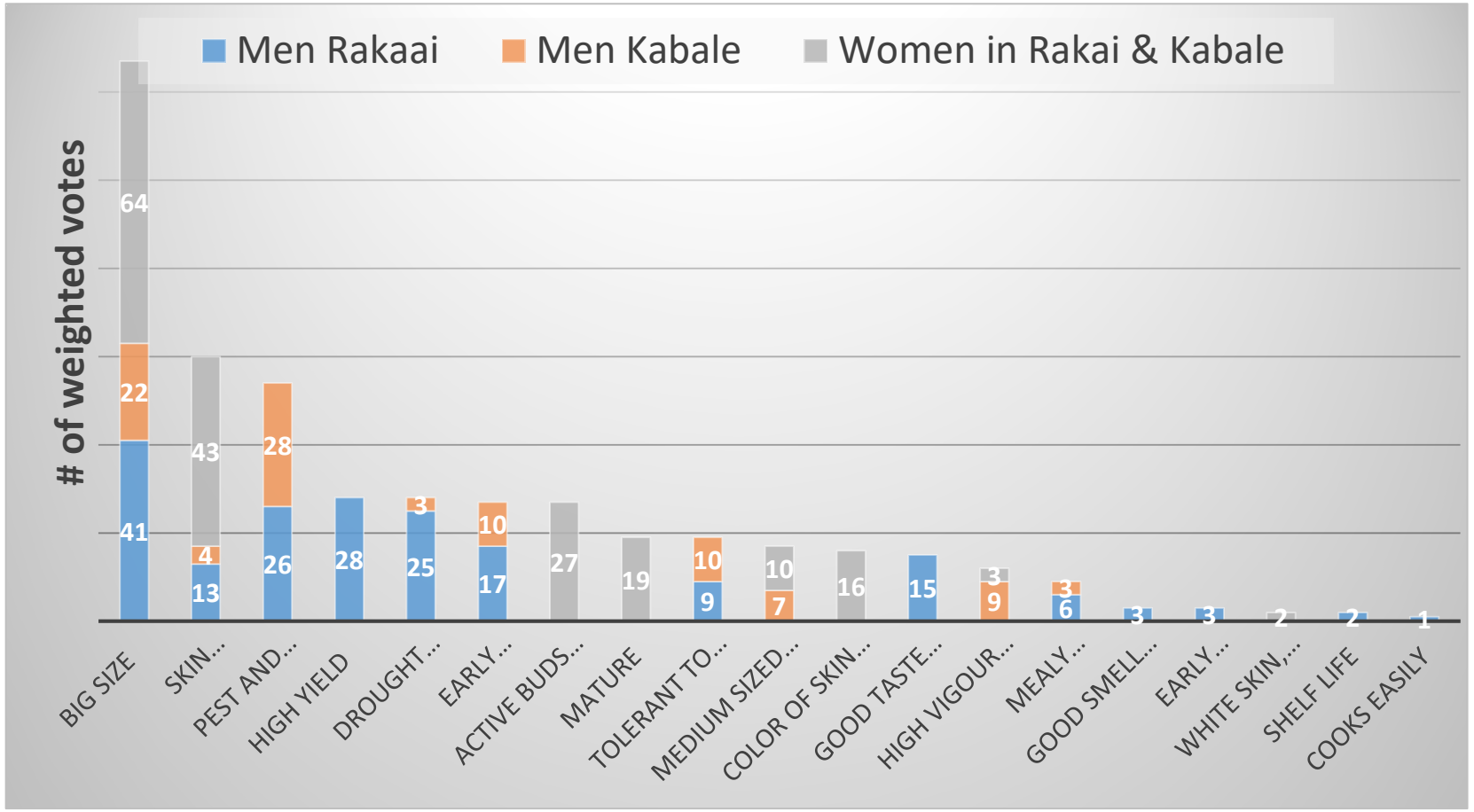
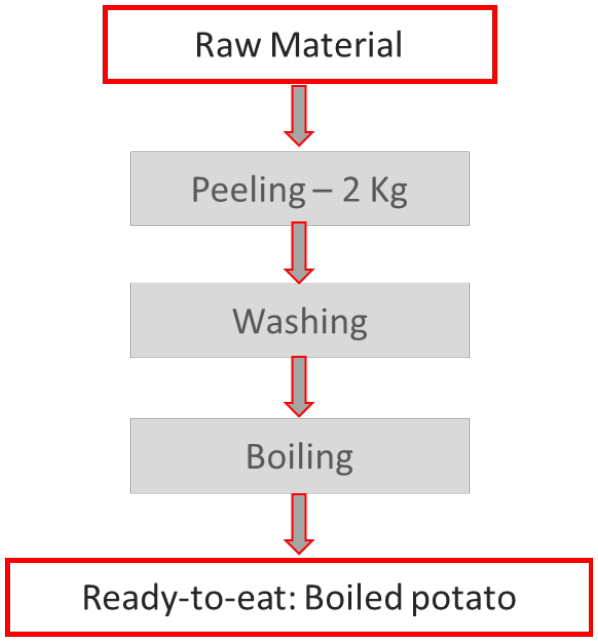


Figure 1: Top three preferred potato traits by men and women in Rakai and Kabale

Process Description

Act. 3 &/or Act. 4

- Flowsheet Diagram of the Process (Act. 3 &/or Act. 4)
- Key Physical Parameters measured: yield & duration at each step, cooking temperature, dry matter (Act. 4)



List of Quality Characteristics of the **Raw Material**

Rank	Most Preferred	Least Preferred
1	Big size tuber	Small size tuber
2	Bright shiny skin	Rough skin
3	Few nice buds/eyes, not deep	Dead buds
4	Red skin	Shapeless
5	Yellow flesh	

- Women prefer big sized tubers, bright and shiny skin, nice buds and eyes, mature potato and red skin and yellow flesh,
- Men mentioned big size tubers, pest and disease resistance, drought tolerance and early maturity.

List of Quality Characteristics of the **Raw Material** during **Processing**

Rank	Most Preferred	Least Preferred
1	Smooth skin	Small size
2	Good shape (for peeling)	Deep, many eyes
3	Few eyes, not deep	Rough skin
4	Size - medium to big	Irregular shape
5	Mealiness (as it boils)	Heart hole, black inside

- Big sized potatoes saved women labour in terms of peeling

List of Quality Characteristics of the **Raw** or **Ready-to-Eat Final Product**

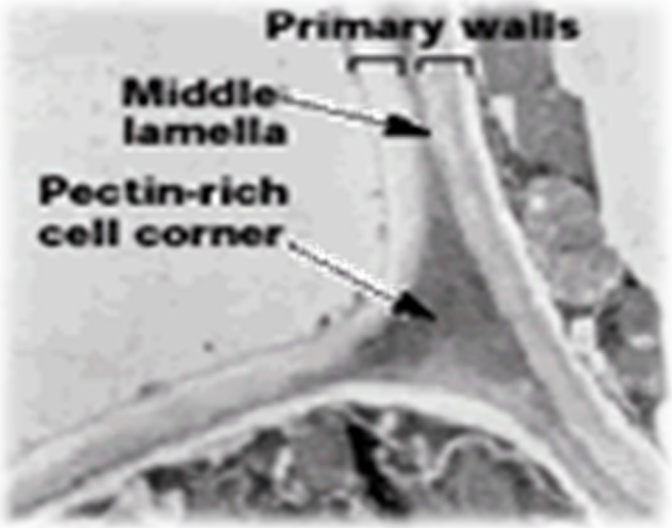
Rank	Most Preferred	Least Preferred
1	Mealy	Glassy (Muwutta)
2	Nice aroma	Too soft - mashy
3	Yellow color of flesh	Bad smell
4	Hard, but not too hard	White color

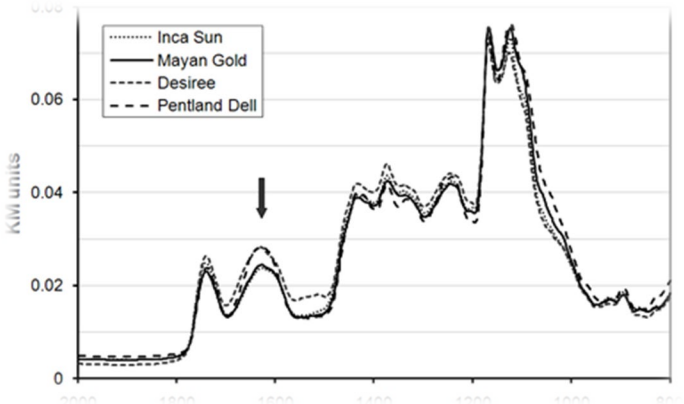
- Men prefered mealy potatoes, children prefered soft ones which could easily be mashe

Main Preferred & Less Preferred Varieties

Rank	Most Preferred	Least Preferred
1	Deo deo	Kimuri
2	Naropot 4 (Rwangume)	Deo deo luguwa
3	Kinigi	Mabunda
4	Victoria	

- Low income homes preferred Kimuri: seed easy to get, early maturing and resistant to disease

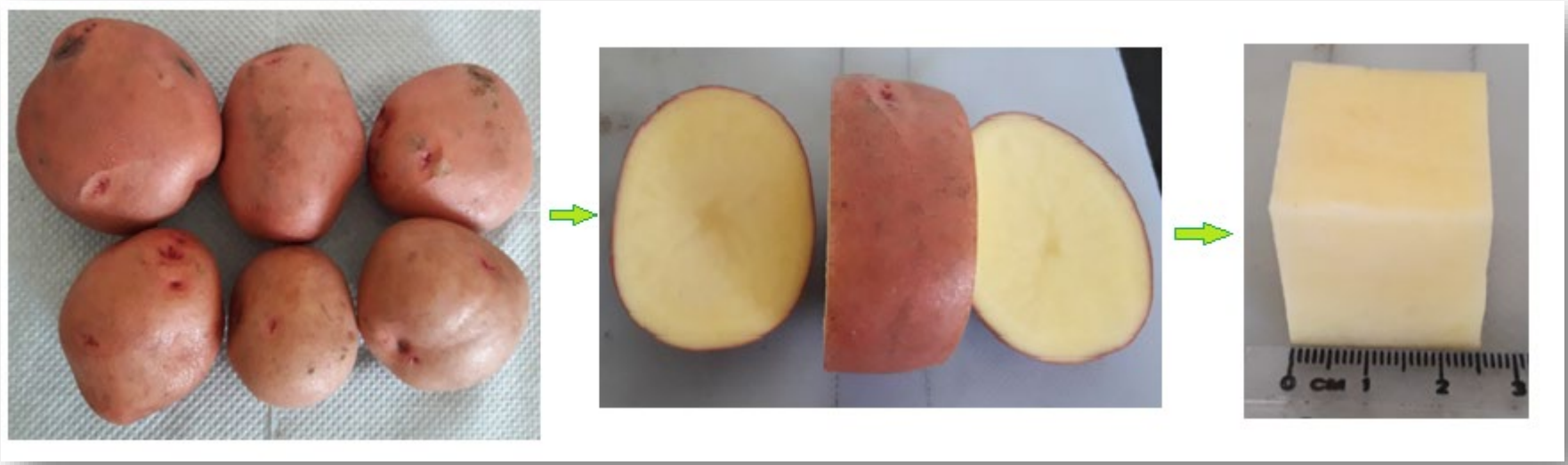




WP2

*Accessing the quality traits.

Sample preparation for cooking and texture



Select tubers
Wash with dH2O, air dry

Cut to remove bud and stem end

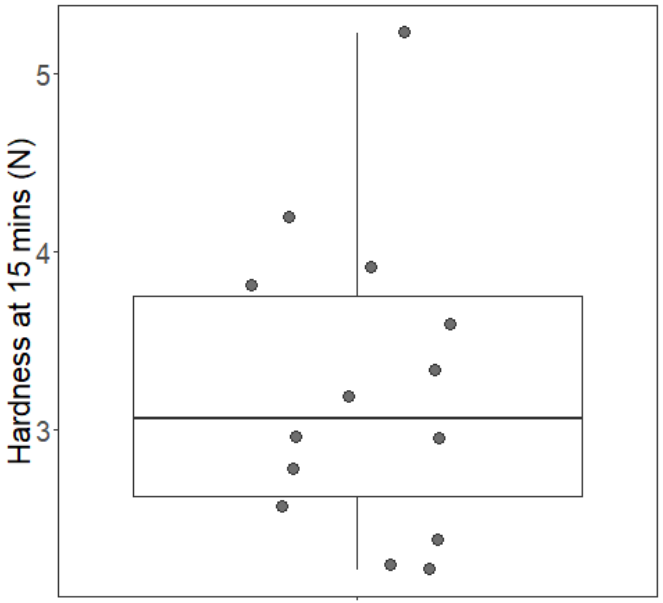
Excise a 2.5 x 2.5cm cube from the central part (pith)

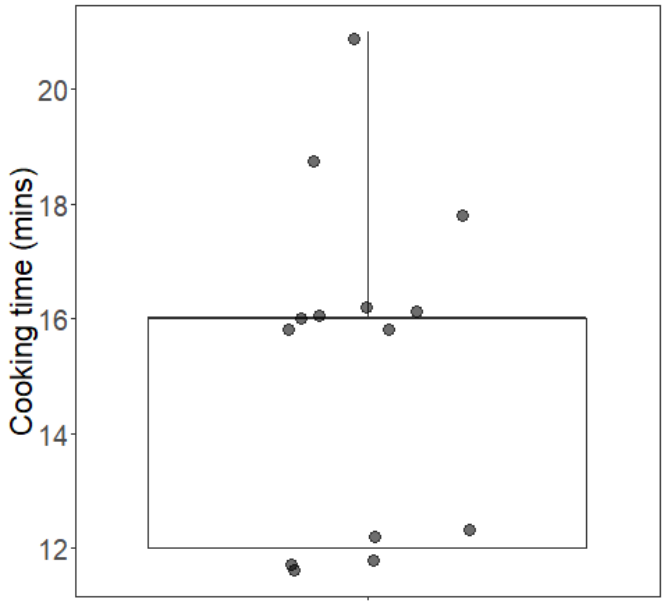
Optimum cooking time (OCT)
Add cubes to boiling water,
Record time taken to be soft enough to insert wooden toothpick through the centre

Texture
Incubate cubes in boiling water for 15 minutes
Measure texture (firmness) – Blade probe distance 8mm, speed 2mm/sec.

Characterization of Cooking/Processing Ability

- SOP for Boiled Potato
  - ✓ The SOP for cooking and texture determination is under development
  - ✓ A single cooking exercise was conducted in September 2019 (NARO, Kawanda Uganda), with14 varieties.





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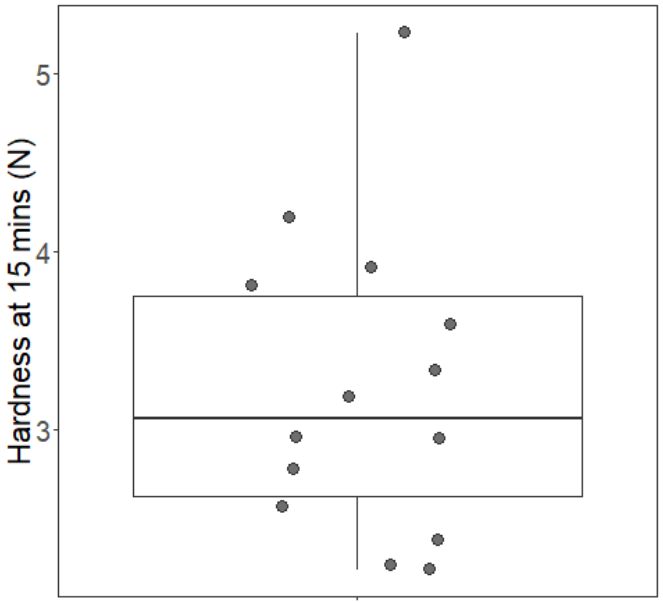

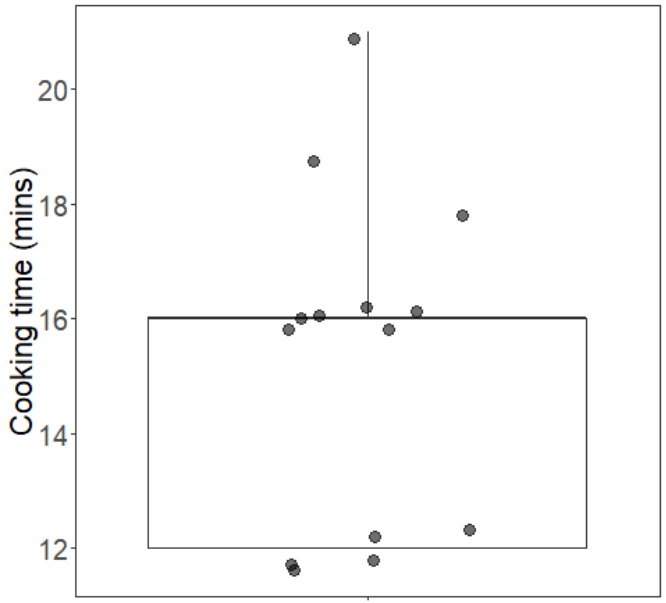

✓Cooking time ranged from 12 to 21 minutes,

✓There was no correlation (R^2 = 0.028) with texture (firmness) results

(boiling for 15 minutes at 96°C not ideal)

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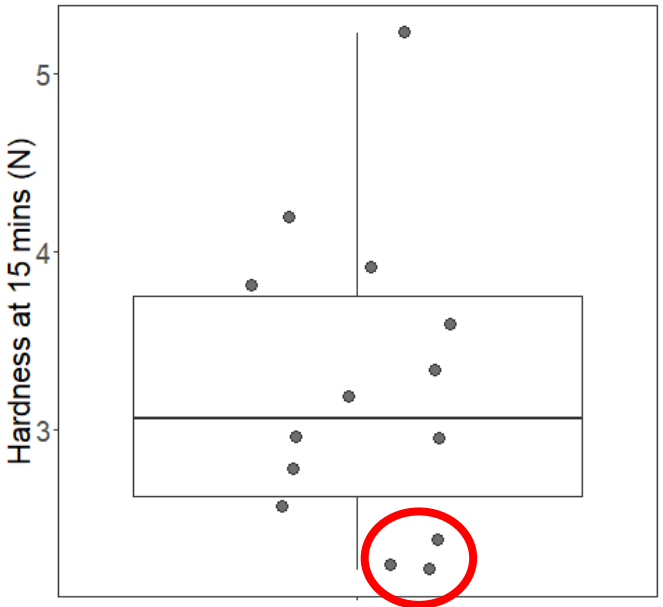
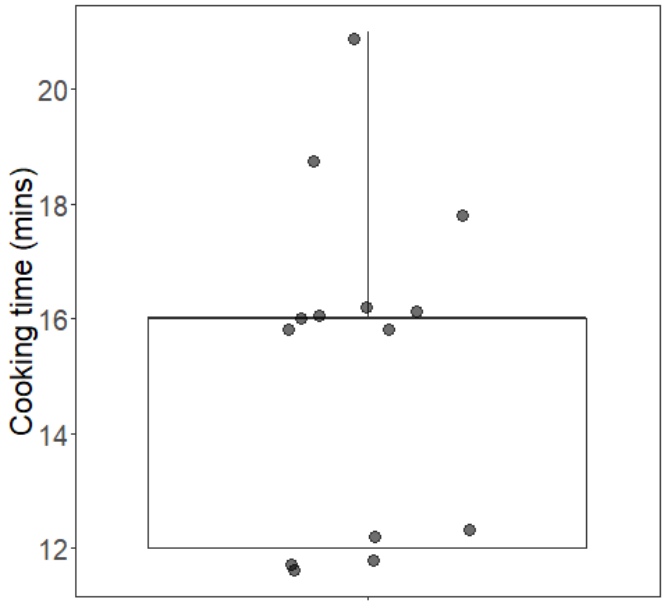


Victoria and NAROPOT4



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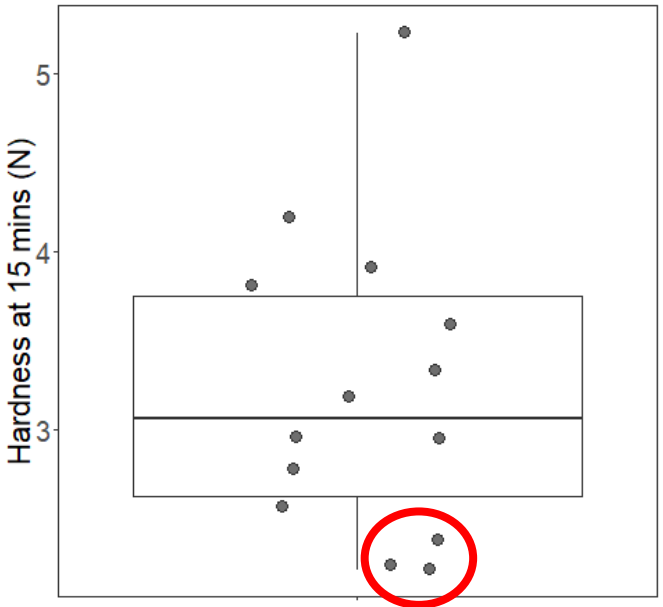

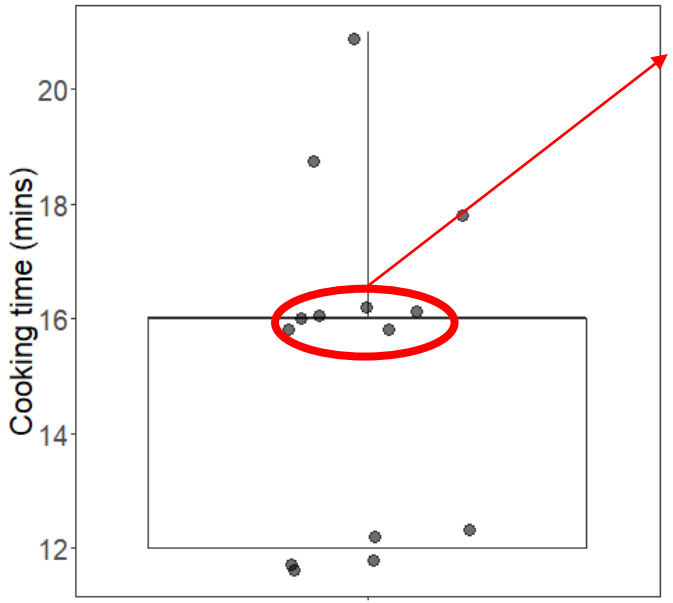

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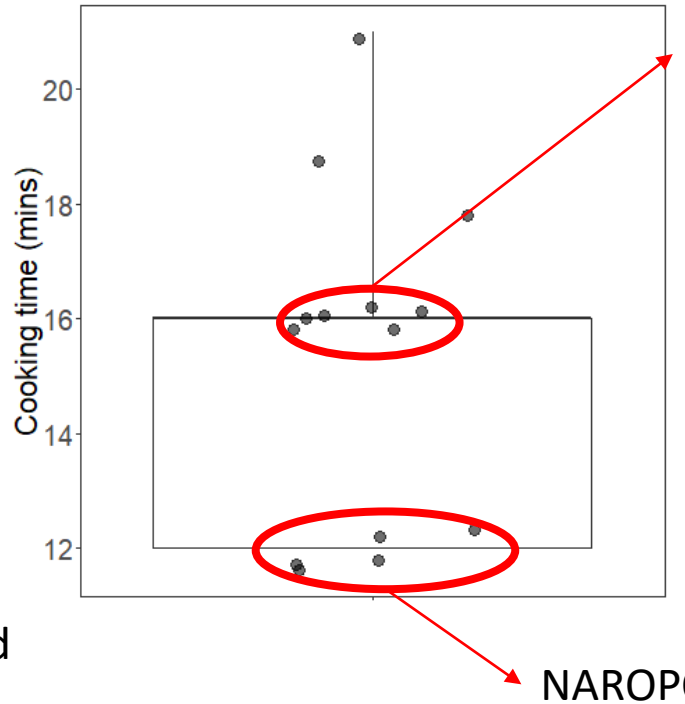

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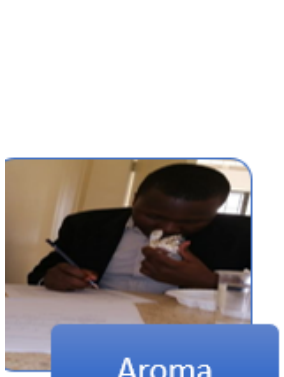
Sensory Profiling of Boiled Potato

Generated an initial list of 20 descriptors with clear definitions and scales for scoring

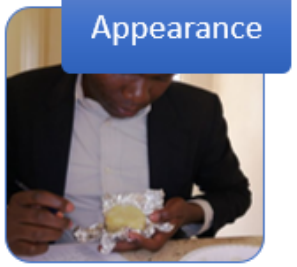
Category	Descriptors
Appearance	Yellow colour, homogeneity of color, translucency (=3)
Aroma	Potato, green vegetable aroma, root tuber aroma, cooked carrot (=4)
Odor	Potato, green vegetable aroma, root tuber aroma, cooked carrot (=4)
After taste	Bitter (=1)
Texture	In mouth: fracturability, hardness, crunchiness, moisture in mass, moisture release, mealiness, smoothness (=7) By hand: Cohessiveness (moldability) (=1)

Sensory Profiling of Boiled Potato

Developed systematic workflow for sensory analysis to standardise assessment



Aroma



Appearance

Chew slowly and score the intensity of the flavors and basic tastes that you observe

Flavor

First bite

Bite with molars:
- Hardness

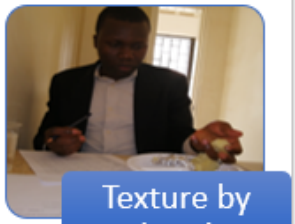
Compression

Chew down

While chewing:
- crunchiness
- moisture in mass
- moisture release

After 3 chews:
- mealiness

After 5 chews:
- smoothness



Texture by hand

Sensory Profiling of Boiled Potato

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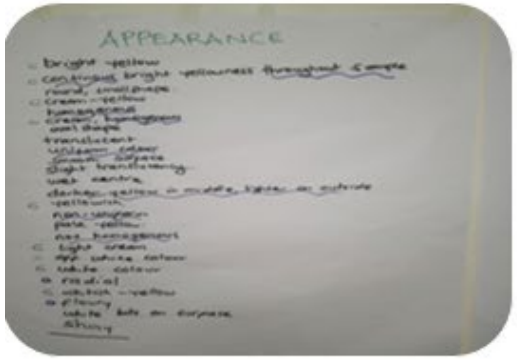
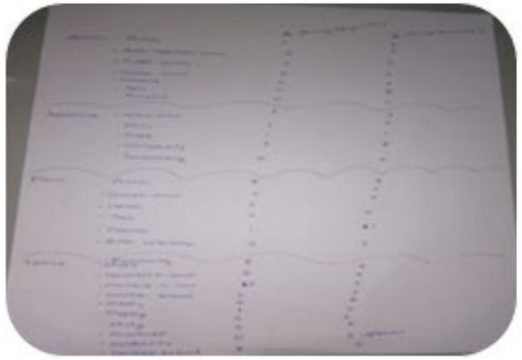


Initial list of terms generated to describe appearance

Panellists getting familiar with green vegetable aroma by tasting reference product



Panellist's scoresheet – first trial analysis using the developed Lexicon

Panellist's scores compiled, analysed and discussed

Traits Dissection to Explore/Explain Biophysical Quality Characteristics

- Proofs of Concepts to explore/explain Processing/Cooking Ability & Other Quality Traits (textural analysis, starch & parietal compounds analysis, image analysis, etc.)

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  - Cell wall analysis
    - Clones with highly contrasting textures will be analysed for cell wall and soluble polysaccharide composition
      - FANEL, CIP-Nairobi and JHI
  - Starch analysis
    - Starch content and composition (amylose/amylopectin) as well as gelatinization properties will be analysed
      - FANEL, Nairobi, Kenya
    - Starch granule structure will be determined using SEM (selection of varieties)
      - South Dakota State University
  - Enzyme analysis
    - Enzymes involved in pectin hydrolysis (pectin methyl esterase)
      - FANEL, Nairobi, Kenya
    - Rate and extent of hydrolysis could correlate with the cooking time and/ or texture
    - Extensive work at JHI has proved that PME1 activity is correlated with texture and cooking time in Phureja and Tuberosum potatoes.

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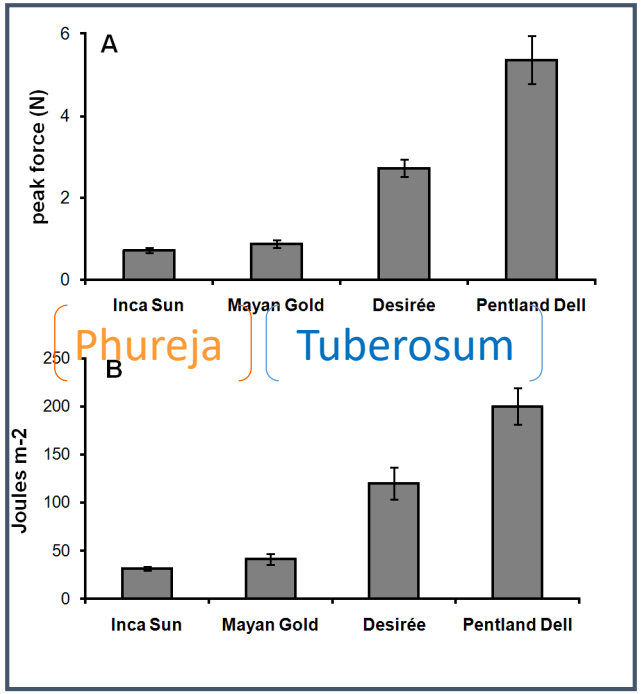
Understanding basis of potato texture

Phureja group tubers have much softer texture



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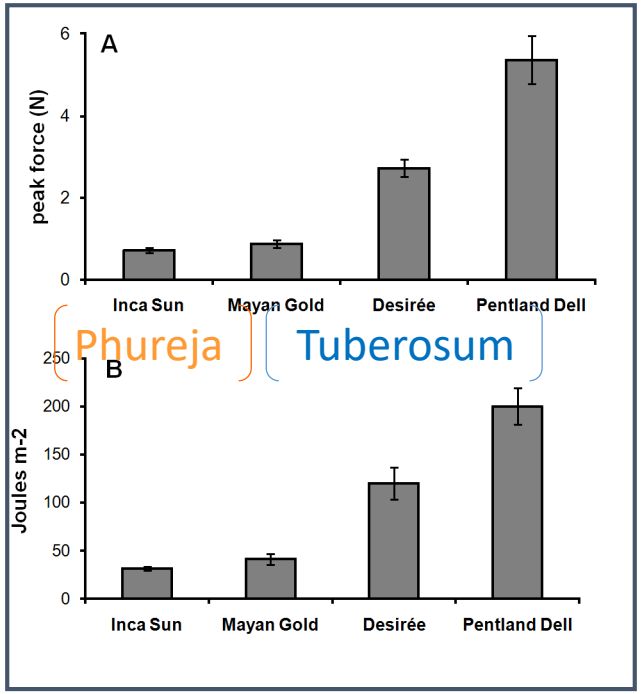

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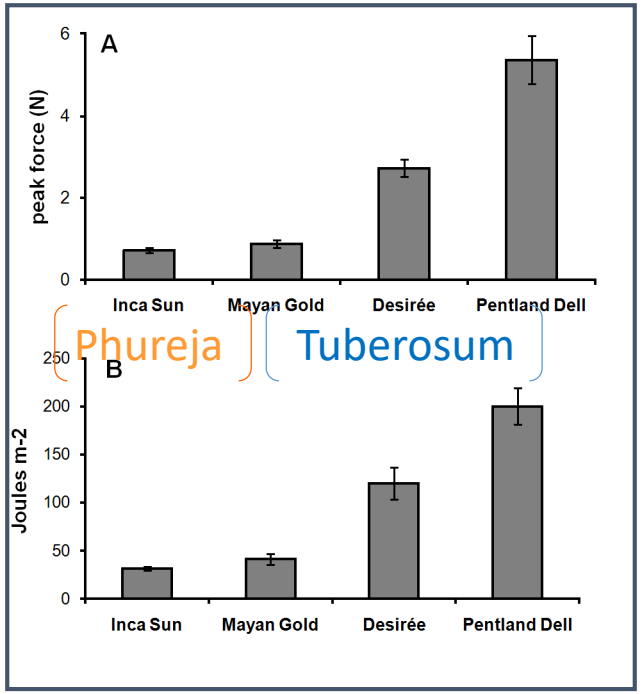

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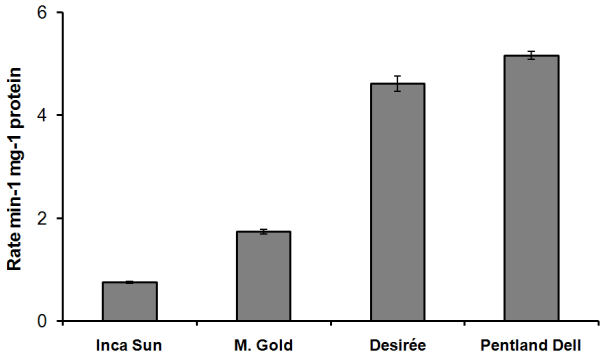

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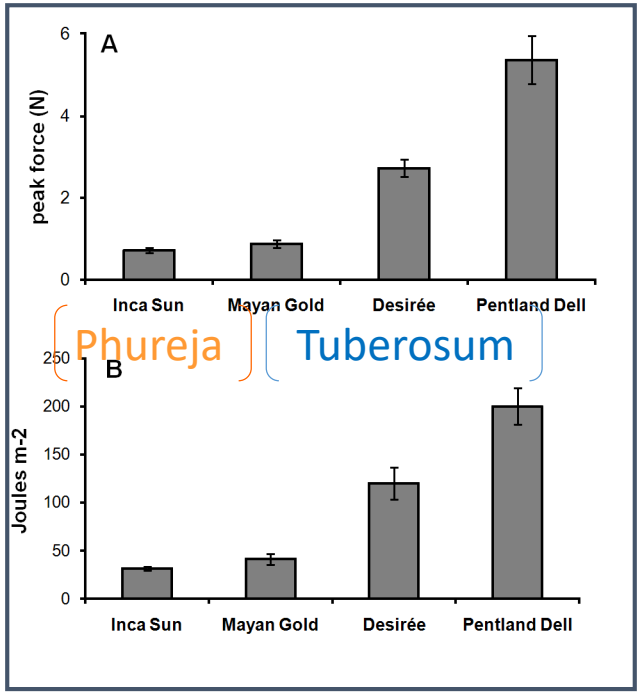

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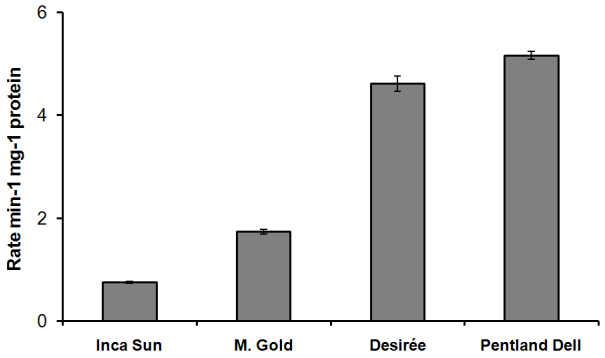

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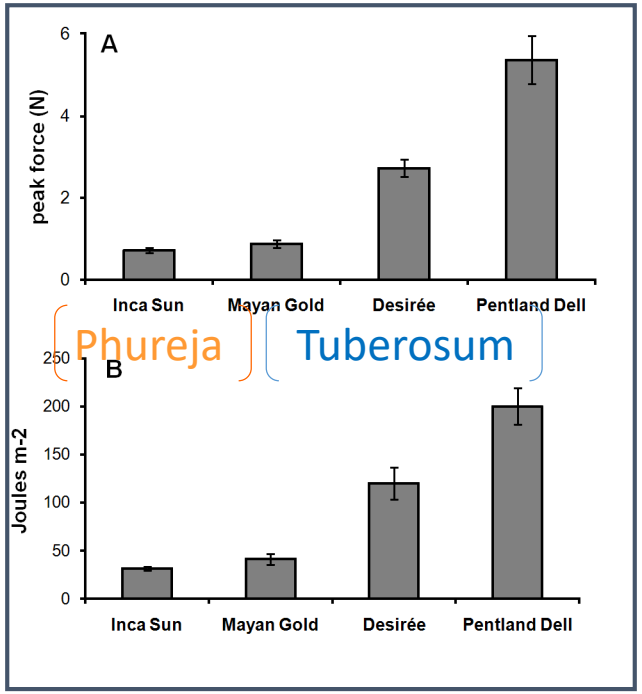

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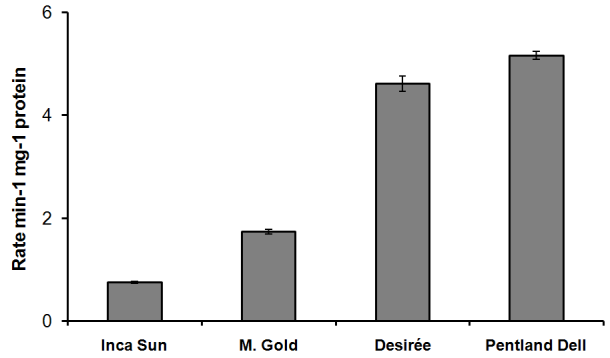

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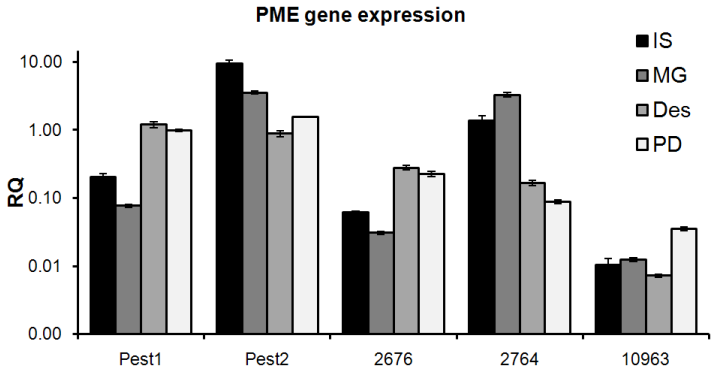

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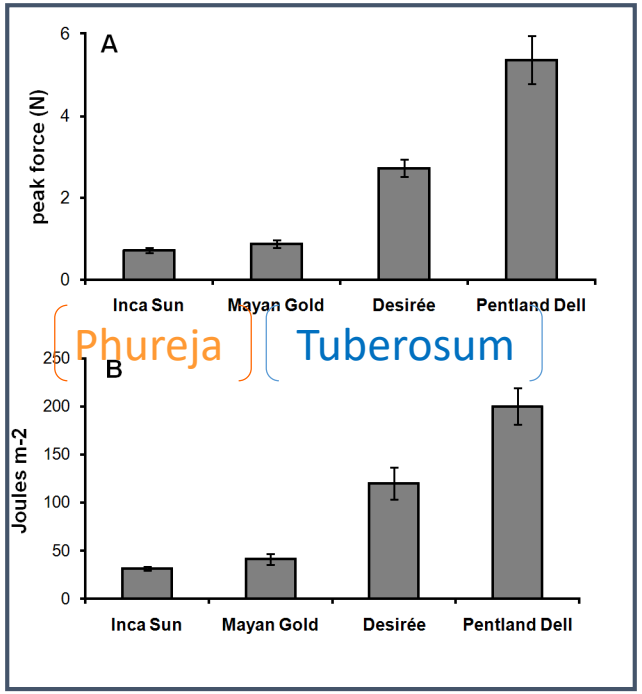

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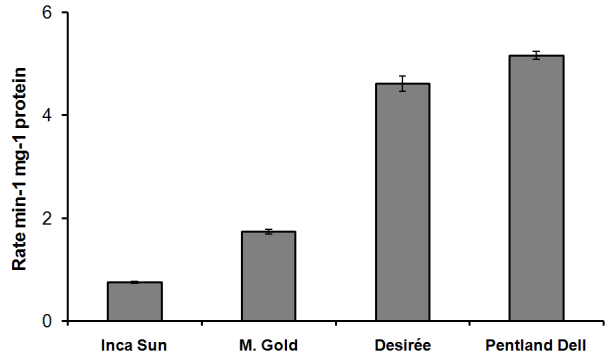

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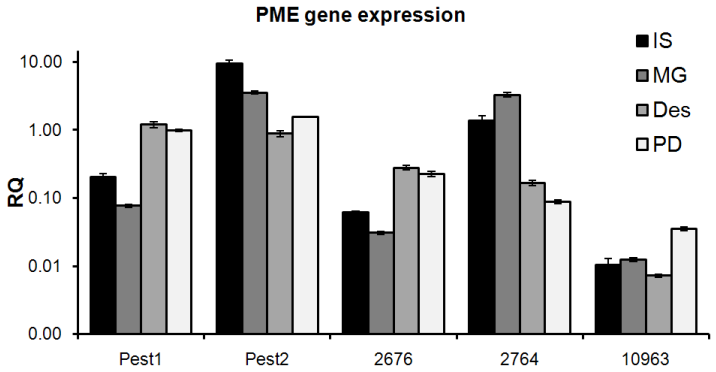

PME expression confirmed by quantitative RT-PCR

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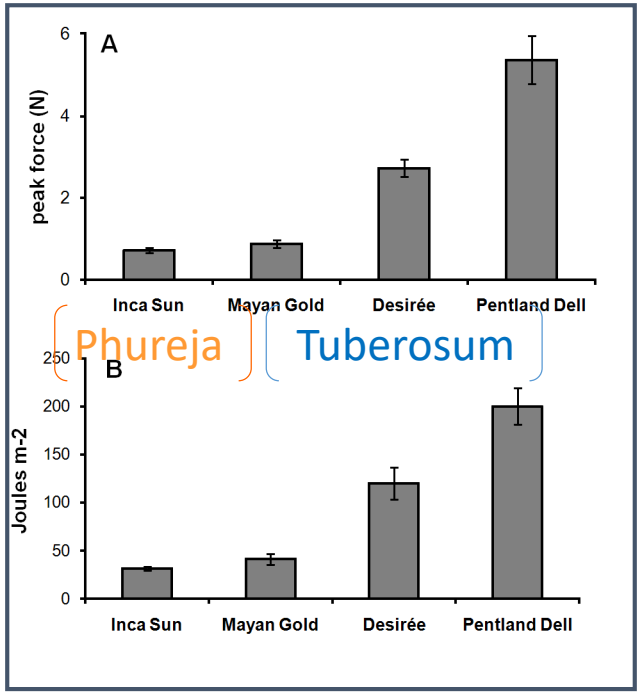

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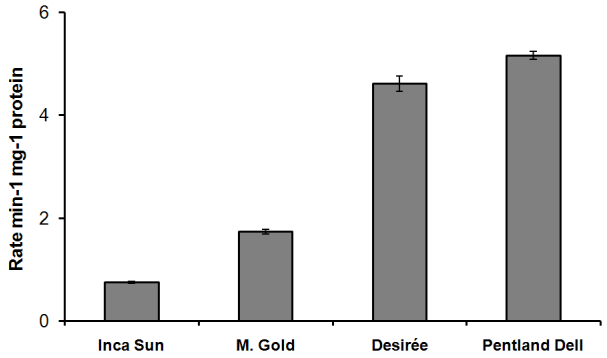

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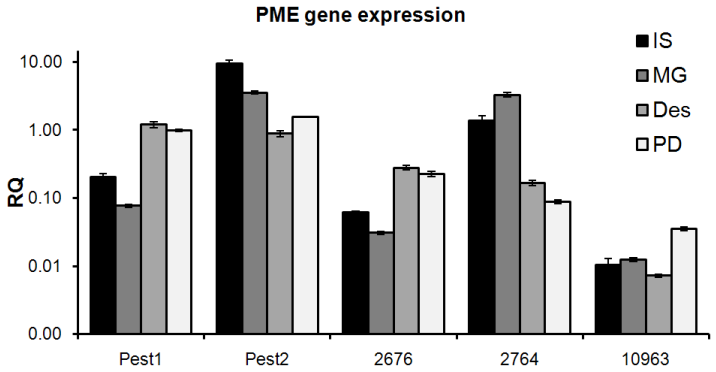

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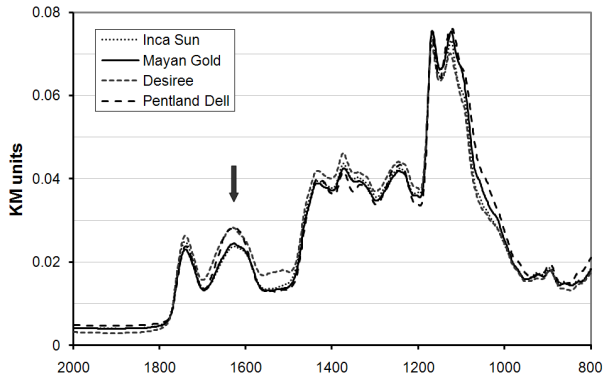

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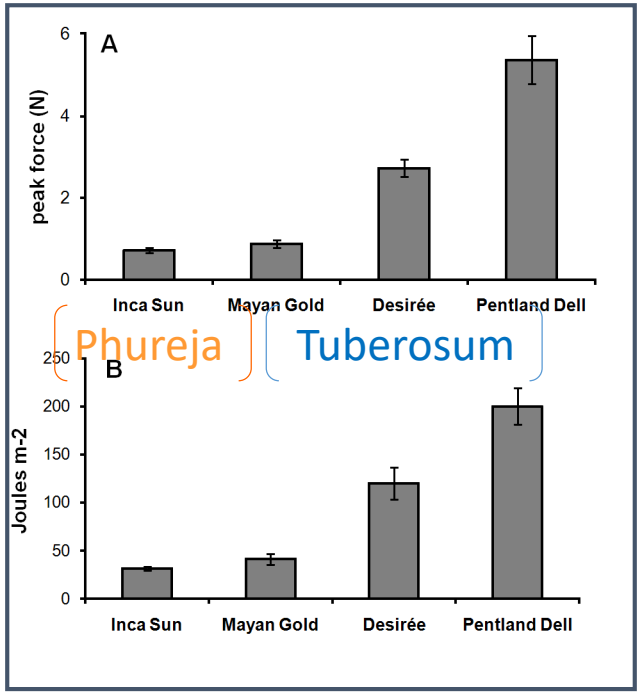

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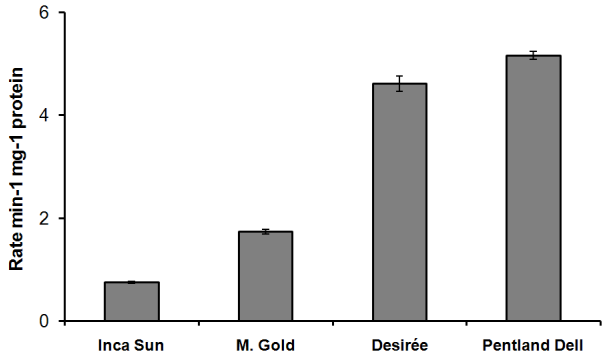

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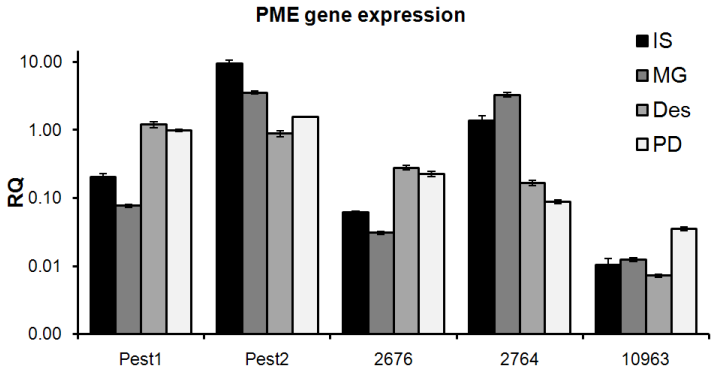

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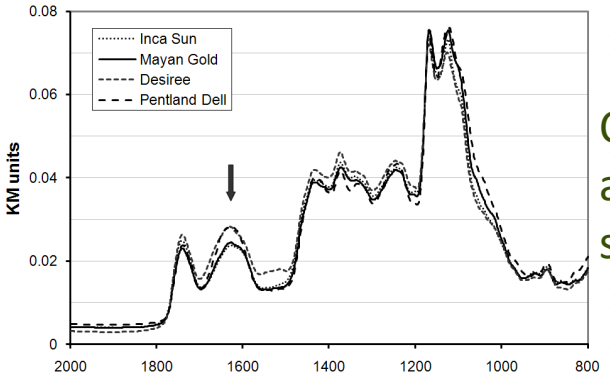

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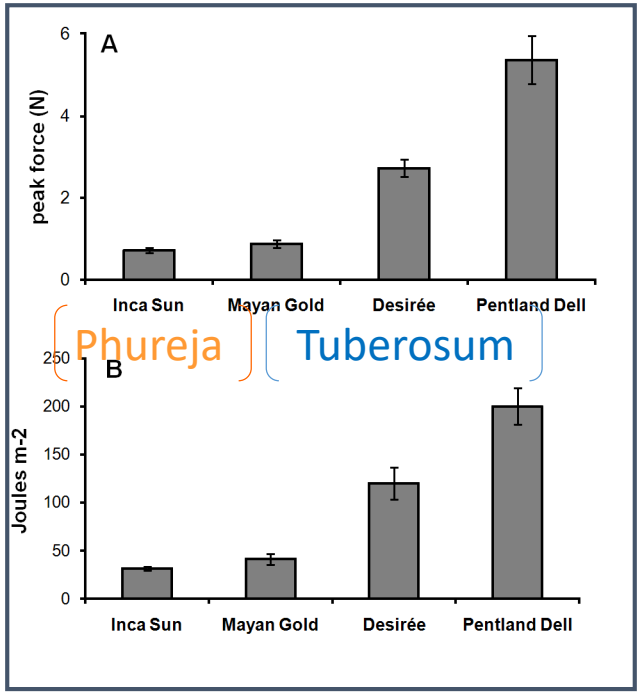

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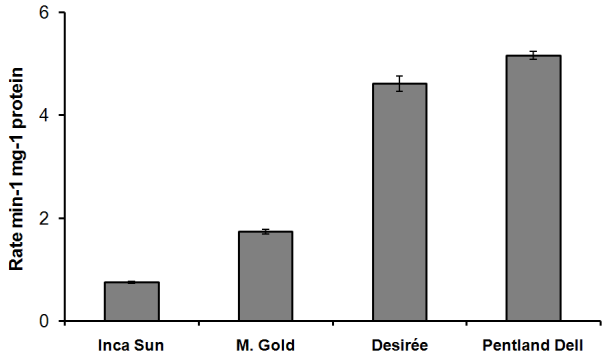

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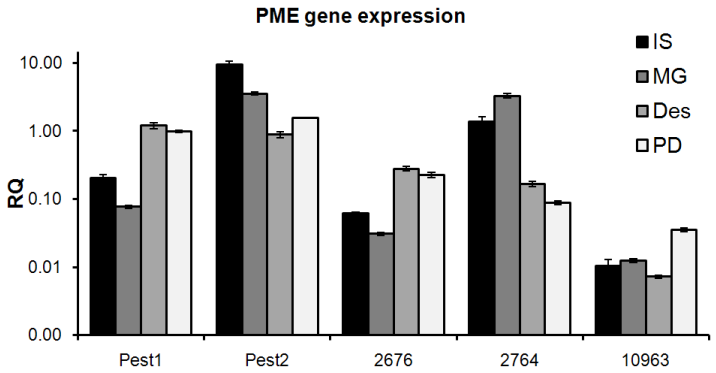

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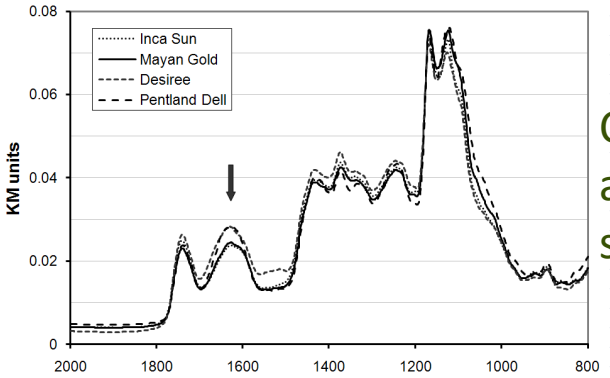

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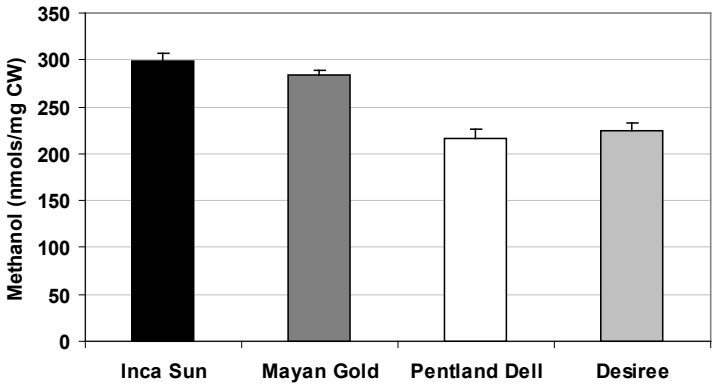

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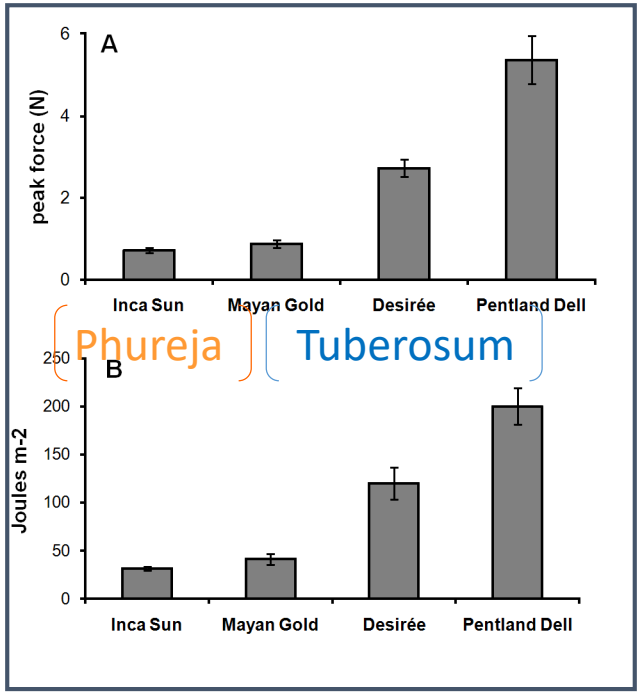

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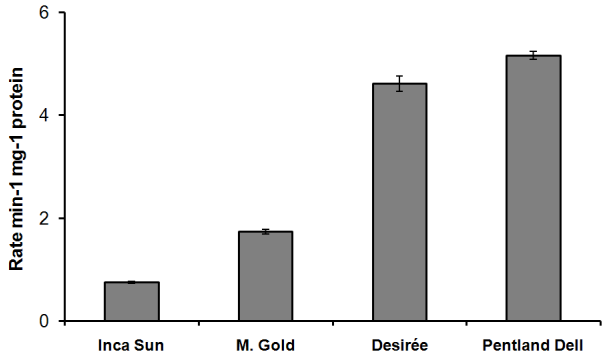

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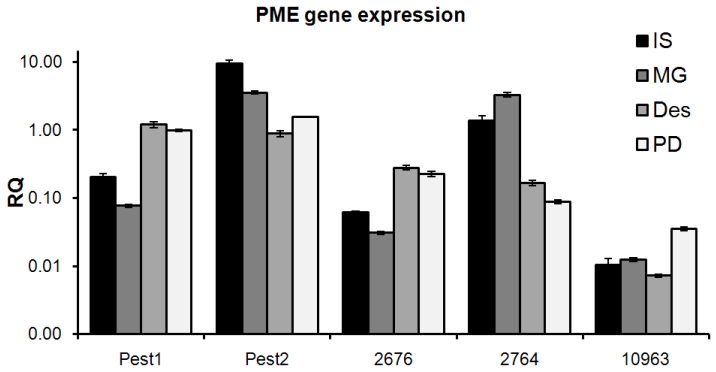

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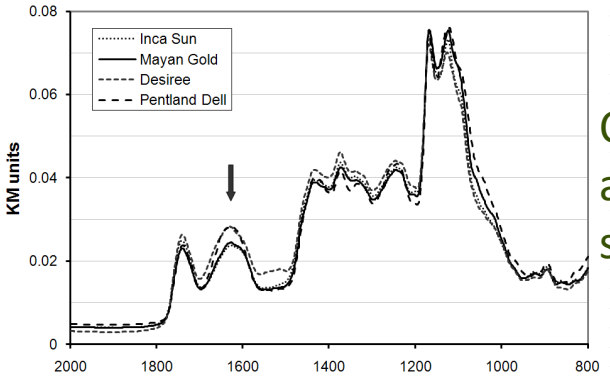

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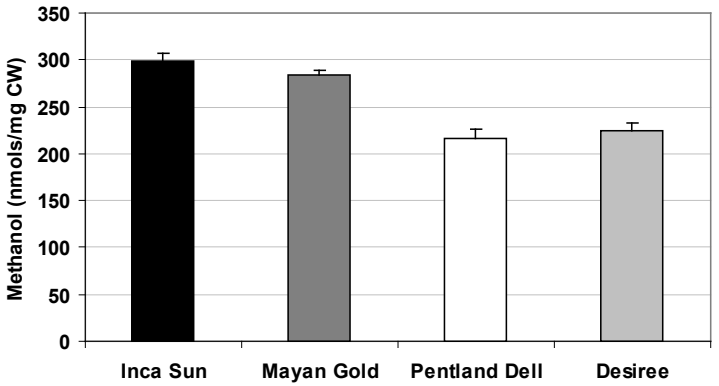

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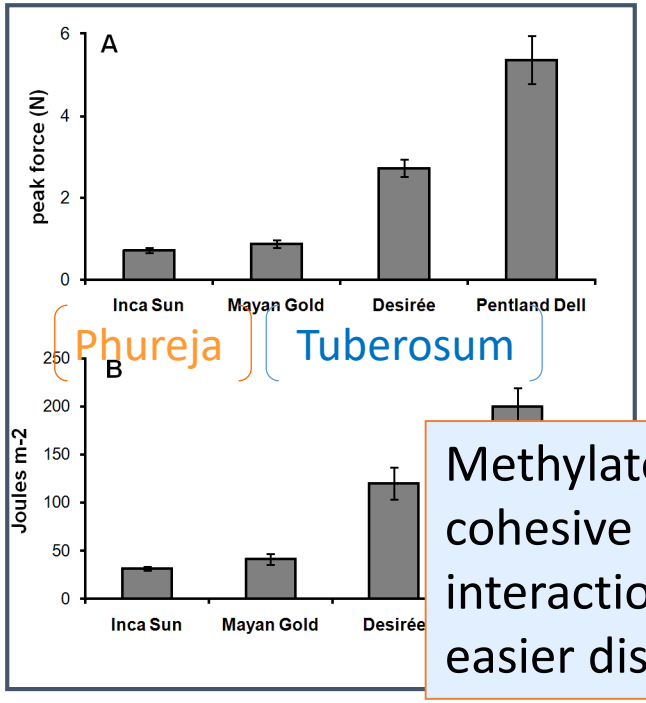

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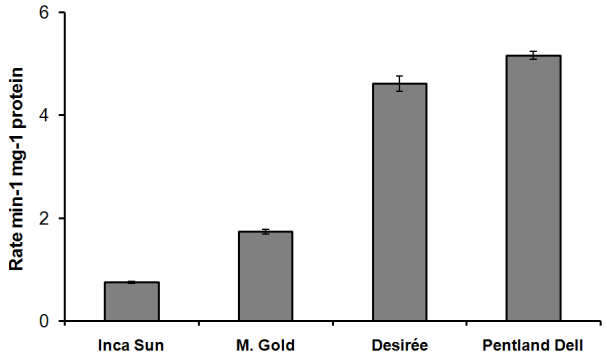

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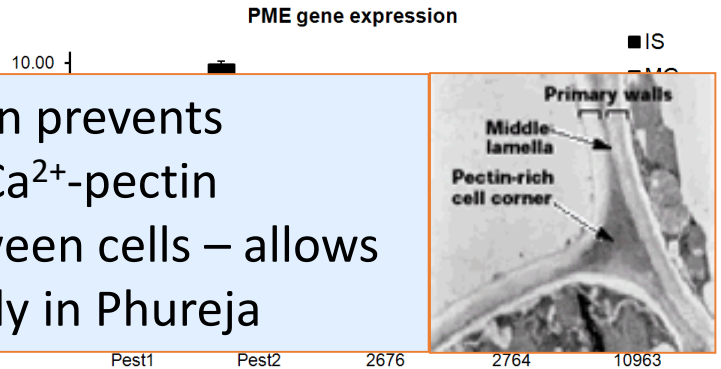

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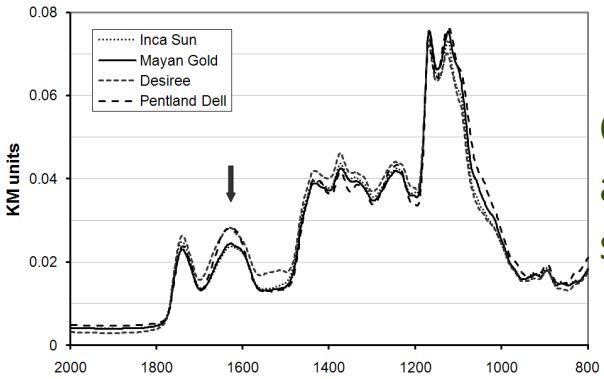
Methylated pectin prevents cohesive pectin-Ca^{2+}-pectin interactions between cells – allows easier disassembly in Phureja



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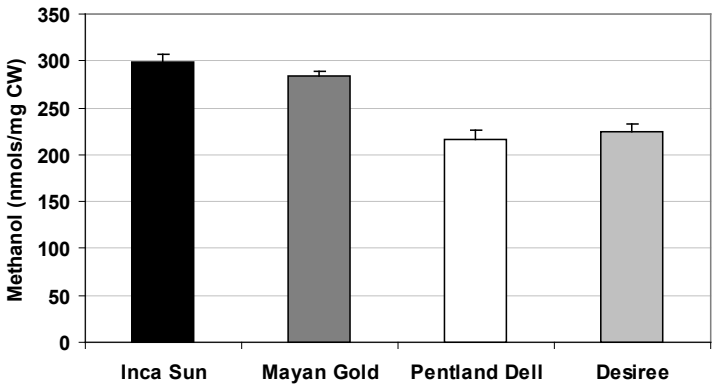

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WP3

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- Specific quality parameters have still to be defined, some of the quality traits to be assessed will surely be sugar profiles, texture, cooking time, starch and antinutritional components such as glycoalkaloids.

WP4

*CIP Breeding trials in Kenya

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- Some of the quality traits to be assessed will be: sugar profiles, texture profile (dry after, cooking time, cell wall, cooking time), nutritional and antinutritional (glycoalkaloid) and sensory analysis.

Performance of advanced clones and local varieties

Kachwekano Research Station

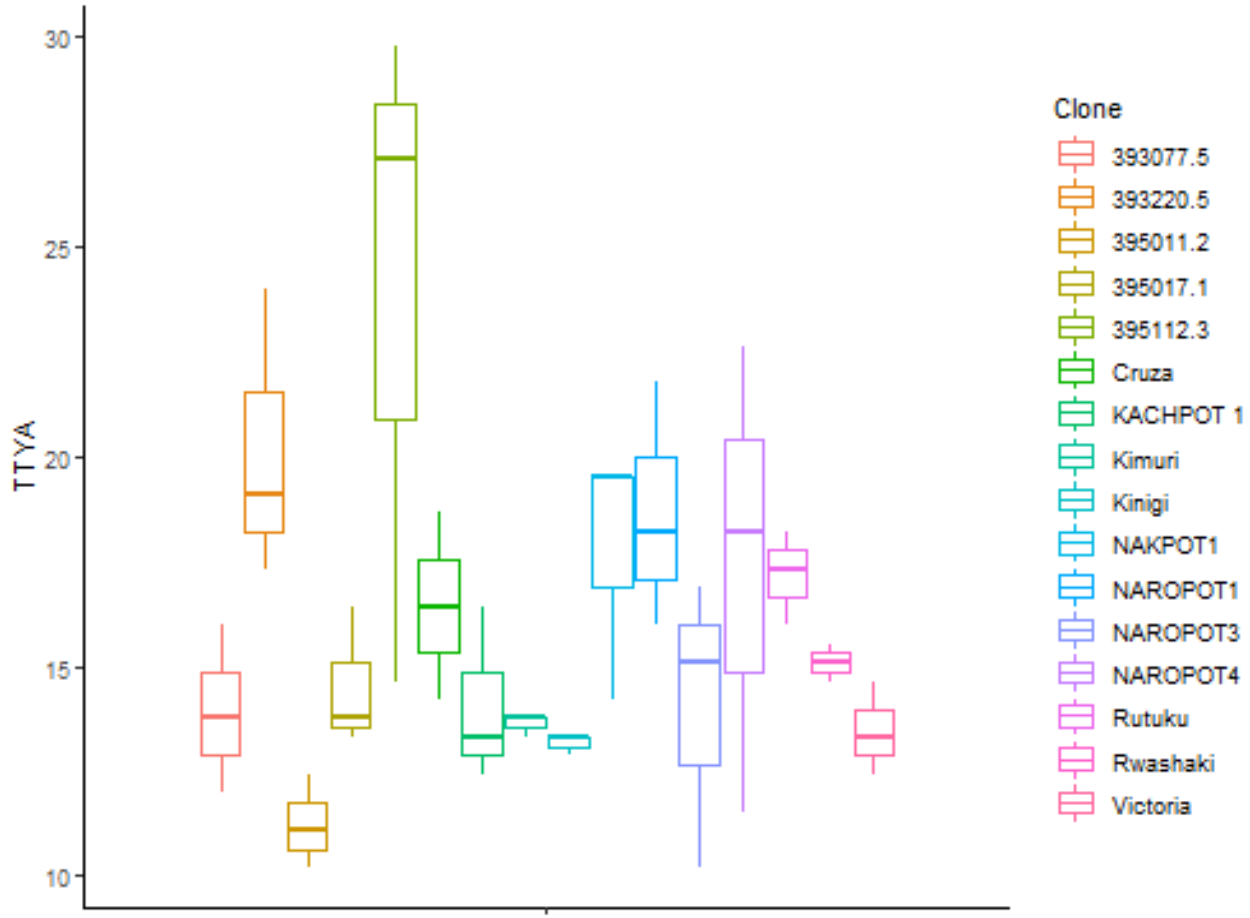


Figure 1: Performance of sixteen genotypes including advanced clones and local varieties at the Kachwekano Research Station, located in South-western Uganda. TTYA = Total tuber yield t/ha.

*emerging potato at on farm trials

WP5

On-Farm Trials & Evaluation of Advanced Material

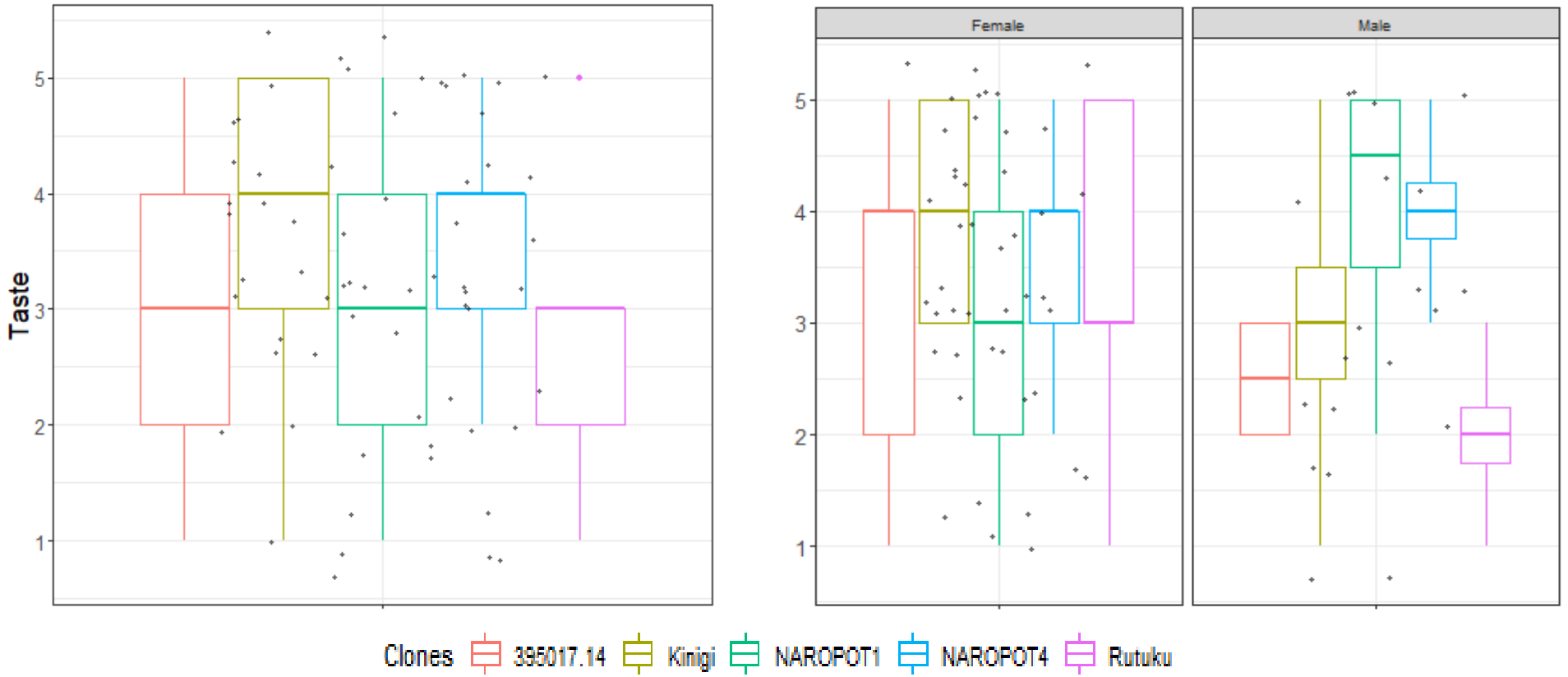
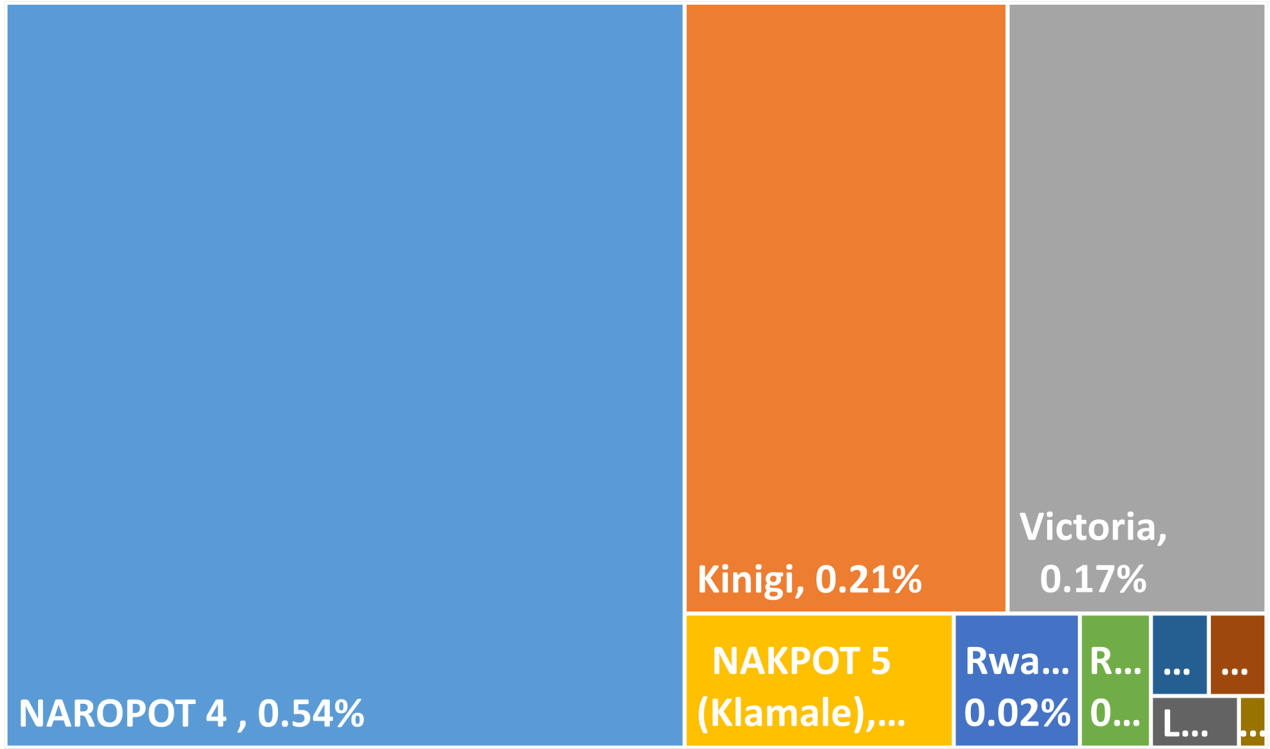


Figure 2: Farmer participatory assessment - Taste scoring (1-poor, 5-very good) of the top five clones selected by farmers (5 men and 7 women)

Potato varieties market share

Expert elicitations workshop, Uganda 2019



Varietal adoption rates in Uganda (110k ha), 2019. *CIP workshop report - Varietal Release & Adoption, Product Profiling, and Biotech Potential - the case of potato in Uganda.*

NAROPOT4

Kinigi

Victoria

RUTUKU

*NAROPOT4 - dominant variety covering almost 50% of the total potato area in Uganda (replacing Kinigi and Victoria)

Conclusion on Perspectives for all WPs

- Consolidation of Final Product Profile - WP1 Data cleaning and analysis (RTB Foods special issue)
- Enhance collaboration with EIB, RTB and private companies
- Coming assessement/sampling
  - Agronomic evaluation
  - Quality Traits to inform Crop Ontologies (by WP2)
  - New Spectral Calibrations to be dvped for Quality traits (by WP3)

Institutes & Main Scientists

- **CIP** – Uganda, Kenya & Peru (S. Mayanja, J. Swanckaert, L. Banda, M. Nakitto, M. Moyo, T. Muzhingi, T. zum Felde, T. Mendes, Netsayi)
- **JHI** – UK (M. Taylor)
- **NARL** – Uganda (Edgar S Tinyiro, K. Nowakunda, E. Khakasa, M. Matovu)
- **KAZARDI** - Uganda (P. Namugga, A. Barekye)

Thanks!

CGIAR RESEARCH PROGRAM ON Roots, Tubers and Bananas

BILL & MELINDA GATES foundation

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CIP INTERNATIONAL POTATO CENTER A CGIAR RESEARCH CENTER

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Source: http://cipotato.org/