Presentation on Marama bean activities, its achievements as on 31 March 2023.

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22-23 November 2023




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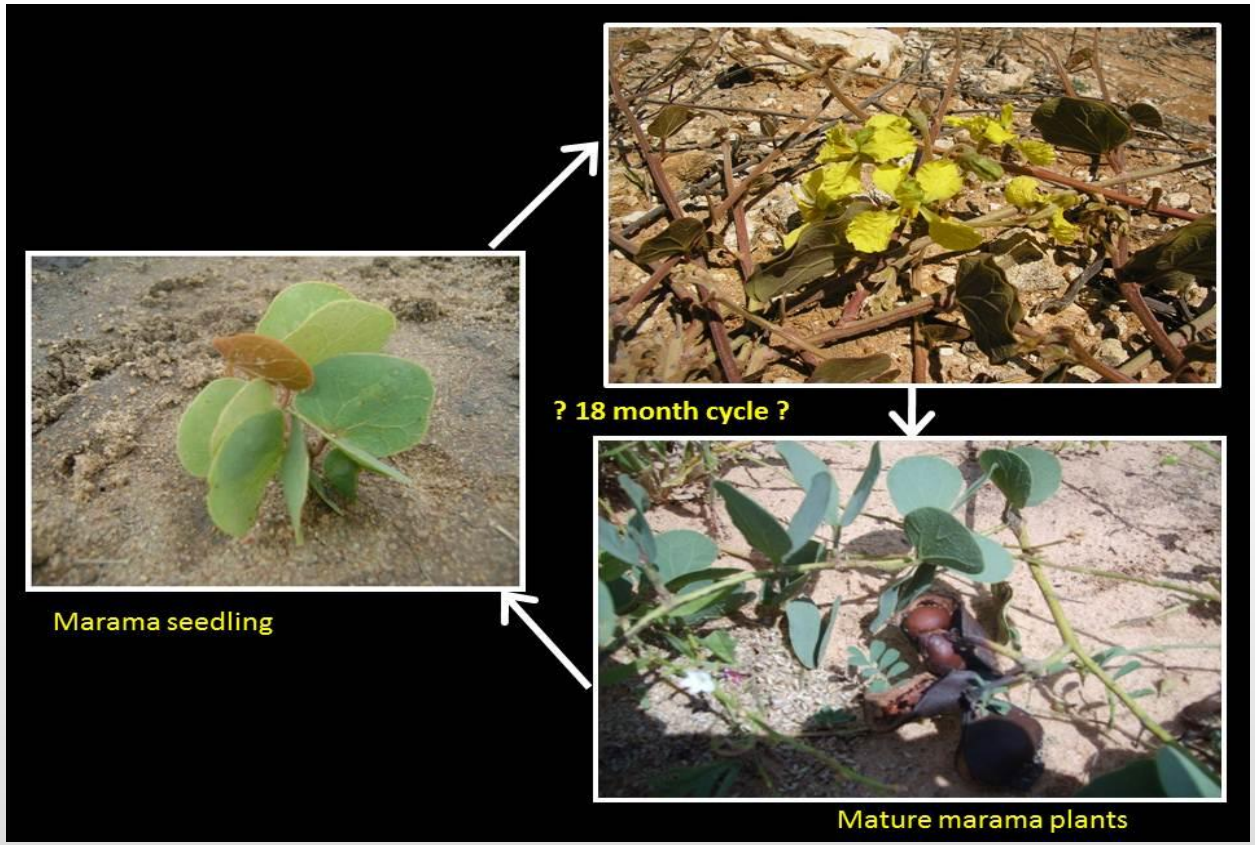
MARAMA BEAN (TYLOSEMA ESCULENTUM)

Marama bean: Life cycle



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Current project site: Okatumba gate, Omaheke region

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Criteria for germplasm selection

- 50 accessions out of 521 accessions collected (since 2008)

General characteristics recorded

- Seeds/pod
- Seed colour
- Internodal length
- Flowering time

Criteria for germplasm selection and planting

- 50 accessions out of 521 accessions selected
- 16seeds/accession: 800 seeds /2ha
- 5metre distance/seed, 15-20cm planting depth
- Choosing the 1 seed/pod (PMCMB1-10); 2 seeds/pod (PMCMB100-10) and 3 seeds/pod (PMCMB200-210)
- Ensuring selection varying geographical locations
- 20 accessions (Both early and late) flowering groups selected for production (early light brown: PMCMB 300-310), (late, light brown:PMCMB400-410)
- PMCMB 309, 2 seed/pod, 5 pods/flower)
- 95% germination rate

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Crop Management protocols

- Tractor ploughing
- Plot de-bushed
- Weeding not yet done, no weeds yet in the plot
- Mesh wire fencing to keep rodents and other wild animals out of the field
- No irrigation yet
- No fertilizer application yet

Germplasm storage

- Currently the 521 accessions are being kept at 4°C at NUST cold room in khaki papers
- Negotiation are ongoing with NBRI to keep the germplasm
- More germplasm collections on-going
- Possibility to engage an SME company for seed cleaning, packing and dispatch
- Seeds for WFP project

Activities

1. Pre-season weeding (manual weeding vs grazing livestock)
2. Fence inspections and mending
3. Insect monitoring and control
4. Third set of seeds set: Oct/Nov 2021
5. Seed dissemination to STOL partners

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Current report

- 1. 95 % resprouted (608 plantlets)
  2. All selected 50 accessions represented in 640 seeds
  3. Various phenotypic traits observed
- Harvesting at the end of May 2023




Associated work

- WFP PROGRAMME:
  - Home grown school feeding Program (Marama bean& Moringa)
- Paidamoyo Mataranyika (PhD): Plant-Microbe Interactions on STOL crops
- **Food security and Nutrition Improvement by Fostering protein-rich legume using low-cost Biotechnology in Namibia (FOODSECBIO).**

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For Objective 1: Maintenance and harvesting of seeds shall continue into year three.

- During this season the current marama bean plants at Okatumba gate (Epukiro) in Omaheke region was maintained with usual crop husbandry and harvest seeds will be distribute to communal farmers and the STOL project partners.
- *Activities:*
- In this season 18 promising germplasm with varied crop performance for highest seed yield/plant to lowest seed yield/plant as well as other observable morphological variabilities were distributed to STOL partners (India).

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For Objective 2: Sharing marama bean with STOL partners in year 3

- During this season the harvested seed from year two will be disseminated to STOL partners via standard material transfer agreements.
- Each will STOL partners will be supplied with 18 marama bean germplasm under a SMTA.
- Local farmers (Mr Sakkie Kamburona, Mr Lee Mbirijona, Mr Kakujaha Kahepako and Ms Elizabeth Mbuende) will be supplied seed of the best performing germplasm and will be given marama bean production workshops.

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Results

- During this period and overall yield of 600kg seeds was achieved. However, the 18 selected marama plants had a low yield of only 10kg seed in total. This is because of some of the selected plants were low seed producers. The Farmers' Day in Epukiro (Marama bean trial site) was held on 27th August 2022.
- It was attended by 15 people. There was a translator from English to Otjiherero and vice versa.

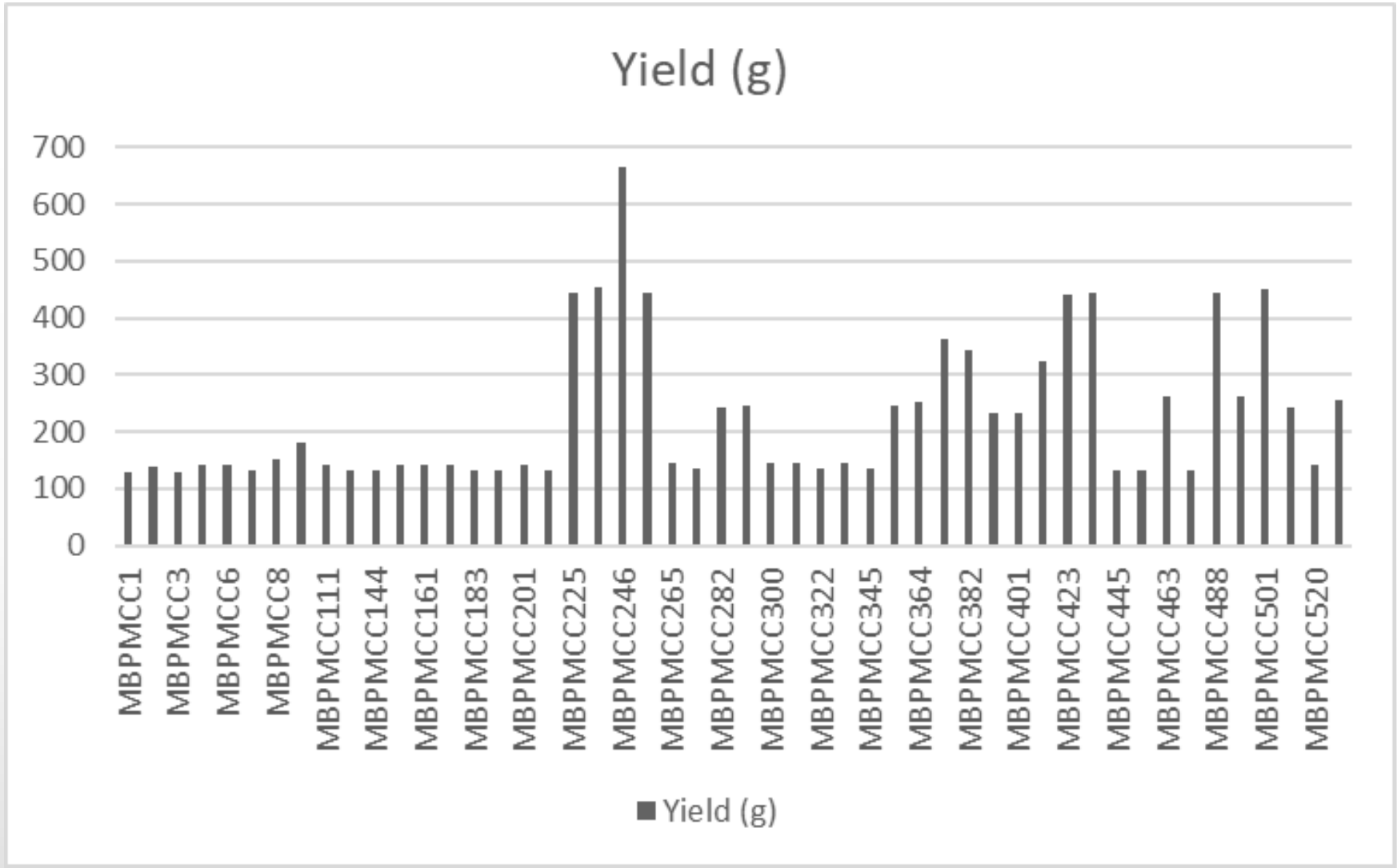

Figure 1: Seed yield for marama bean cultivars.




Marama Accession send to India

- Marama accessions (18) had previously selected based on seed production. Nine (9) were high seed producers and the other nine (9) were low seed producers. These were monitored for other agronomic traits.
- These were high seed producers : MBPCC225, MBPCC226, MBPCC246, MBPCC248, MBPCC382, MBPCC423, MBPCC424, MBPCC488, MBPCC501
- and the low seed producers MBPCC1, MBPCC3, MBPCC6, MBPCC114, MBPCC161, MBPCC201, MBPCC300, MBPCC401, MBPCC405.

Plant-Microbe Interactions on STOL crops: search for plant growth promoting bacteria




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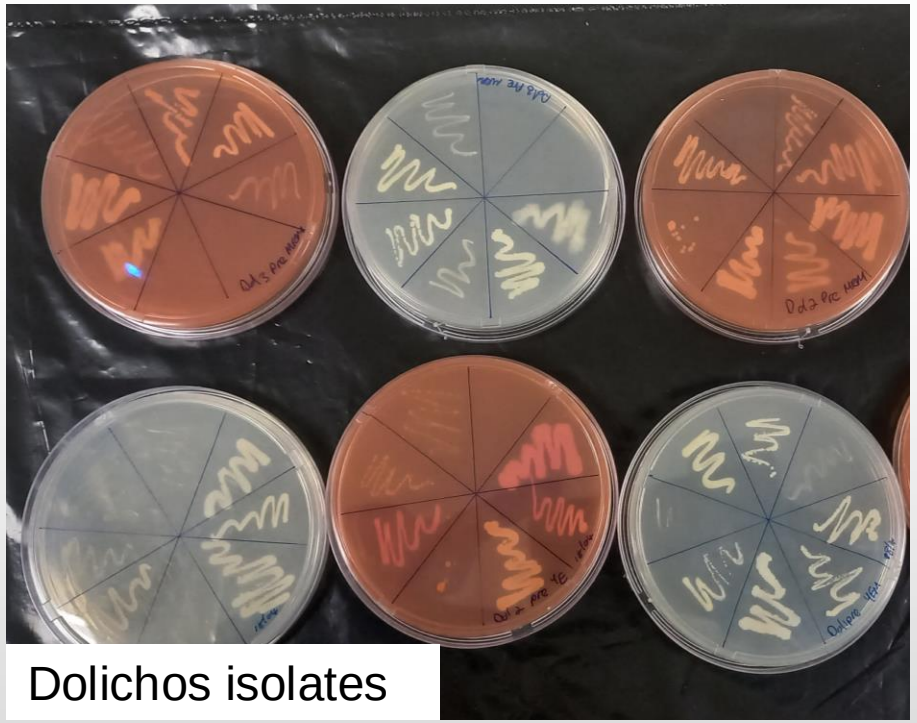
Nodule formation

Dolichos nodules

Dolichos (*L. purpureus*)
Average number of nodules/ plant- 12
Nodule size- 2mm-8mm



Dolichos isolates

Nodule formation- cont'd

Horsegram nodules

Horsegram (*M. uniflorum*)
Average number of nodules/ plant- 10
Nodule size- 2mm-5mm

Horsegram isolates

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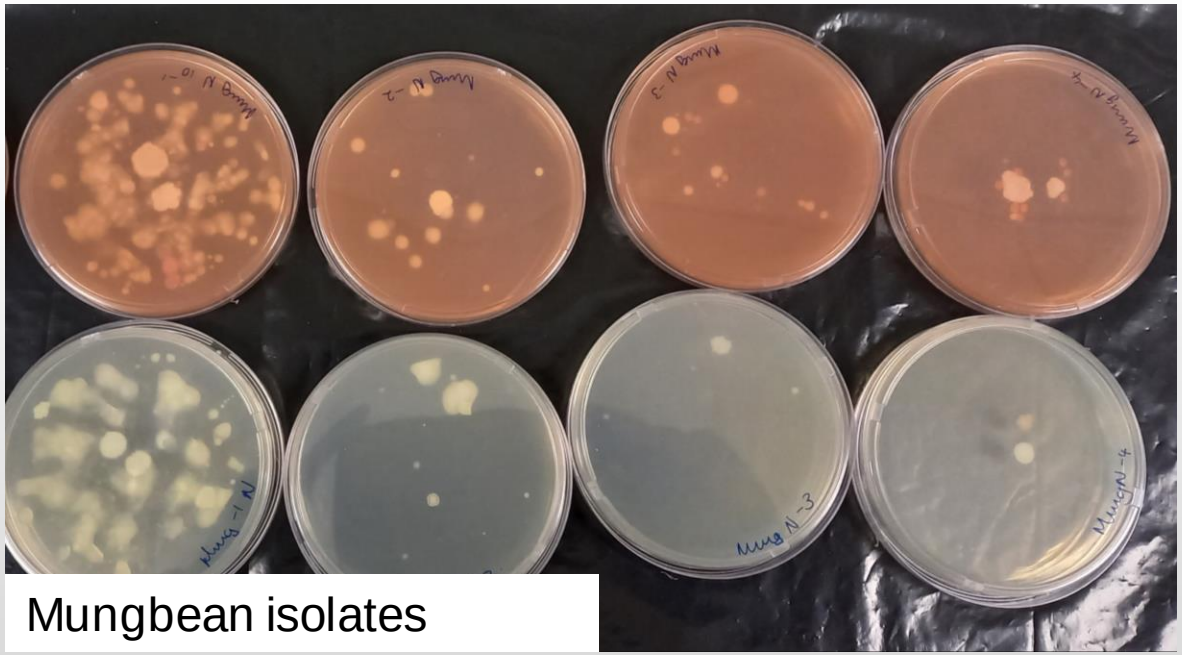
Nodule formation- cont'd

Mungbean nodules

Mungbean (*V. radiata*)
Average number of nodules/ plant- 2
Nodule size- 1mm-2mm



Mungbean isolates

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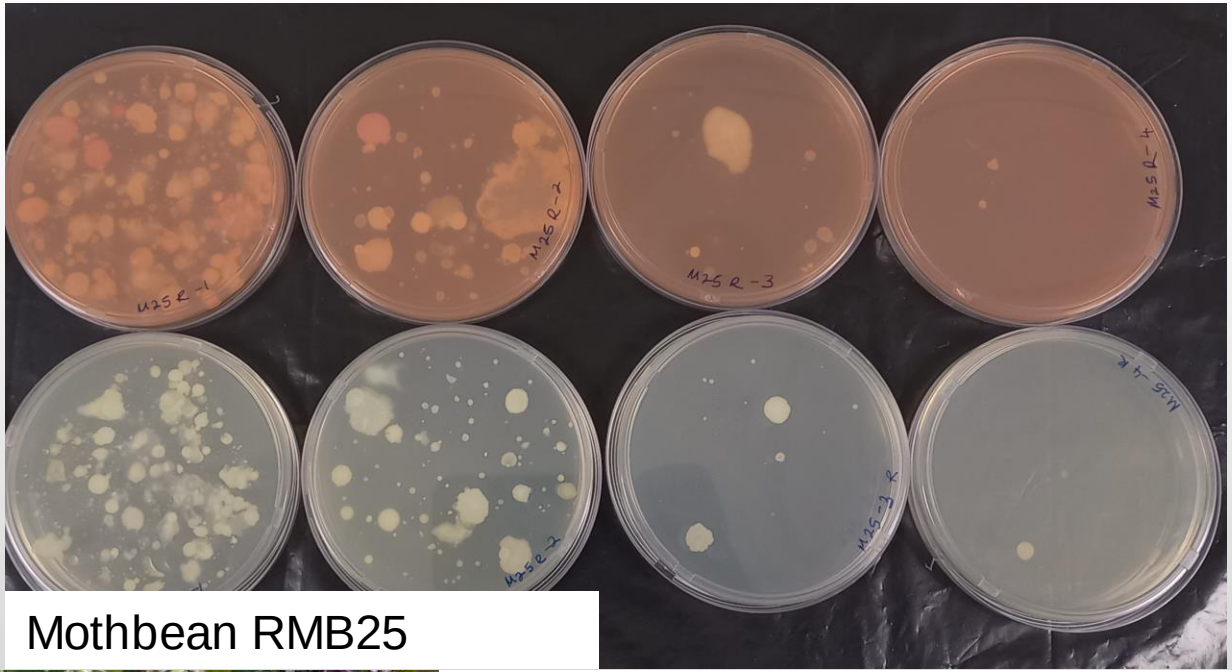
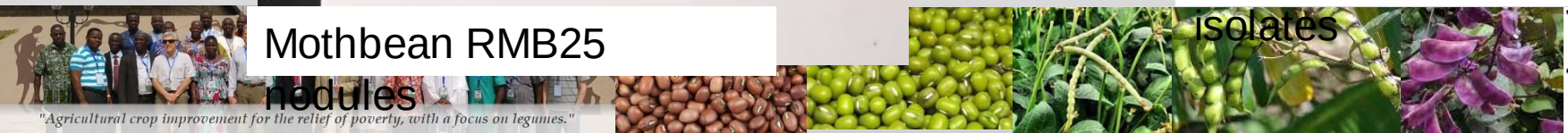
Nodule formation- cont'd

Mothbean RMB25 nodules

Mothbean RMB25 (*V. aconitifolia*)
Average number of nodules/ plant- 5
Nodule size- 1mm-3mm



Mothbean RMB25 isolates



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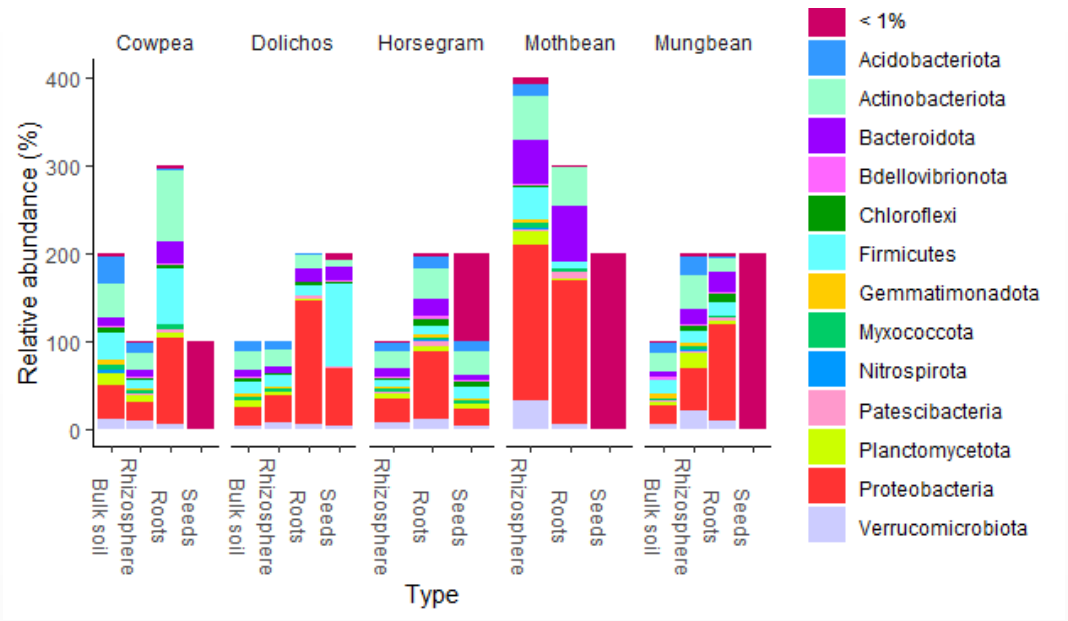

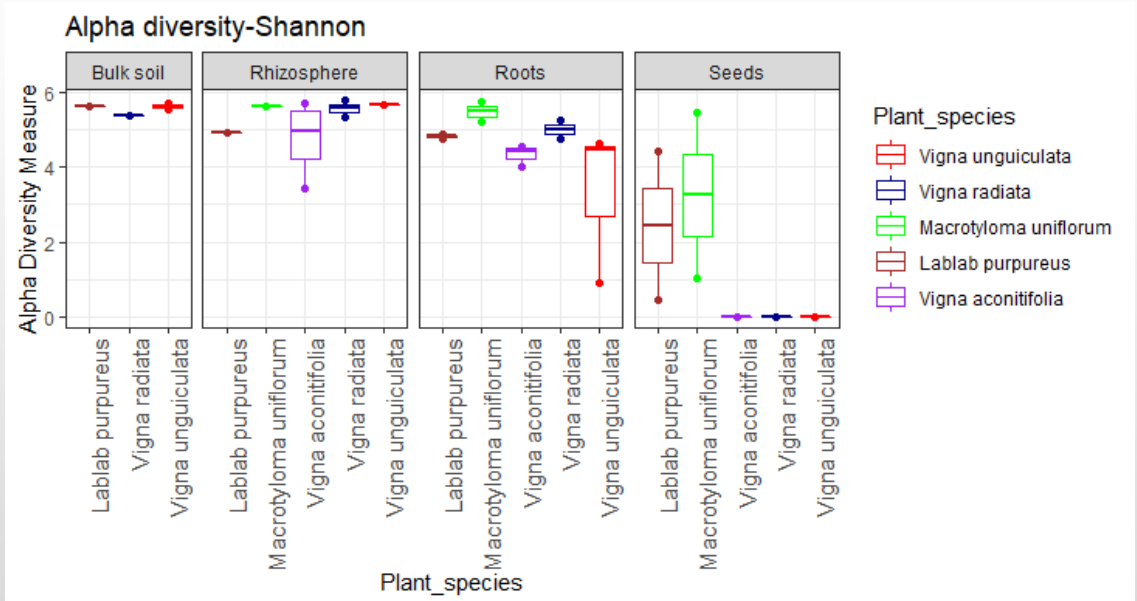

- Diversity was observed to decrease from bulk soil, rhizosphere, roots and seeds.
- Several plant growth promoting genera were identified
  - *Rhizobium*
  - *Bradyrhizobium*
  - *Allorhizobium-Neorhizobium-Pararhizobium-Rhizobium*
  - *Pseudomonas*
  - *Bacillus*.

Published Articles

1. Cullis, C., **Chimwamurombe, P**., Kunert, K., & Vorster, J. (2022). Perspective on the present state and future usefulness of marama bean (Tylosema esculentum). Food and Energy Security, 00, e422. https://doi.org/10.1002/fes3.422
2. Mataranyika PN, **Chimwamurombe PM**, Venturi V and Uzabakiriho JD (2022) Bacterial bioinoculants adapted for sustainable plant health and soil fertility enhancement in Namibia. *Front. Sustain. Food Syst.* 6:1002797. doi: 10.3389/fsufs.2022.1002797.
3. Mukelabai Florence and **Chimwamurombe Percy**. (2023). Sustainable Enhancement of Soil Fertility Using Bioinoculants. In H.A. Mupambwa etal. (eds.),Vermicomposting for Sustainable Food Systems in Africa, Sustainable Agriculture and Food Security, https://doi.org/10.1007/978-981-19-8080-0_15
4. Livia Rasche, **Percy Chimwamurombe**, Annette Eschenbach, Jihye Jeong, Jona Luther-Mosebach, Alex Gröngröft, Barbara Reinhold-Hurek, Abhijit Sarkar, Uwe A. Schneider. 2023. Exploring the benefits of inoculated cowpeas under different climatic conditions in Namibia. *Scientific Reports* **13**, 11761 (2023). https://doi.org/10.1038/s41598-023-38949-2
5. Jean D. Uzabakiriho and **Percy M. Chimwamurombe.** 2023. Phylogenetic Diversity of Endophytic Bacteria Communities from marama bean *Tylosema esculentum* (Burchell.) A. Schreiber. Int. Sci. Technol. J. Namibia 16:65-78.
6. **Percy Chimwamurombe** and Erold Naomab. Domestication of Marama bean in Namibia: Challenges and Opportunities in a Climate Changing agro-ecology (**Manuscript submitted**).




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