

# Stress Tolerant Orphan Legumes (STOL)

## Promoting India-African Framework of Strategic Cooperation

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STOL Coordinator



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**1**

Many important food legumes are grown in arid and semi-arid regions of Africa and Asia, where crop productivity is hampered by biotic and abiotic stresses

**2**

Cultivated in isolated regions - the Indian legume species are not known for their potential in Africa and *vice versa*

**3**

Neglected by researchers and industry due to their limited economic importance in the global market

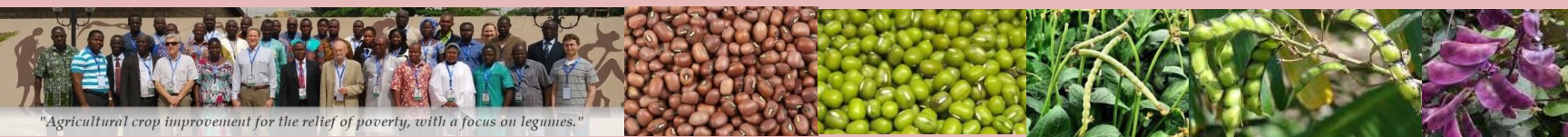
**4**

Greater investment of resources and manpower are necessary if the potential is to be unlocked and applied in the future

**5**

Promoting cultivation of such legumes can play significant role in addressing food and nutrition security in arid region

## **STOL – Programmatic approach**



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# Stress Tolerant Orphan Legumes (STOL)

## Current legume production issues in Africa:

1. Suitability of pulse crops cultivation in the context of climate change (**cowpea**)
2. Lack of diversity among pulses crops – need germplasm introduction
3. Problem for exchange of germplasm exchange
4. Lack of expertise for the cultivation of new introduced crops

## Suggested approach:

1. Assessment of existing germplasm collections and their accessibility
2. Adaptation trials and seed multiplication
3. Capacity building of farmers, extension workers and researchers

## STOL focus:

To promote pulse crops that are heat and drought tolerant – to provide a resilient response to a changing climate in India and Africa.



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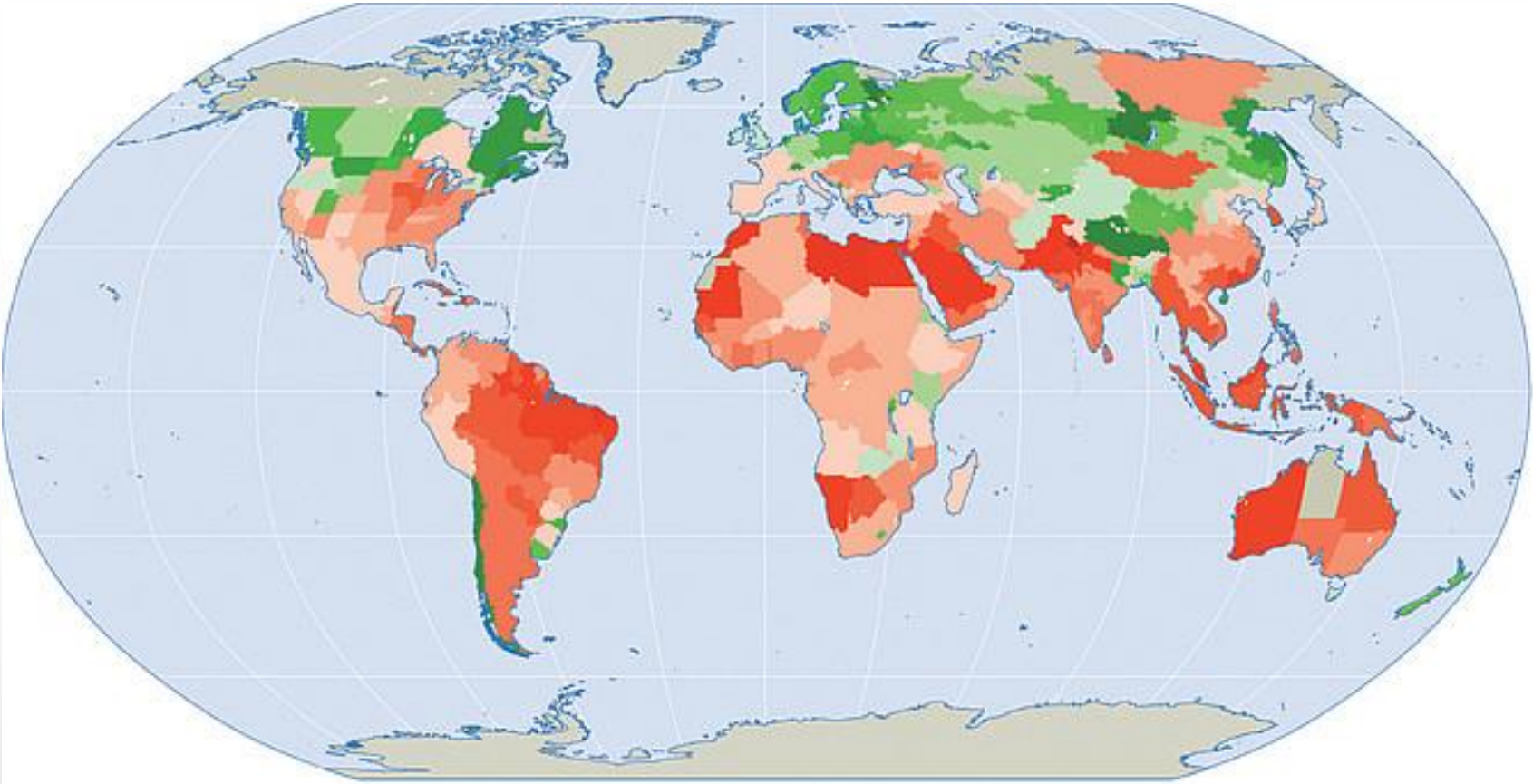


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# Impact of climate change on potential agricultural yields by 2050

Red areas indicate negative impacts and green indicate gains



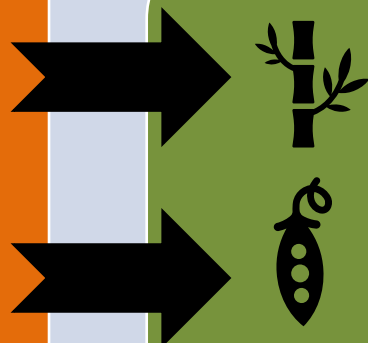
Percentage change in yields between 2010 and 2050



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## With CC

Farmers need to make their crops and cropping systems adapt to new conditions, quicker than ever before



New Varieties  
Shift in crops  
Changes in  
food habit

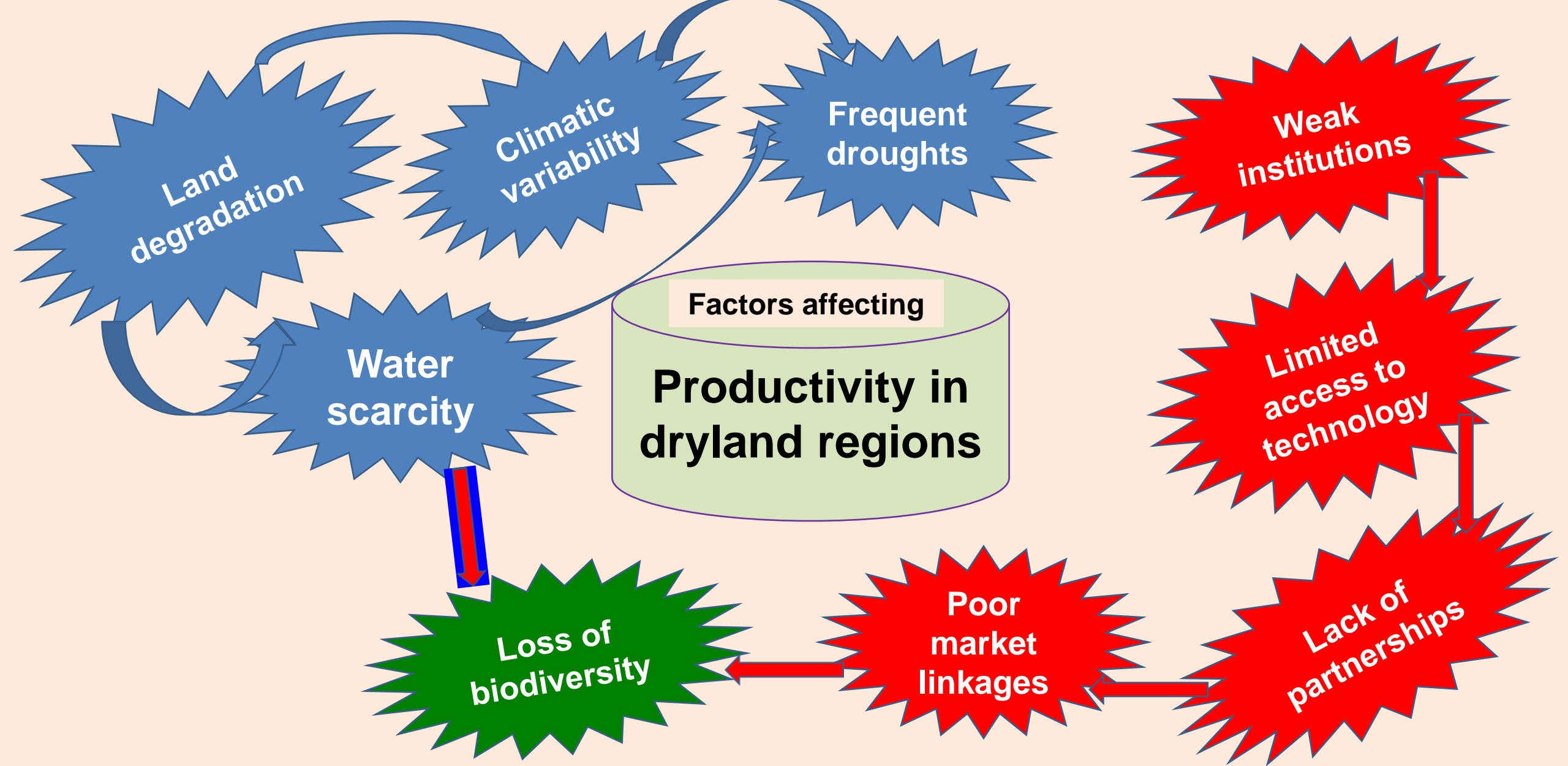


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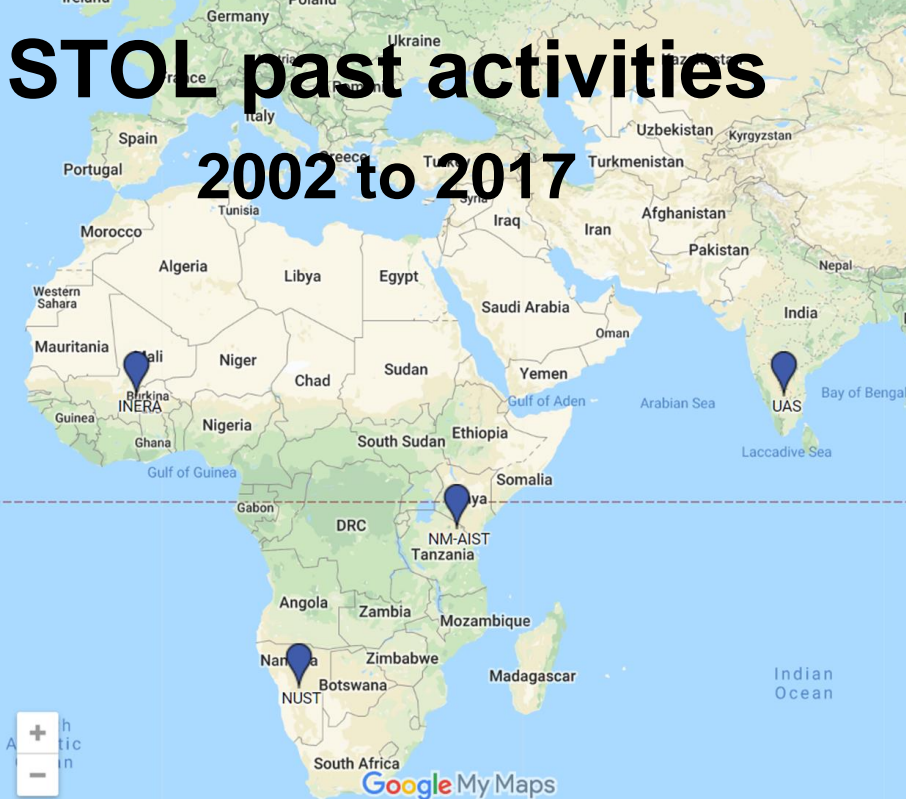
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# STOL past activities

## 2002 to 2017



- Support to improve legume crops using conventional breeding, enhanced by modern molecular techniques.

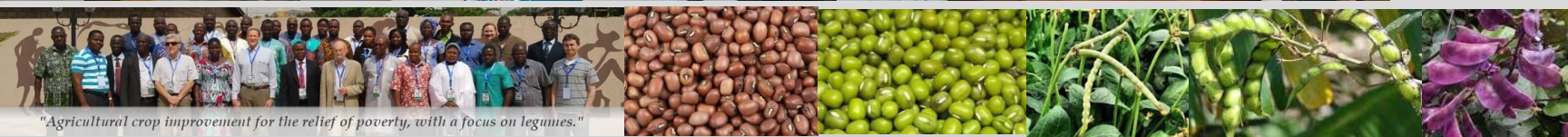
- ✓ India: lablab bean – 650 germplasm, converting photoperiod sensitive to incentive varieties
- ✓ West Africa: Cowpea
- ✓ Namibia: Marama



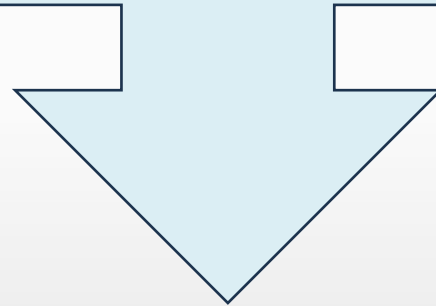
- Establish laboratories and train scientists to enable them to use molecular markers in their breeding work.



- Most of those studies have looked at the **crops individually**; little has been done comparing their response to stress conditions **under various agro-climatic conditions** located across sub-Saharan Africa and India.



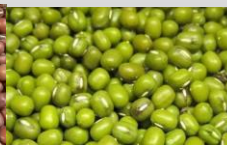
- KT partners suggested a more coordinated approach, where the germplasm of different pulse crops can be exchanged between African countries and India.
- Followed by testing under different agroclimatic conditions and release of varieties by national system



**Need to identify crops, partners and protocol for setting up STOL Network for coordinated activities and outputs.**



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# Strengthen STOL Activities:

1. Mung bean (*Vigna radiata*)
2. Moth bean (*Vigna aconitifolia*)
3. Horsegram (*Macrotyloma uniflorum*)
4. Dolichos (*Lablab purpureus*)
5. Cowpea (*Vigna unguiculata*)
6. Marama bean (*Tylosema esculentum*)
7. Bambara groundnut (*Vigna subterranean*)
8. Tepary bean (*Phaseolus acutifolius*)

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9. Pigeonpea (*Cajanus cajan*)
  10. Rice bean (*Vigna umbellata*)
  11. Lima bean (*Phaseolus lunatus*)
  12. Adzuki bean (*Vigna angularis*)



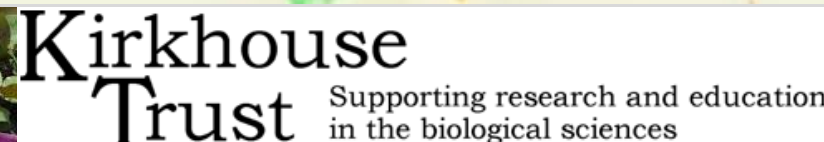
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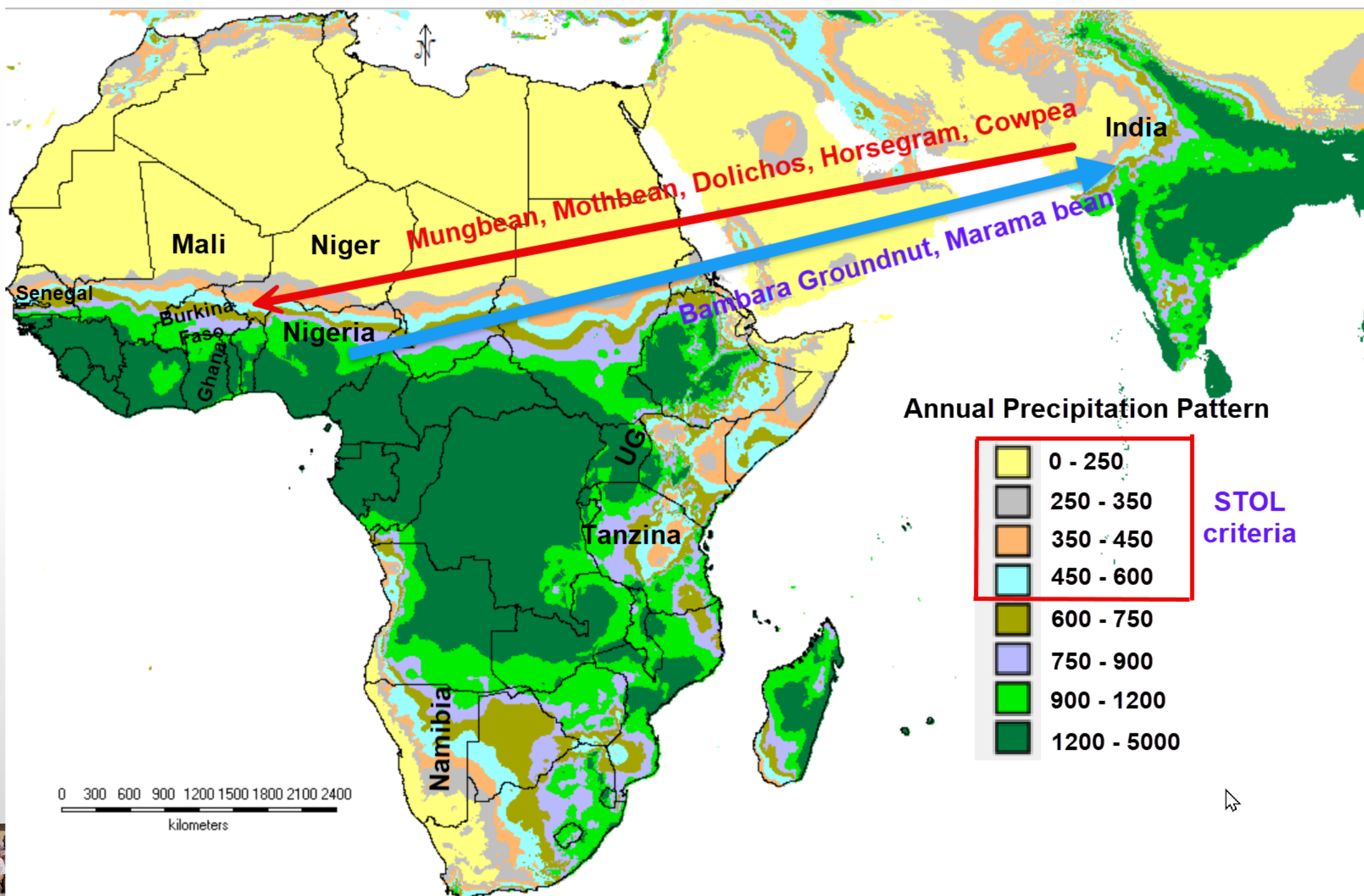


# Strengthen STOL Activities:

ICAR-NBPGR-KT MoU was signed on May 2018 to April 2023 & extended until May 2025.

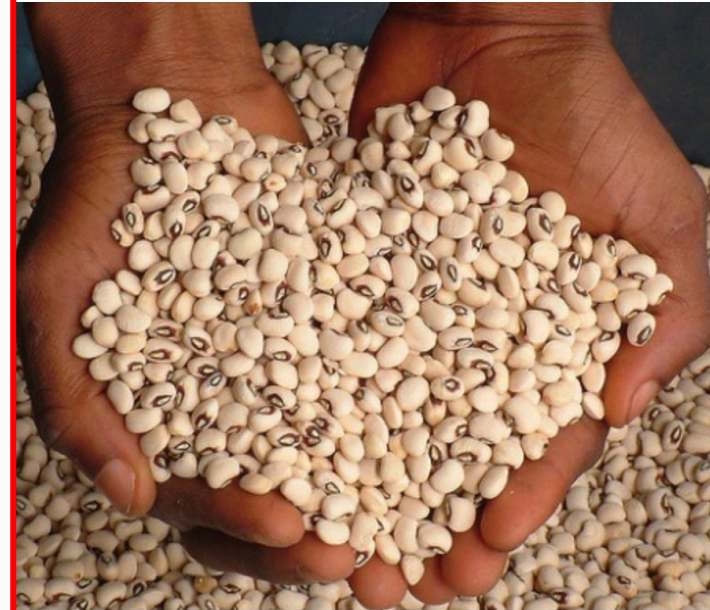
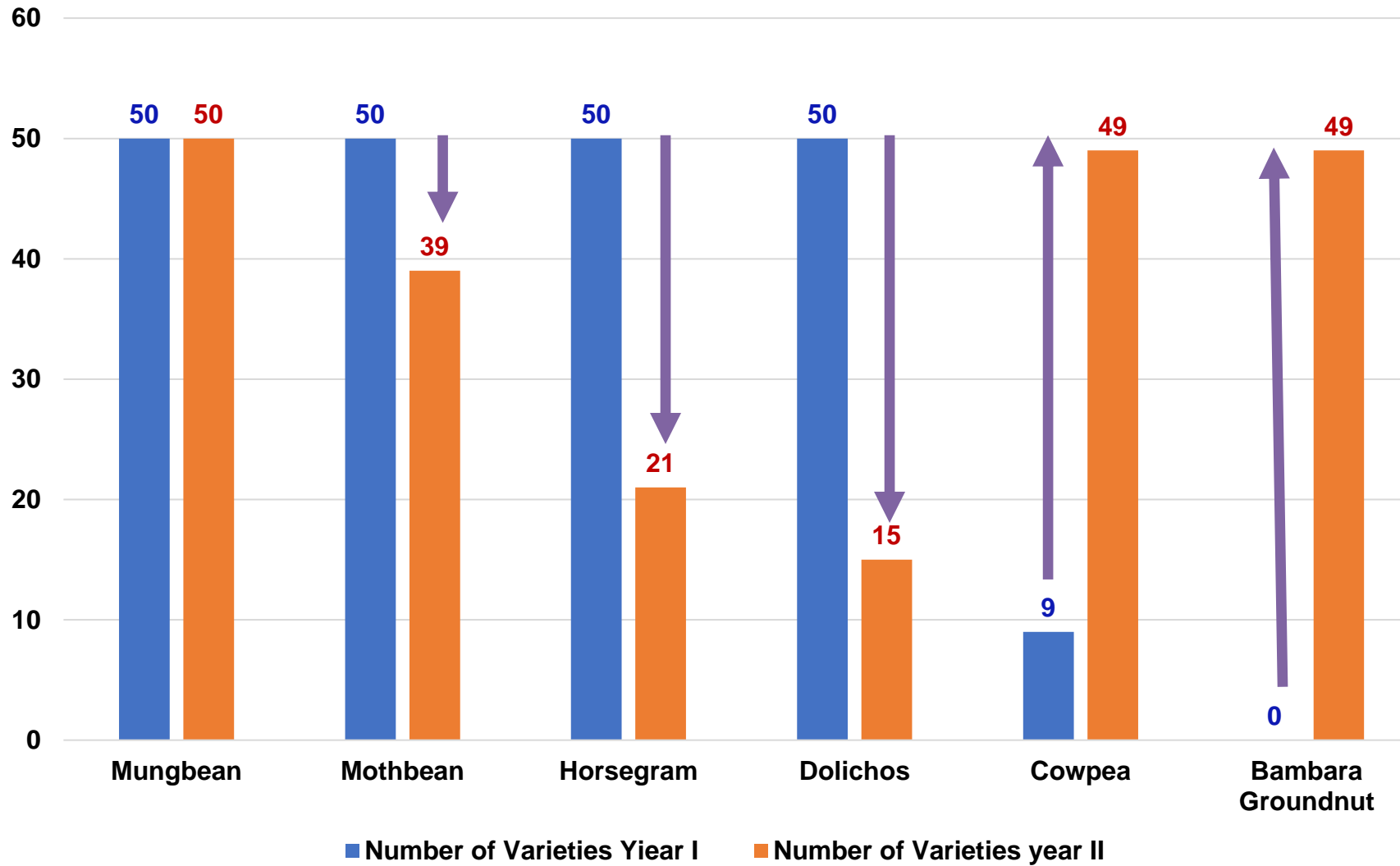
- Establish collaboration between institutes in India and Africa under the India-Africa Framework for Strategic Cooperation.
- Project activities are aligned within agreed India-Africa Forum Summit:
  - Improving farming techniques through appropriate and affordable technology, organic farming, **improving crop varieties, seeds**, efficient use of fertilizers and other measures;
  - Priority to **food production** and improving levels of **nutrition** to increase the **resilience of local and traditional food systems** and **biodiversity**;
  - Initiatives to diversify their economies to expand climate sensitive sectors and to **promote adaptation measures** that are capable of increasing resilience within the sector.





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# Evaluation of STOL Crops



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# Farmers Field Day

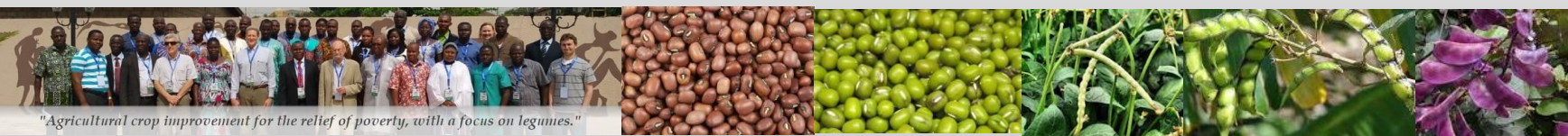


**Impressed with the introduction of new STOL crops**



# Farmers' Choices over Cowpea

- 1. Mungbean:** Preferred across all countries due to early maturity, high seed and fodder yield, many harvesting cycles, ease of harvesting, suitable for mixed farming
- 2. Mothbean:** Early maturity, high seed yield, extreme drought resistance, good soil coverage and as fodder crop
- 3. Horsegram:** Early maturity, high fodder yield, suitable for mixed farming
- 4. Dolichos:** Bold seed size, erect plant type and large leaves for high fodder production
- 5. Bambara Groundnut:** High seed and fodder yield, large seed size



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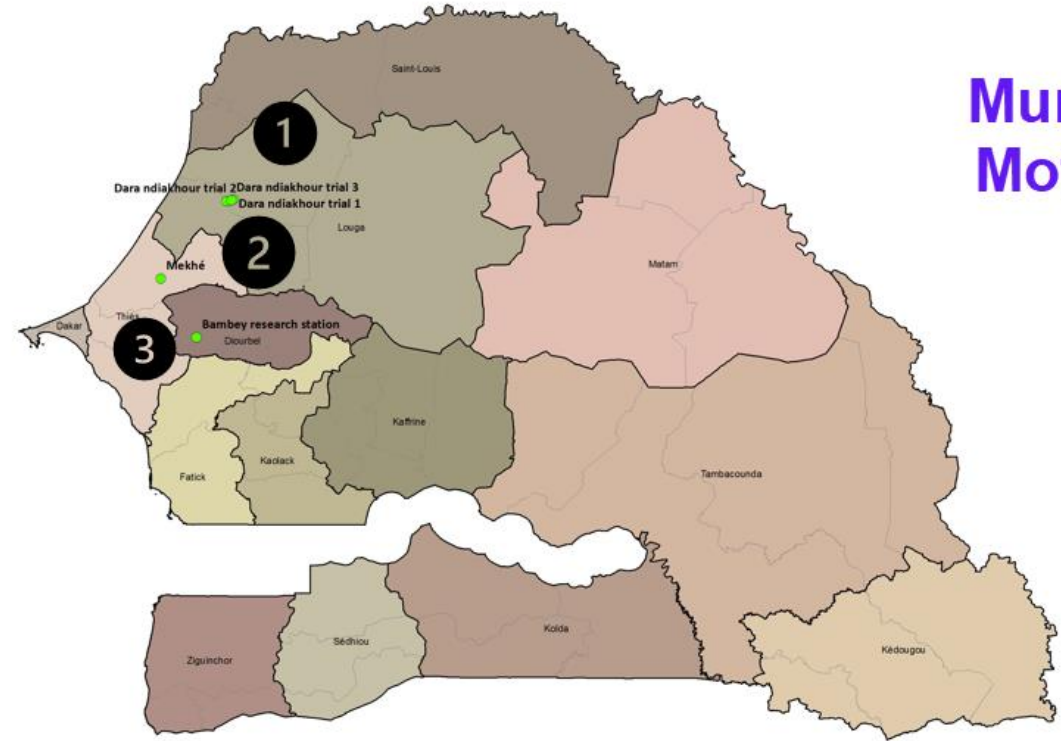
# Current Activities - Africa

Mungbean  
Dolichos



Burkina Faso

Mungbean  
Mothbean



Senegal

- Verities release trials as per national protocols
- Varieties release recommendations
- Seed multiplication



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# Marama bean germplasm collecting and exchange



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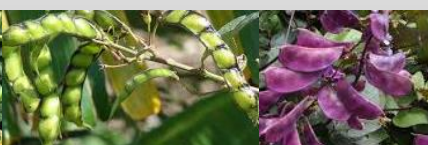
# Current Activities - India

## Agriculture University, Jodhpur:

- Evaluation and documentation of germplasm of mungbean, mothbean, horsegram, cowpea, Dolichos
- **AVRDC mungbean germplasm evaluation**
- Seed increase and medium-term conservation
- Farmers' field demonstration and capacity building for seed production
- **Marama bean field evaluation for its suitability in western Rajasthan**



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## Marama bean plantation at ARS Jalore



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# Current Activities - India

## Bambara groundnut germplasm evaluation at NBPGR RS Hyderabad.

- 59 accessions from 6 countries evaluated during 2023
- Under seed multiplication and second year evaluation



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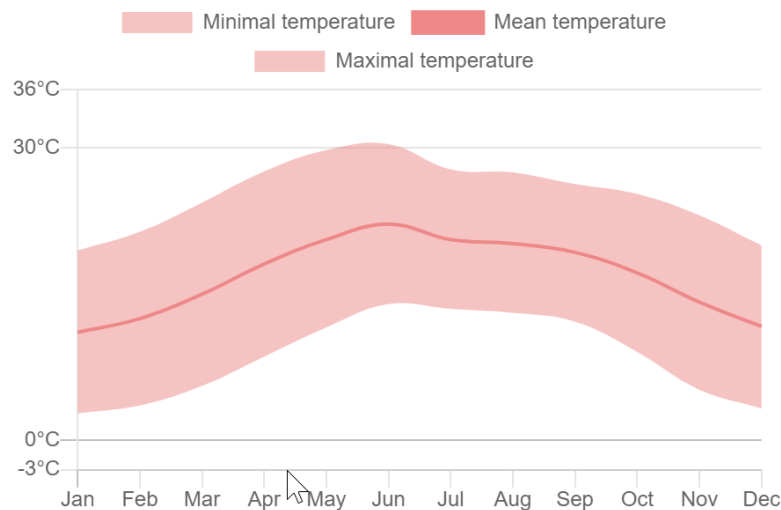
# Tepary bean (*Phaseolus acutifolius*)

1,453 accessions

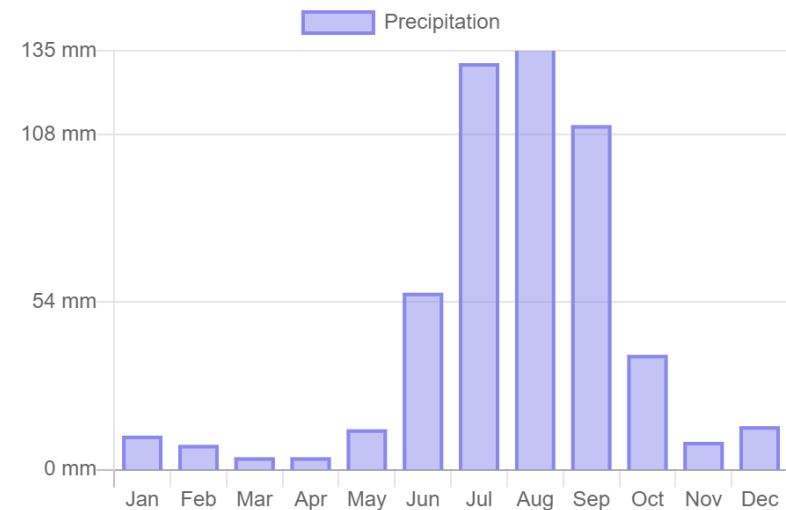
<b>USA</b>	534	<b>Belgium</b>	61
<b>Colombia</b>	326	<b>Russia</b>	56
<b>Ethiopia</b>	125	<b>Ukraine</b>	52
<b>Australia</b>	105	<b>Bulgaria</b>	31
<b>Brazil</b>	97	<b>Germany</b>	26

## Climate at origin

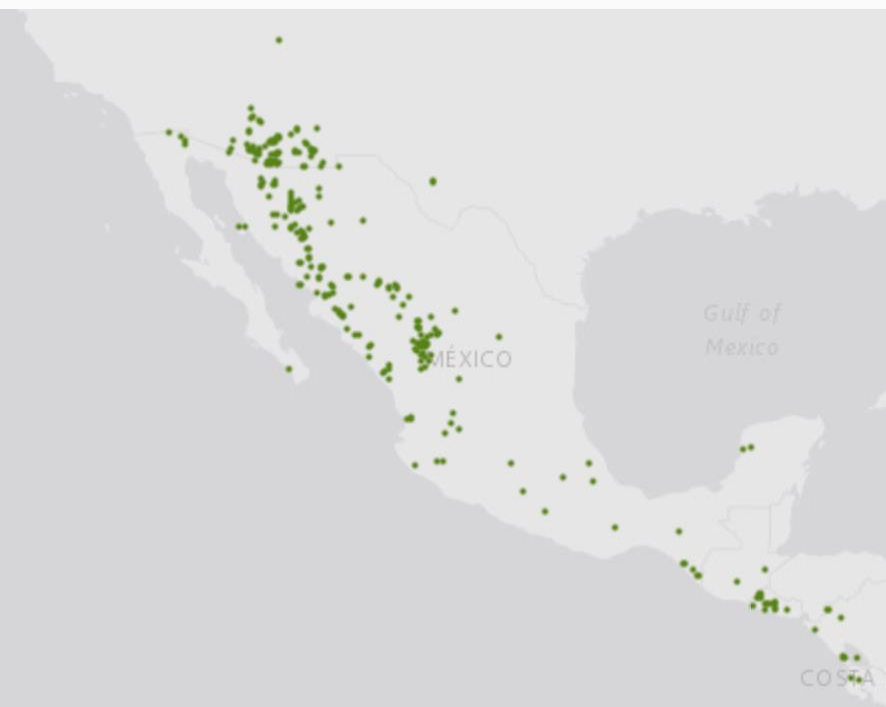
### Monthly temperature



### Monthly precipitation



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Minimum temperature [°C]	2.8	3.6	5.6	8.6	11.6	14	13.5	13.1	12.2	9.1	5.2	3.3
Mean temperature [°C]	11.1	12.5	15	18.1	20.6	22.2	20.6	20.2	19.3	17.2	14.2	11.7
Maximum temperature [°C]	19.5	21.4	24.4	27.6	29.8	30.4	27.8	27.5	26.3	25.3	23.1	20



# Current Activities - India

## Introduction and evaluation of Tepary bean germplasm:

- 17 accessions of Tepary bean (*Phaseolus acutifolius*) imported from University of California, Department of Plant Sciences, USA
- 10 accessions from Burkina Faso
- Not suitable for rainy season but may be suitable for post-rainy season
- Seed variation was observed

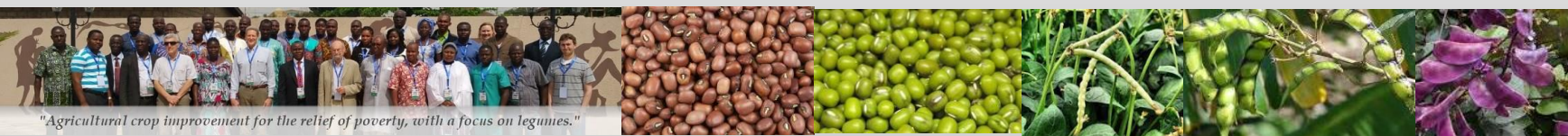
## Cowpea:

- Trait Specific Cowpea Germplasm (45) Supplied by NBPGR to Namibia
- Under seed increase and preliminary evaluation at Mannheim Crop Research Station, Namibia



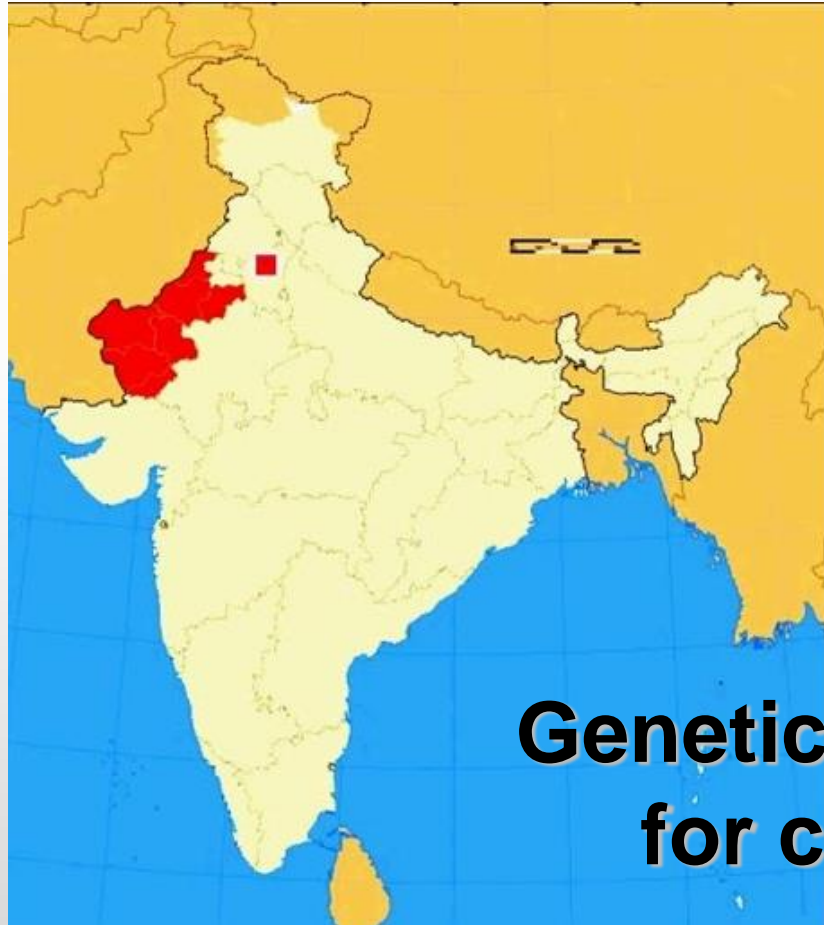
# Way Forward:-

- STOL crops improvement programme will be initiated
- Bambara groundnut has been identified to start with - Bambara breeding Initiative (BBI) - way forward
- It is proposed to introduce a set of diverse collections mainly from IITA and other African countries and Malaysia
- India take the lead for seed increase and distribution to STOL partners for field evaluation under different agroclimatic conditions.
- Suggest to extend the existing MoU between DARE/ICAR and KT for a period of 5 years

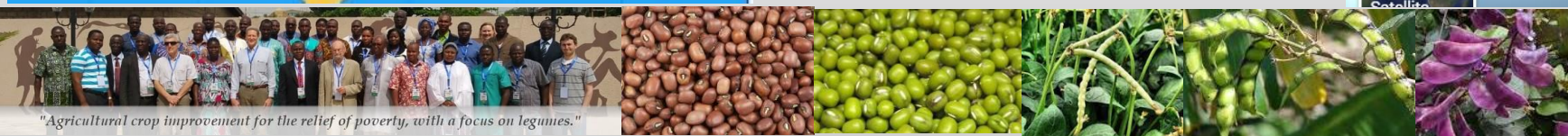


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# THANKS



**Genetic and species diversity is key  
for climate change adaptation**



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