

BREEDING CLONES FOR NON TRADITIONAL AREAS

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Natural Rubber

- **Family** : *Euphorbiaceae*
- **Genus** : *Hevea*
- **Species** : *H.brasiliensis*, *H.pauciflora*,
H.camargoana, *H.nitida*, *H. spruceana*,
H.rigidifolia, *H.benthamiana*,
H.guianensis, *H.microphylla*,
H.camporum

GENUS *HEVEA*



- Natural distribution of *Hevea brasiliensis*
- Region of origin of genus *Hevea*

- Grows wild in the Amazon basin in Brazil as the center of diversity
- Different species prefer varying habitats
- Also growing naturally in the neighbouring countries such as Bolivia, Colombia, Ecuador, French Guiana, Guyana, Peru, Surinam and Venezuela.

Hevea Brasiliensis

RRIM 2001

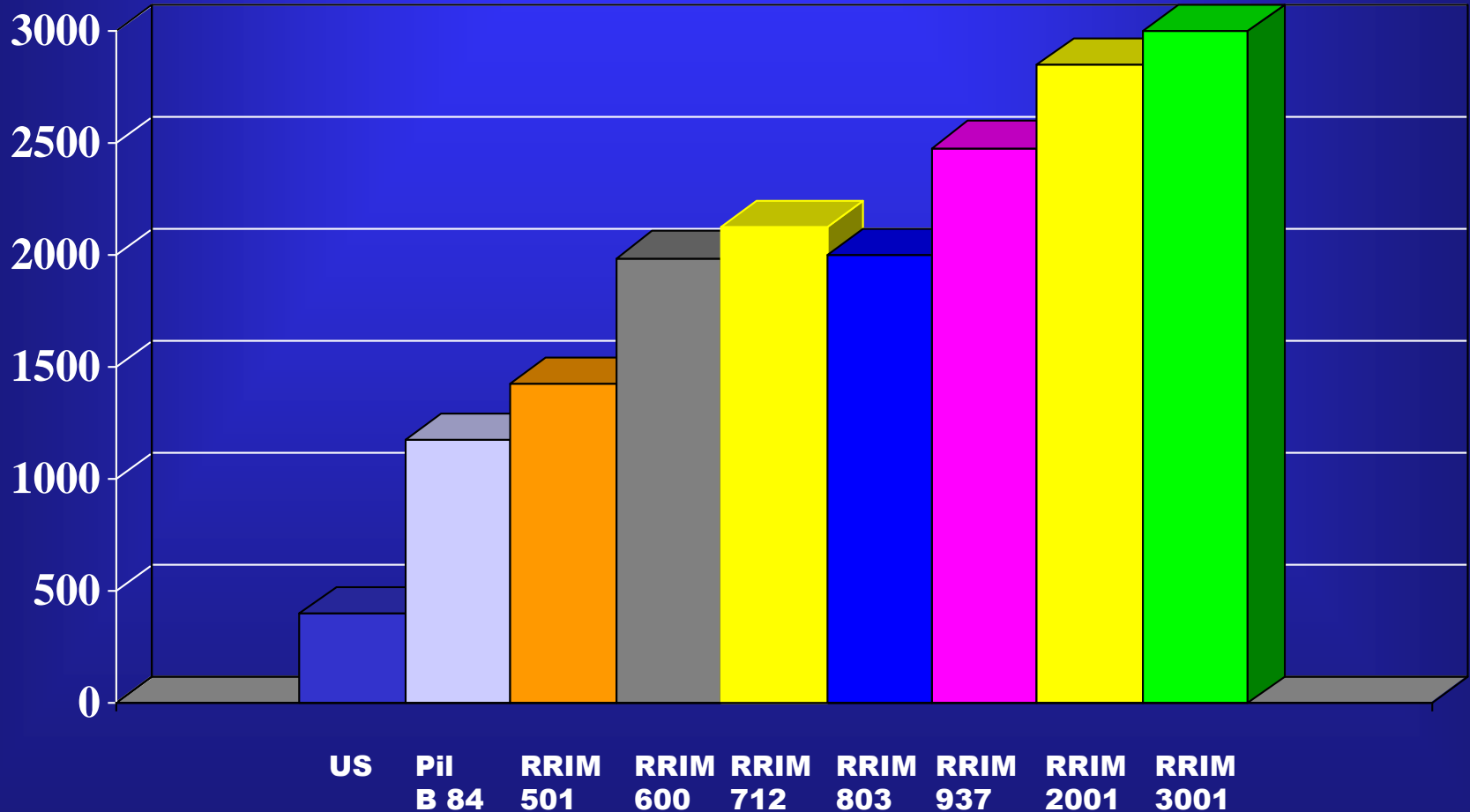


The Environment in Amazon



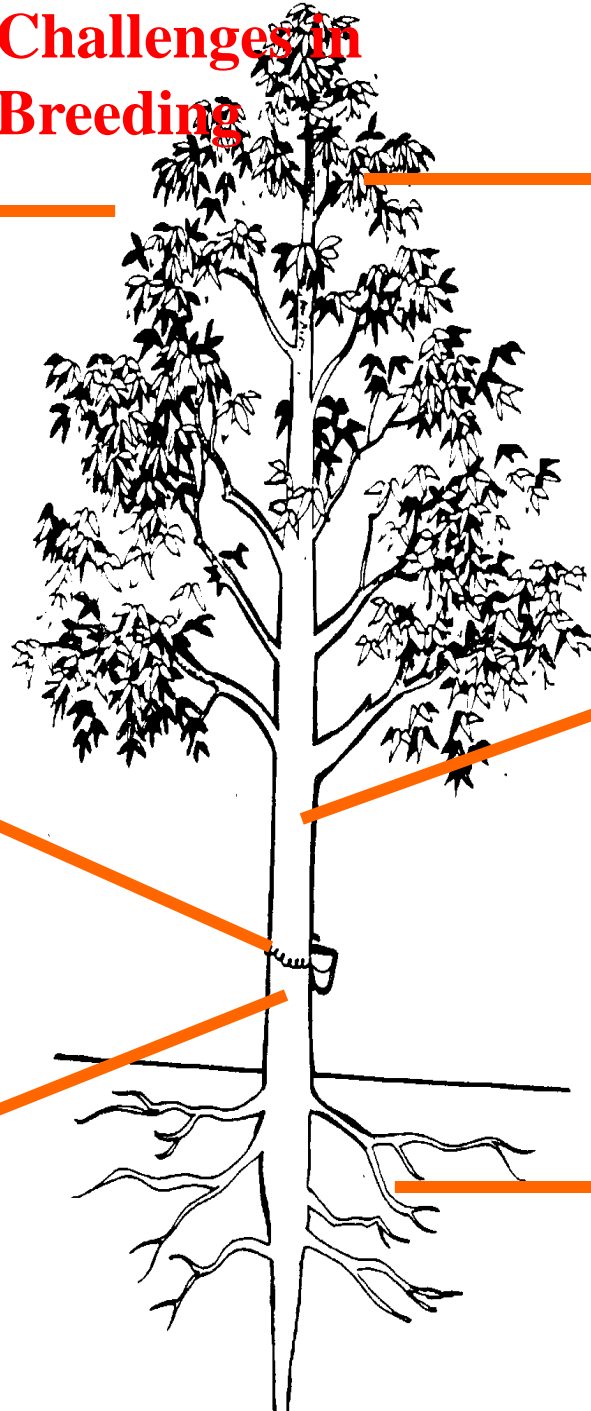
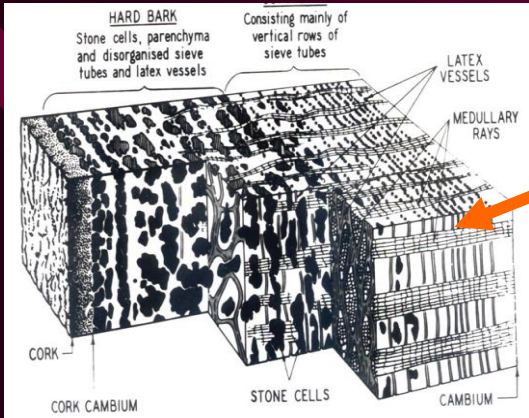
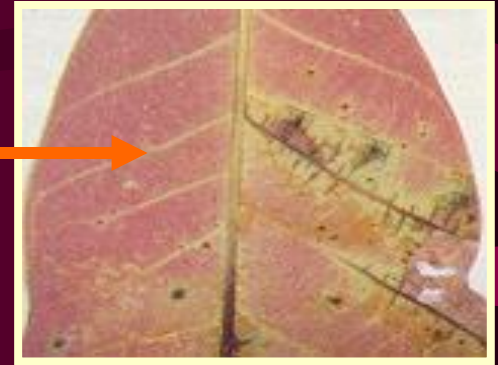
- Flat land, between Equator and 15° S
- Altitudes not exceeding 200m
- Wet equatorial climate 25-28 °C
- Abundant rainfall >2000 mm/yr

Increase In Latex Yield Through Breeding



The increase in latex yield from 400 kg/ha/yr by the unselected seedling to 3000 kg/ha/yr by RRIM 3001 indicated the tremendous success of the RRIM rubber breeding programme

Challenges in Breeding



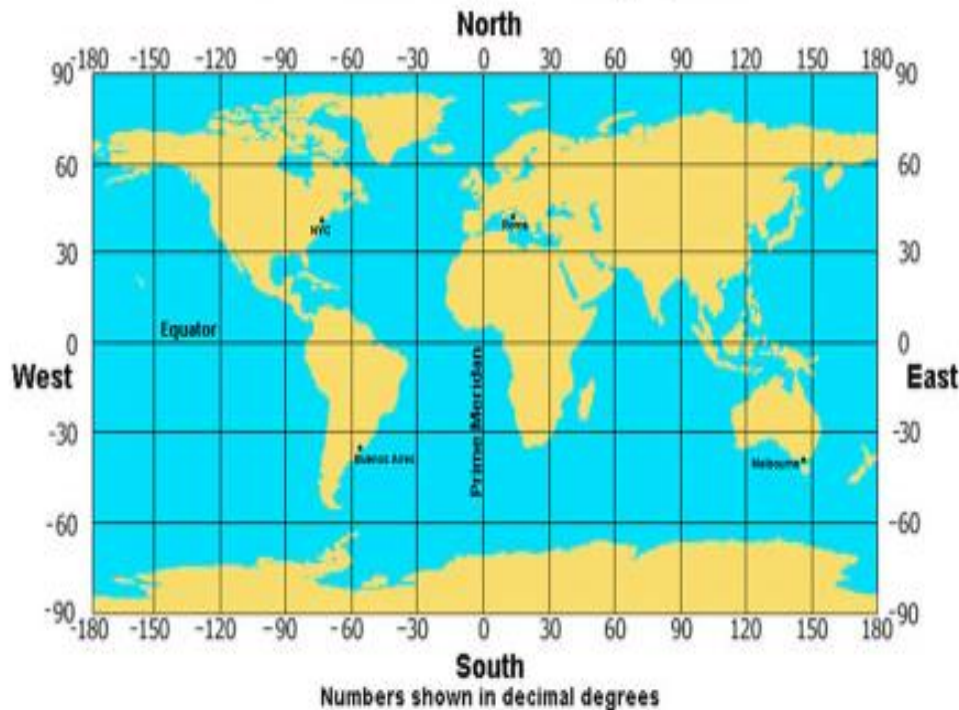
Hevea Breeding Objectives

- High latex yield
- High timber yield
- Good growth vigour
- Resistant to major leaf diseases
- Resistant to wind damage
- Good girth increment on tapping
- Good bark thickness
- Tolerance to tree dryness
- Acceptable latex and rubber properties
- Response to chemical stimulation
- Good seeder (optional)



TRADITIONAL RUBBER AREAS

Latitude and Longitude Coordinates of the Globe
in standard flat-map (Mercator) projection

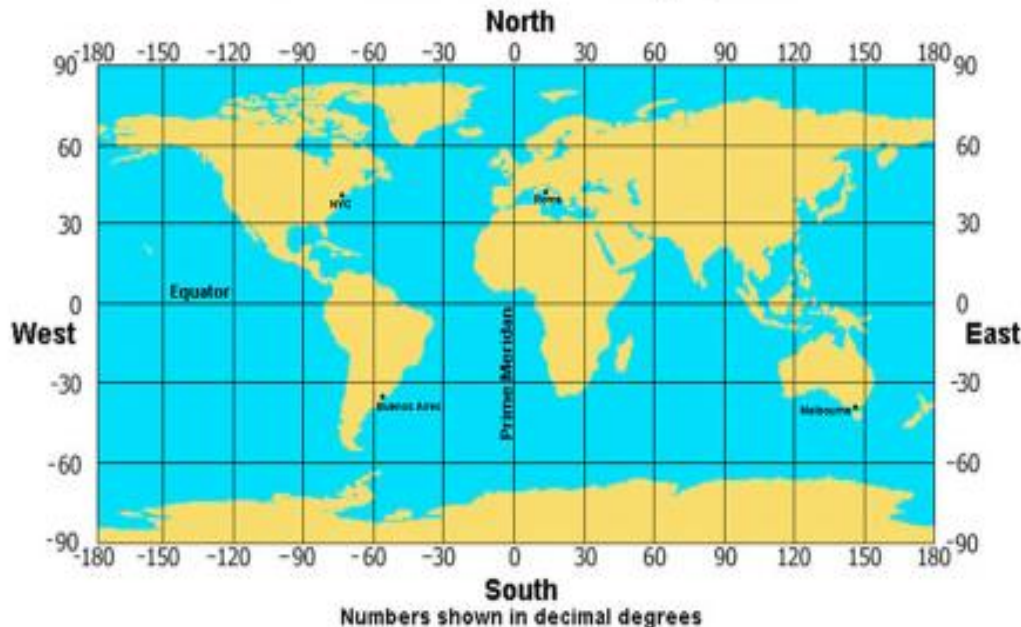


- *Latitude 10° N or S of equator*
- *Rainfall 2000 - 4000 mm*
- *Mean annual temperature 28°C \mp 2°C*
- *Daytime 12 hrs ,regardless of season.*

NON TRADITIONAL RUBBER AREAS

(latitude $>10^{\circ}$ N or S of Equator) :
--sub optimal environments

Latitude and Longitude Coordinates of the Globe
in standard flat-map (*Mercator*) projection



- *Drought*
- *Low temperature*
- *High altitude*
- *Disease*
- *Strong winds*

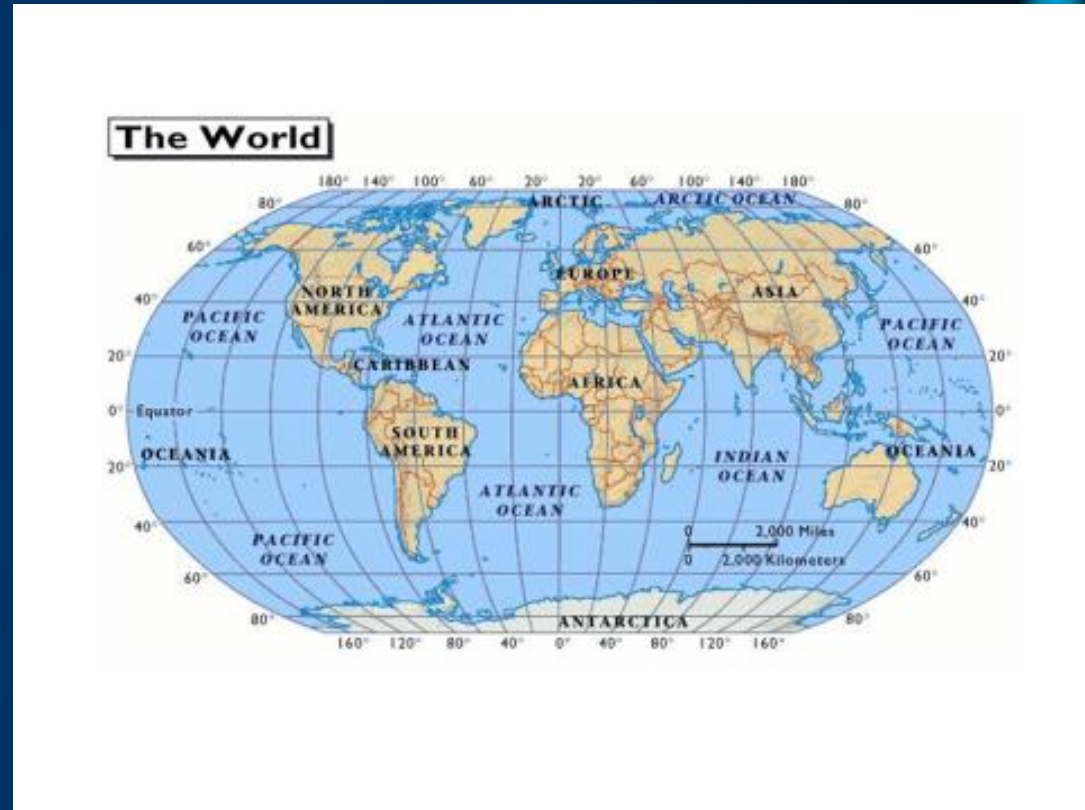
Non Traditional Areas

18° - 24°N

- India North East
- Vietnam Highlands & Coastal
- South China
- Thailand North East
- Bangladesh

20° - 22° S

- Brazil Southern Plateau , Sao Paulo





Rubber is Robust and Versatile

Narrowness of *Hevea* Genetic Base

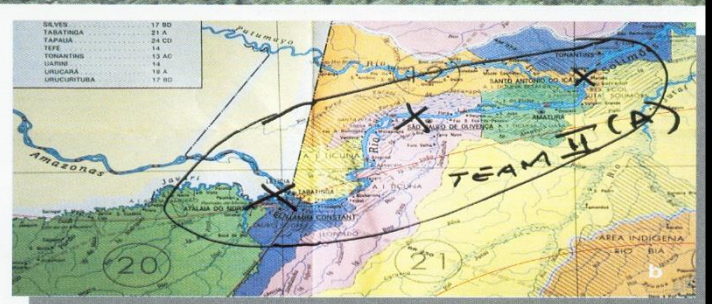
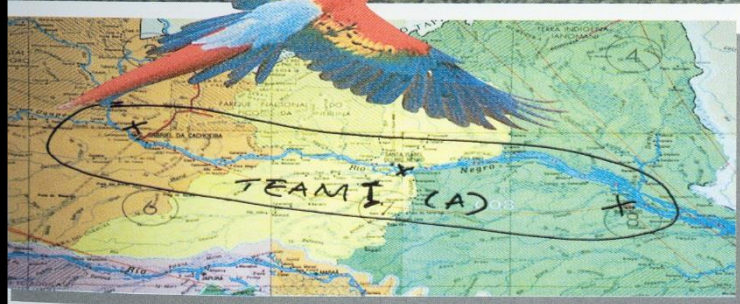
- A major obstacle towards improving the rubber yield and other important character
- Widely discussed by plant breeders at various forums both national and international



The Amazon is the natural habitat of the rubber tree (a). Rubber seeds float in water, and are dispersed by rivers and flood water.

Researchers cover large areas on the ground looking for wild *Hevea* in the rubber seed collection expeditions (b).

a



IRRDB 1981 EXPEDITION

AREAS OF COLLECTION - 1981



Boim

Acre

Rondonia

Mato Grosso



Germplasm 1981

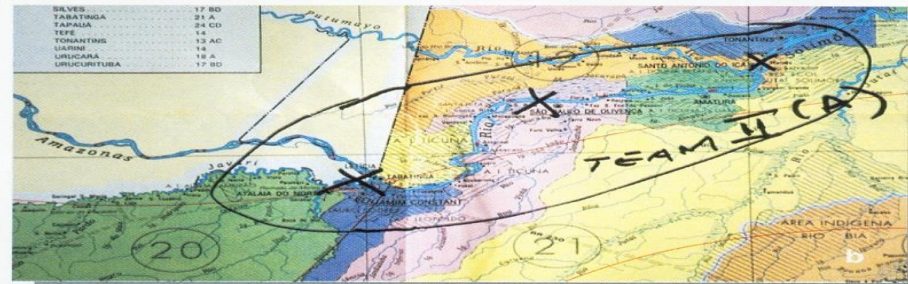
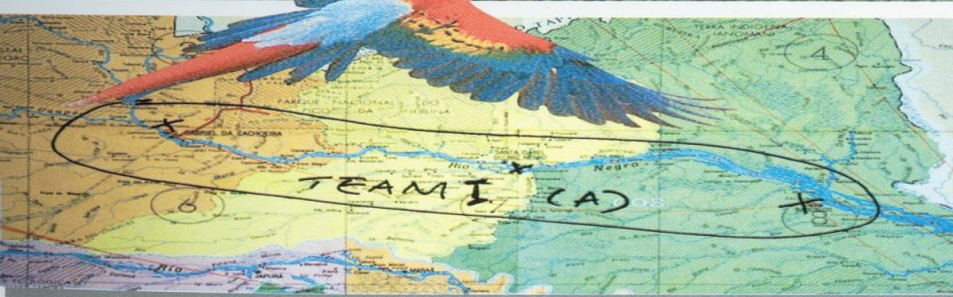




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RRIM 1995 EXPEDITION TO THE AMAZON

AREAS OF COLLECTION - 1995



Tabatinga

- Rio Solimoes

Benjamin Constant

- Rio Solimoes, Feijoa, Capacete, Guanabara

Atalaia do Norte

- Rio Javari, Rio Itaquai, Santa Cruz, Paumari, Contra Banco

Sao Paulo do Olivencia

- Rio Solimoes, Camatian, Santa Rita do Weil, Santa Clara, Santa Rose, Parana Parao, Campo Alegre, Boa Esperansa, Porto Novo



The 1995 *Hevea* Germplasm





IRRDB NEW EXPEDITION: PERU



Objective

To collect seeds of various *Hevea* species from the Amazon of PERU with the purpose of increasing the *Hevea* genetic pool in the IRRDB member countries...Towards Enhancing *Hevea* Genetic Improvement

Justification for Expedition

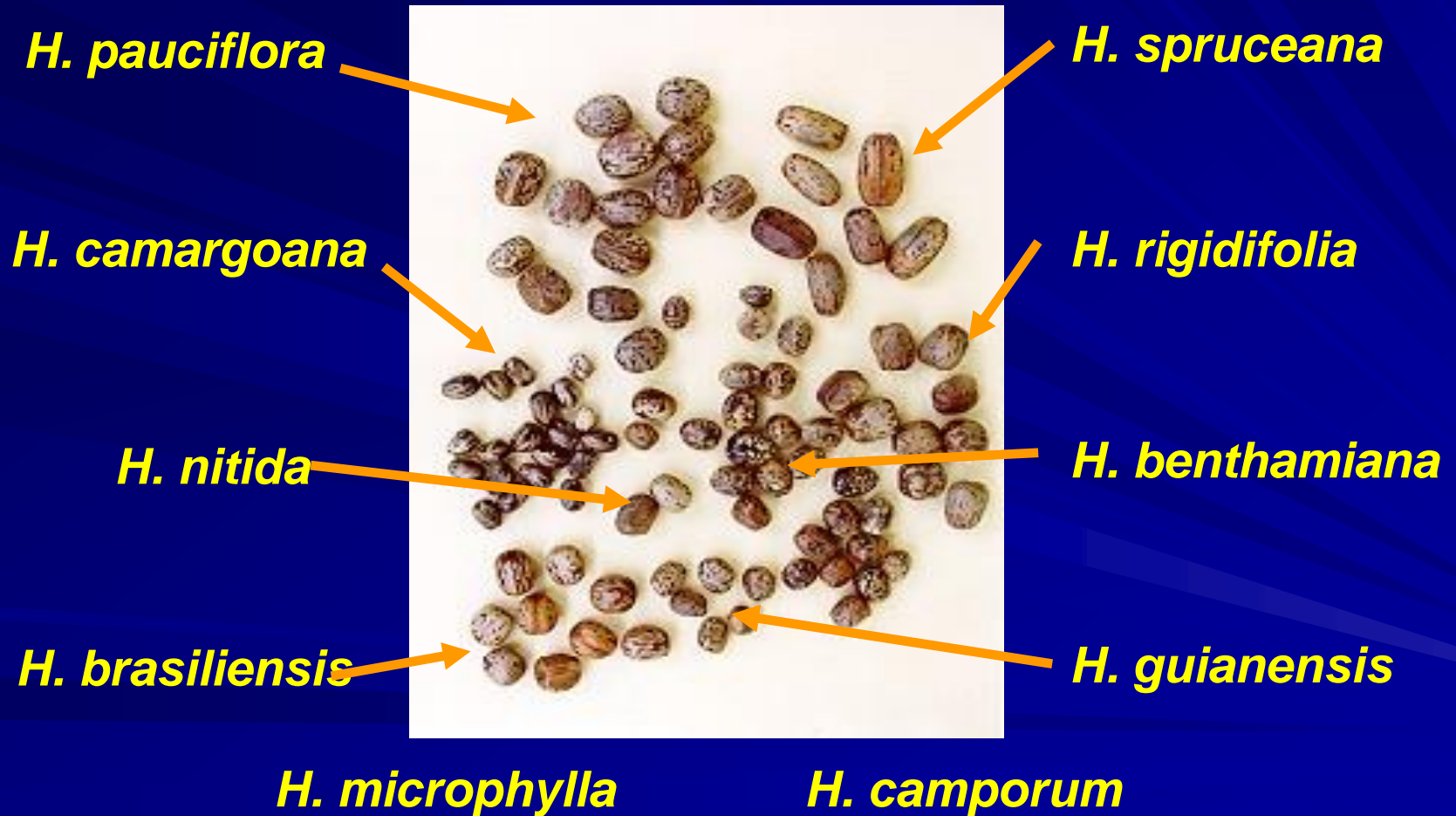
- Further progress in *Hevea* breeding for better yields for both latex and timber can be achieved through the widening of the narrow genetic base of the crop.
- There is evidence that genes for disease resistance and other desirable traits such as tolerance to low temperature maybe found in the *Hevea* species in Peru.
- Advances in biotechnological research has opened up opportunities for plant breeders to shorten the time to produce cultivars with desirable traits.



Areas of Prospection in Peru

- The quadrangle bounded by Iquitos, Lecitia and Rio Putumayo
- Madre de Dios around Puerto Maldonado
- San Guan de Oro near the border of Bolivia
- North of Pucallpa along Rio Ucayali
- Tocache Nuevo are which is situated on the North-West of Tingo Maria
- San Ramon and Puerto Bermudez which is South of Tingo Maria
- The area west of Rio Yurimaguas

Hevea Species



Utilization

- **Direct Use**
- **Hybridization**
 - $G \times W$, $W \times G$, BX
- **Widening the Genetic Base**

IRRDB Multilateral Clone Exchange

- 49 clones, 15 countries
- a way forward to meet the industry needs for vigorous high yielding clones which are resistant to diseases and suited for cultivation in varying climatic conditions including those found in marginal areas.



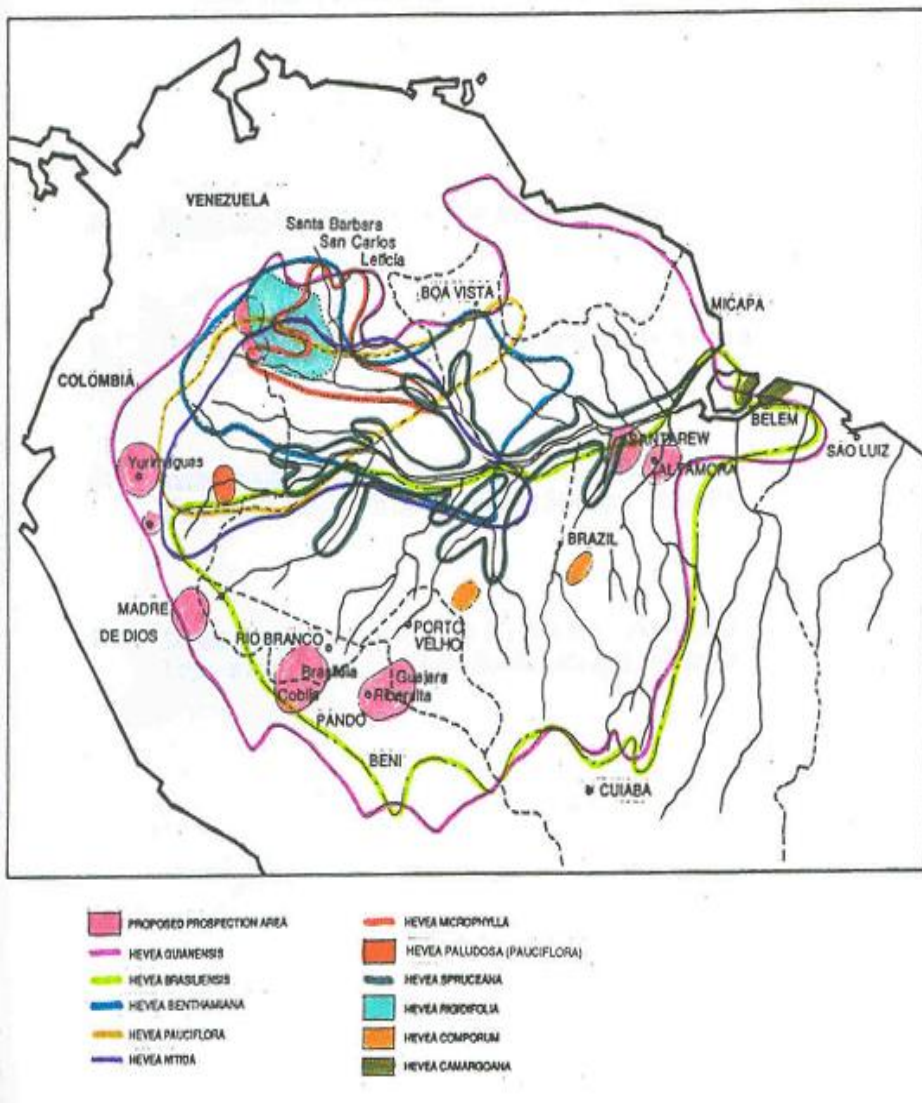
Terima Kasih
Thank You

Oldest Rubber Tree in Malaysia Planted in 1877 in Kuala Kangsar



MAP 1

MAP OF SOUTH AMERICA SHOWING THE CENTRE OF DIVERSITY FOR HEVEA



Species Distribution

- *H. brasiliensis* – South of Amazon river (Brazil, Bolivia, Ecuador & Peru) and some parts of northern region of the Amazon River, west of Manaus and small area south of Colombia.
- *H. guianensis* – throughout the geographical range of the genus (Brazil, Venezuela, Bolivia, French Guiana, Peru, Colombia, Surinam & Ecuador)
- *H. pauciflora* – north and north west of Amazon river (Brazil, Guianas & Peru)
- *H. nitida* – between rivers of Uaupes & Icana, tributaries of the upper Negro river (Brazil, Peru & Colombia)
- *H. rigidifolia* – among Negro river and its affluents, Vaupes and Icana rivers (Brazil, Colombia & Venezuela)
- *H. spruceana* – banks of the Amazon river, start at confluence with Rio Putumayo (borders of Colombia & Peru) and extend eastward to sea coast
- *H. camargoana* – restricted to Marajo island of the Amazon river delta (Brazil)
- *H. camporum* – south of Amazon between Marmeloos and Manicore rivers, tributaries of Madeira river (Brazil)
- *H. microphylla* – middle and upper reaches of Rio Negro (Venezuela)