Genetic resources in/and plant breeding

-8 September 2009 Anke van den Hurk-

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- Genetic resources in the plant breeding process
  - Use
  - Maintenance
  - Availability
- Consequences of the CBD and IT PGRFA
- Conclusions

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Plant breeding (definitions)

- **Plant breeding** is the art and science of changing the genetics of plants for the benefit of humankind

- **Plant breeding** is the use of techniques involving crossing plants to produce varieties with particular characteristics (traits), which are carried in the genes of the plants and passed on to future plant generations.

- **Plant breeding** is the purposeful manipulation of plant species in order to create desired genotypes and phenotypes for specific purposes, such as food production, forestry, and horticulture.

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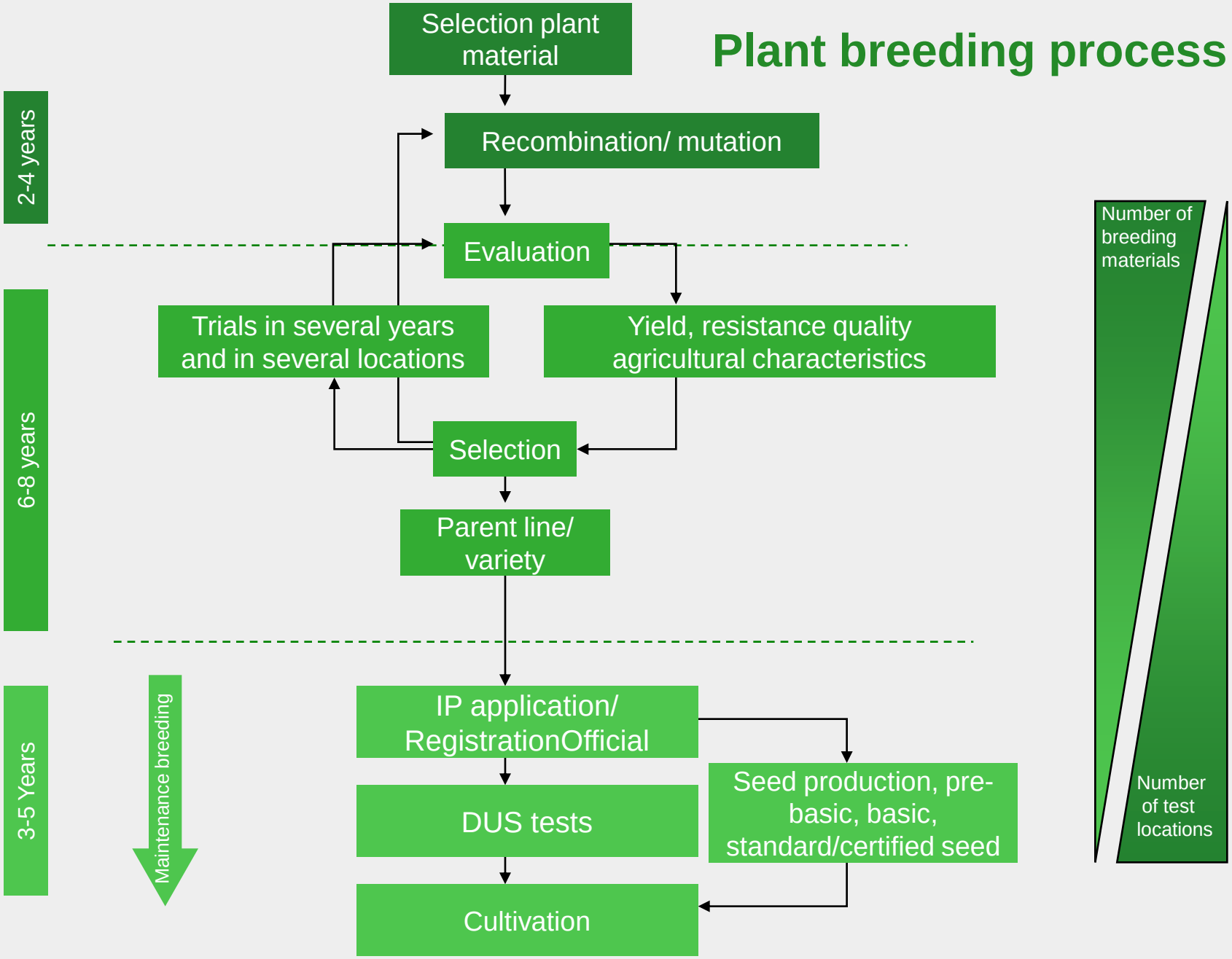
Plant breeding process



Use of genetic resources

Direct use

- Recombination
  - Modern varieties
  - Research materials
  - Landraces
  - Wild relatives
- Gene selection
  - Modern varieties
  - Research materials
  - Landraces
  - Wild relatives
  - Microbials
  - Pathogens

Indirect use

- Plants/Varieties as test plants for comparison
- Pathogens to check for resistances
- Pollinators for seed production

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Direct use; Creation of genetic resources

- New gene combinations
  - Within species
  - Between species
- Domestication of species
  - New species
  - New uses

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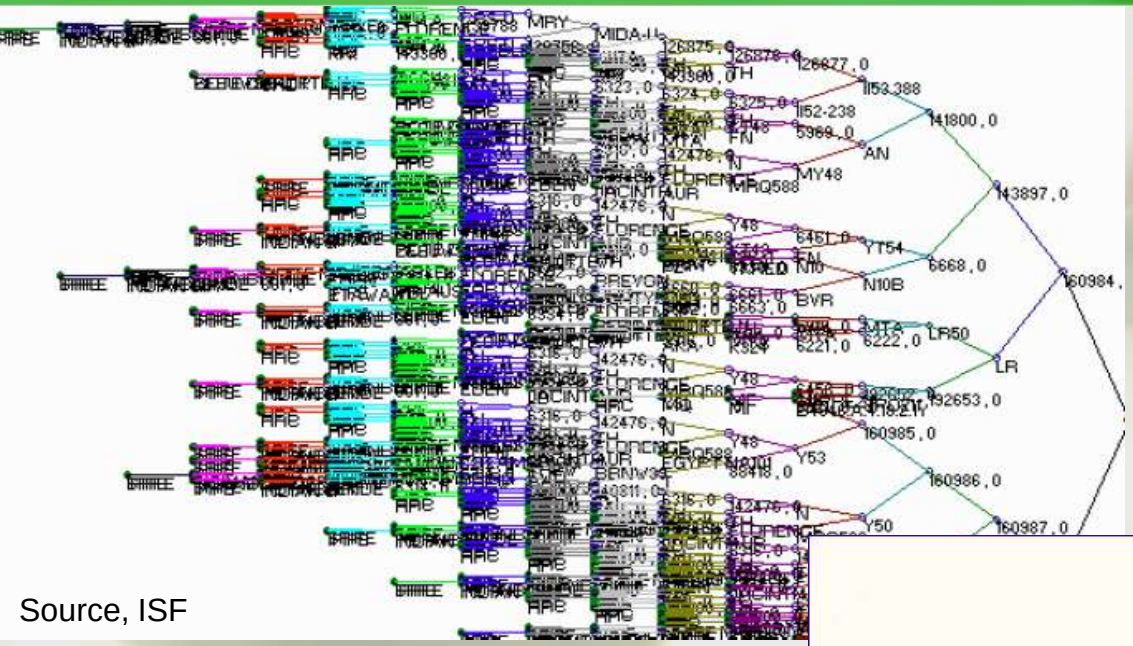
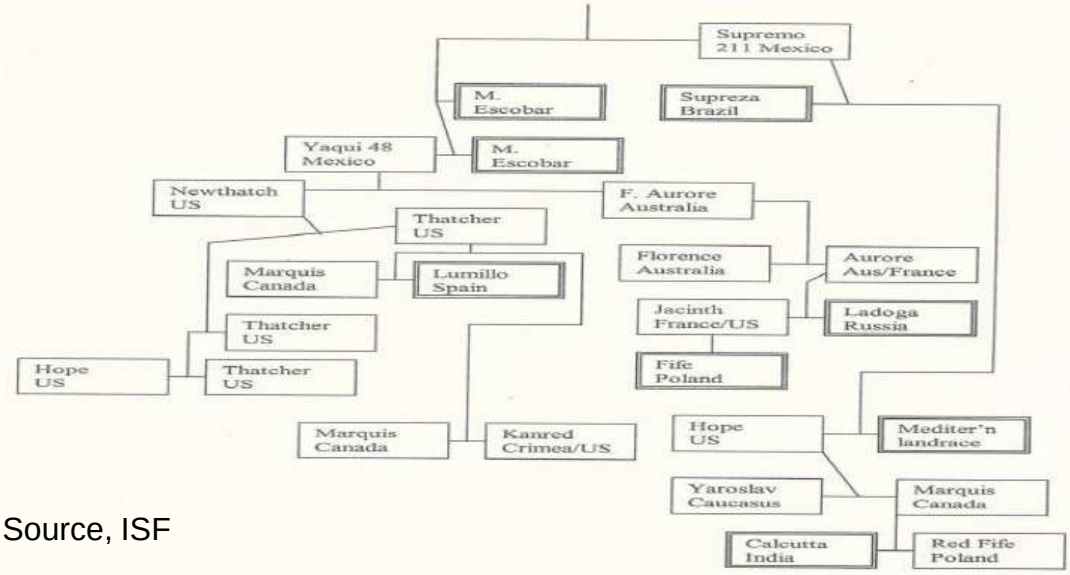
Recombination; Ancestry wheat variety Sonalika

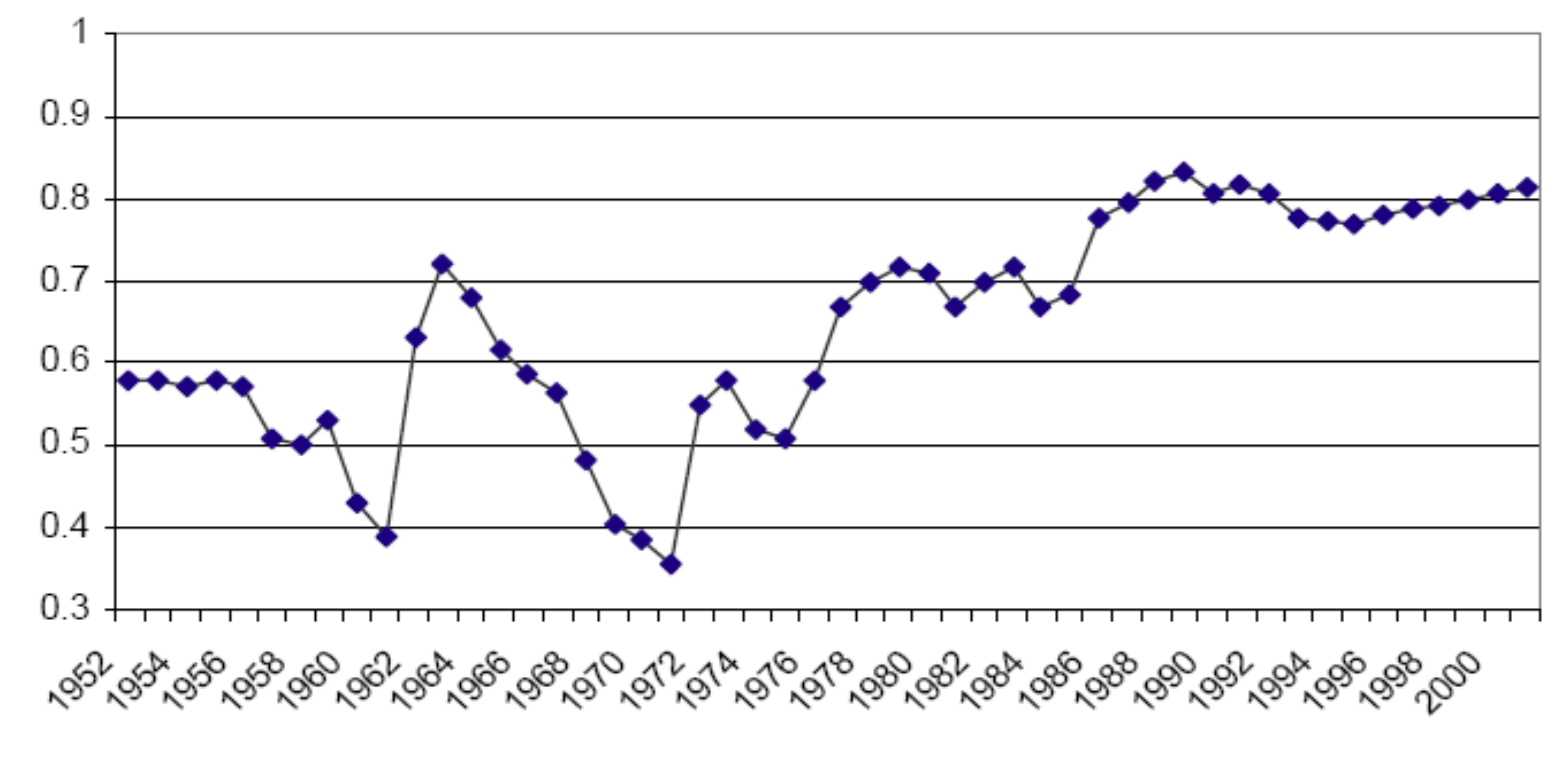


Source, ISF



Source, ISF

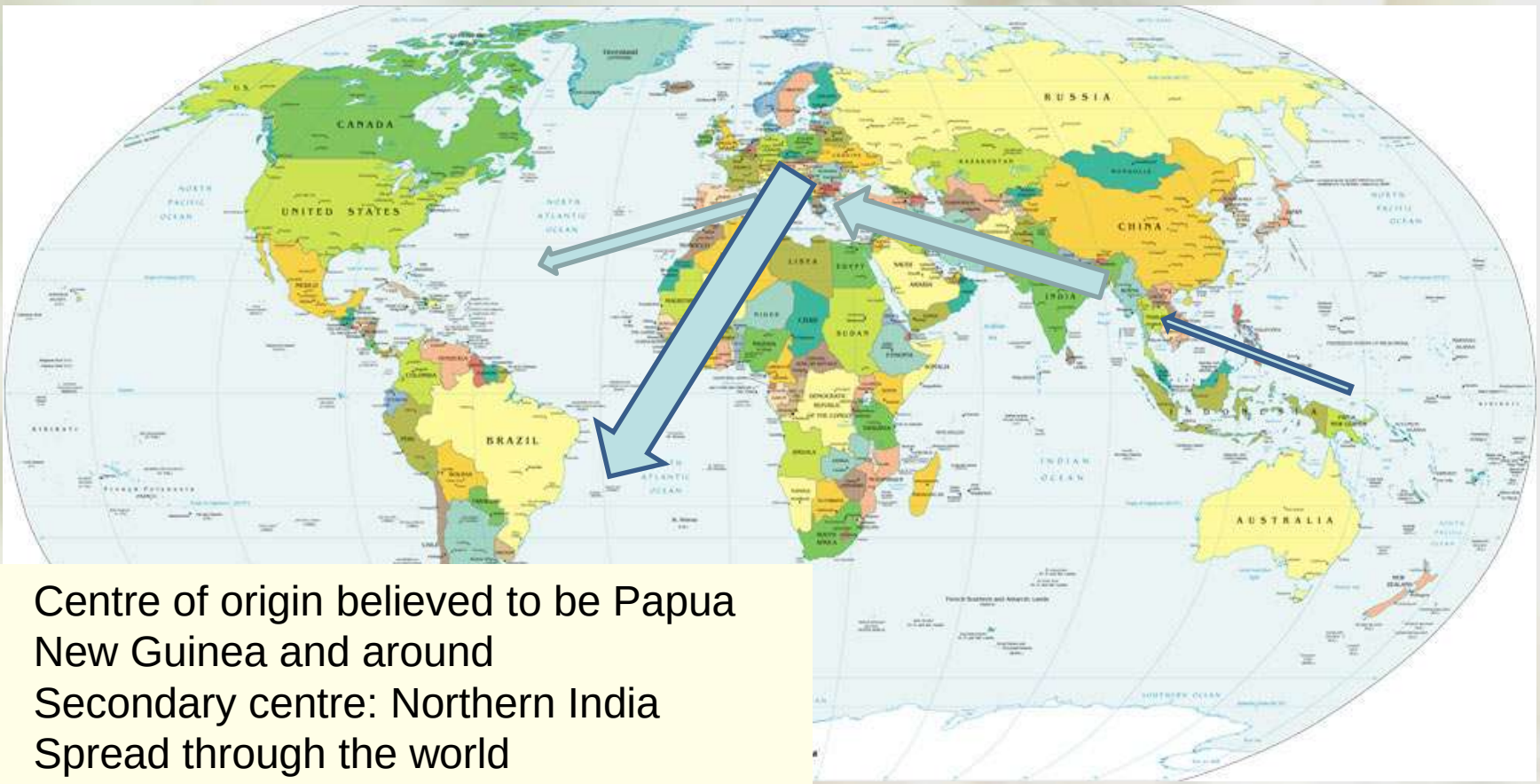
Wheat diversity in Hungary



Weighted diversity in the Hungarian wheat production
(calculated from COP, number of varieties and market share of varieties; range 0 to 1)

Source, ISF

Domestication; The spread of sugarcane



- Centre of origin believed to be Papua New Guinea and around
- Secondary centre: Northern India
- Spread through the world
- Current top producer: Brazil
- New uses for old crops: top bioethanol crop

Source, Willy Degreef

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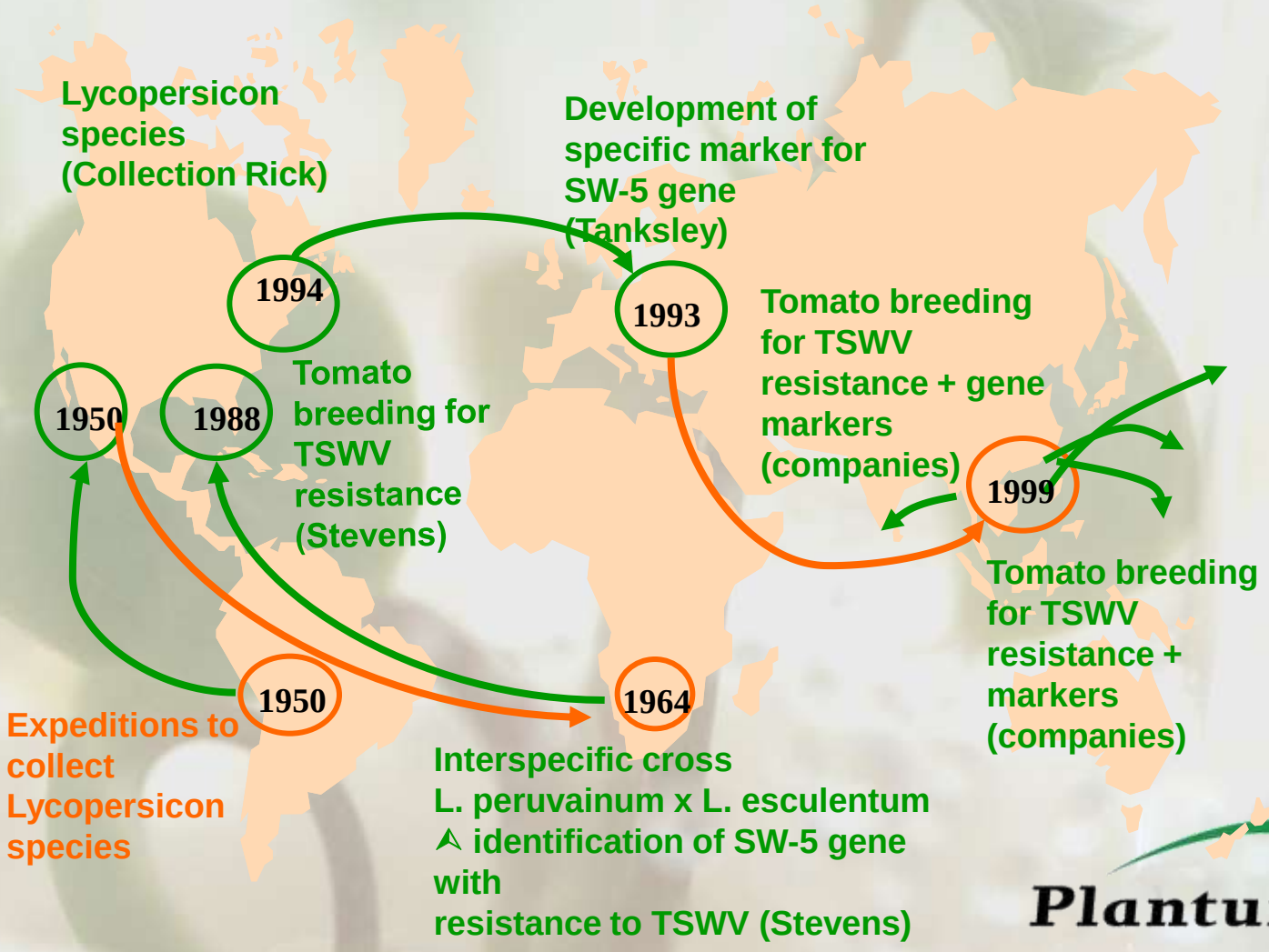
Flow of tomato TSWV resistance germplasm around the world



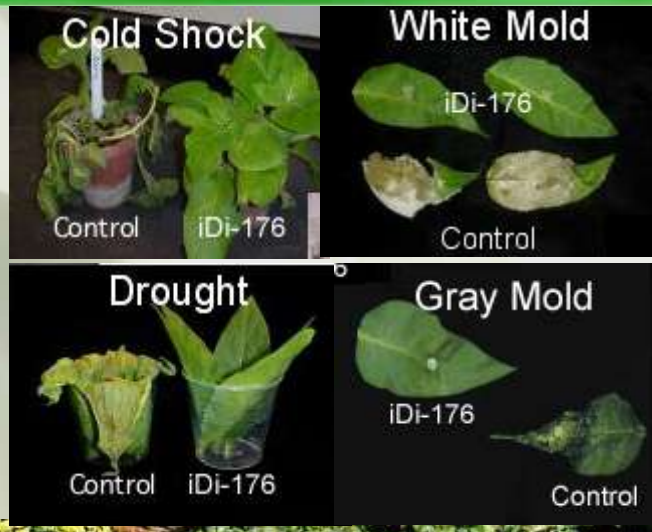
Source: Orlando de Ponti

Levels of Dependency for Countries in the Asia-Pacific Region

Country	Dependency (%)	Main source of energy supply	Primary region of diversity of crops
China Japan Republic of Korea	46 - 55 43 - 61 30 - 54	Non-native - wheat, sugar, maize, potato Native - rice and soybean	East Asia - rice, soybean, orange, Brassica, millet, tea, onion
Bangladesh India Nepal	14 - 21 35 - 47 47 - 57	Non-native - wheat, maize Native - rice, sugarcane, millet	South Asia - rice, banana, sugarcane, sesame, millet, *Brassica rapa*, *B juncea*
Kenya South Africa Ethiopia	89 - 98 90 - 98 28 - 56	Non-native - *Phaseolus*, maize, sweet potato, potato, cassava, banana, plantain, wheat, rice Native (for Ethiopia) - tef, *Avena Abyssinian*, *Brassica carinata*	East and Southern Africa - sorghum, millet, yam
Brazil Andean Region Argentina Colombia	81 - 94 89 - 95 84 - 94	Non-native - wheat, sugar, rice, maize, soybean, plantain, banana Native - potato, *Phaseolus* (for Andean Region); cassava (Brazil)	Andean region – pineapple groundnut, sweet potato, tomato, cocoa, Phaseolus, potato, cassava,
US Canada	77 - 100 84 - 99	Non-local - wheat, sugar, soybean, potato, maize, barley, rice, groundnut	North America - sunflower

Source: Palacios (1998)

Indirect use



Use of genetic resources

Plant breeding equals to a continuous flow of genetic resources

From anywhere to everywhere

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Maintenance of genetic resources

- Private collections
  - Breeding materials
  - Modern varieties
  - Landraces and wild relatives
- Support gene banks/botanical gardens
  - Multiplication accessions
  - Characterization and evaluation
  - Financial support
- Support collection missions
  - Participation in collection missions
  - Financial support

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Maintenance of genetic resources

Without maintenance of genetic resources -

no availability of genetic resources

no plant breeding

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Availability of genetic resources

Places where to obtain genetic resources

- Gene banks
- Botanical gardens
- Farmers
- Markets
- *In situ*

Benefit sharing

- Breeders' exemption
  - Varieties under PVP can be used without consent of the owner for further breeding and commercialization of the new product
- Conservation activities
- Capacity building
- Research projects

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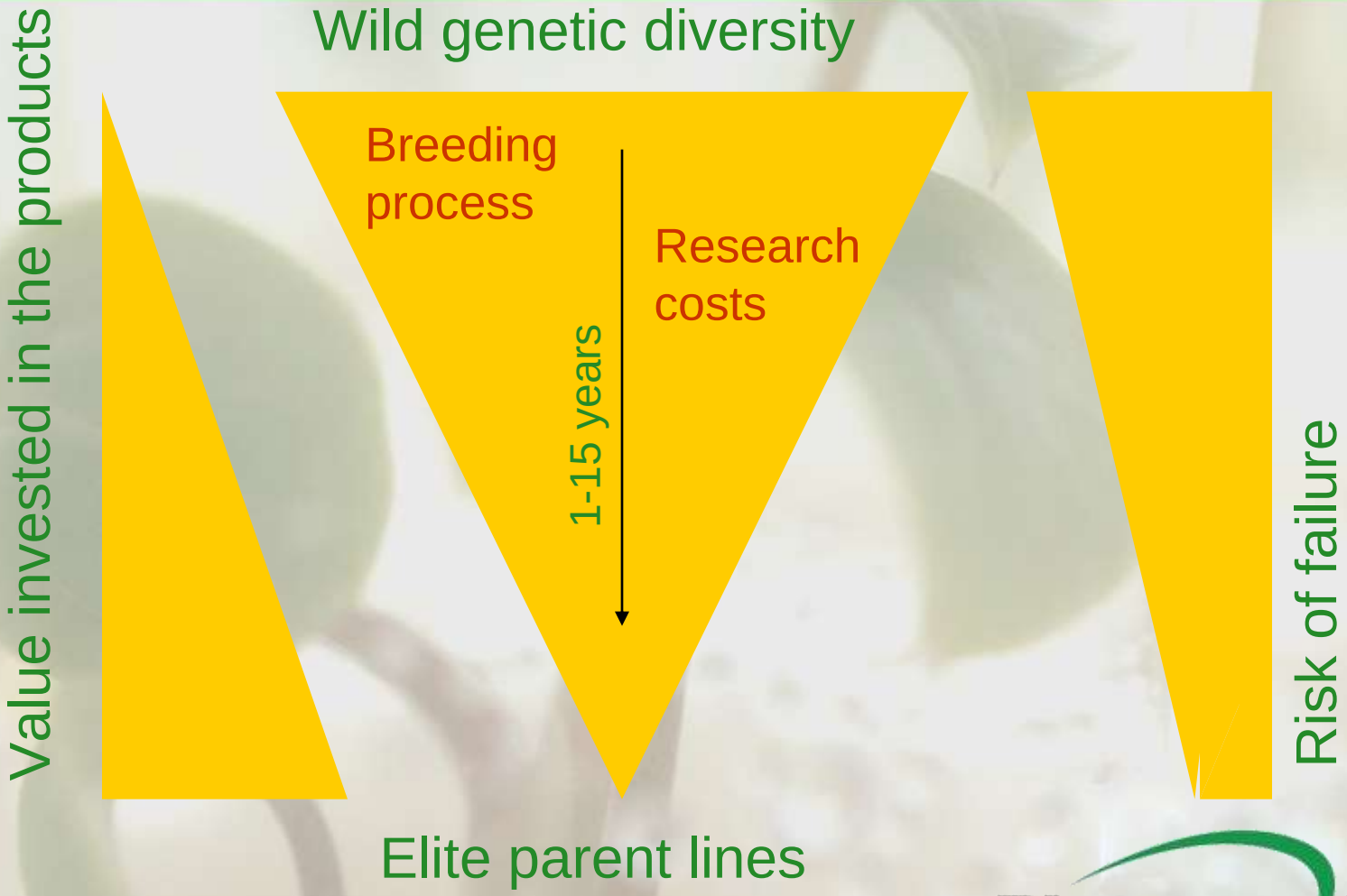
Value of genetic resources in breeding process



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Availability of genetic resources

Availability of genetic resources leads to benefit sharing

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CBD and IT PGRFA

- Development CBD
  - International regime for access and benefit sharing
- Development IT PGRFA
  - Standard Material Transfer Agreement (SMTA)
- Consequences of the CBD and IT PGRFA for plant breeding sector

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Development CBD

- From common heritage to national sovereignty
- Objectives CBD
  - Conservation of genetic resources
  - Sustainable use of genetic resources
  - Access and Benefit Sharing (ABS)

- International regime on ABS
  - Prior informed consent
  - Mutually agreed terms

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sunflower
BROADBAND
HARTHOLT OLIE
EURO 1229
SUPERPLUS 1319
EURO 1279
DIESEL 0919
LPG 0409
24 UUR
bp
Complexity
Access and Benefit Sharing. Where does it start?Where does it stop?
Nationale Vereniging
DE ZONNEBLOEM
KUIFJE
DE ZAAK ZONNEBLOEM
SUNFLOWER AUCTION

Development IT PGRFA

- From International Undertaking to International Treaty on Plant Genetic Resources for Food and Agriculture (IT PGRFA)
- Objectives
  - Conservation of plant genetic resources for food and agriculture
  - Sustainable use of plant genetic resources fro food and agriculture
  - Access and Benefit Sharing (ABS)
- Multilateral system
  - Standard Material Transfer Agreement

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Consequences CBD and IT PGRFA on the plant breeding sector

- Interruptions in the continuous flow of genetic resources
- New/different process on availability and benefit sharing
- Risk on burdensome administrative procedures and lack of transparency on exchange of genetic resources
- Risk of loss in biodiversity
- Slowing down the plant breeding process
- Multilateral system may make availability easier and more transparent for Annex 1 crops
- SMTA takes care of level playing field
- Relatively clear recognition of intellectual property and in particular the value of the value of the breeders' exemption in SMTA is important

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Conclusions

- Plant breeding and genetic resources cannot be seen separately
- Plant breeding and genetic resources strengthen each other; the one cannot exist without the other
- Multilateral system of IT PGRFA is most consistent with plant breeding activities and therefore best option for ABS

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