Orientation Talk on

"Scopes of Plant Breeding & Biotechnology in Agriculture"

Resource Persons:

Dr. Bal Krishna Joshi, NARC/ PGaBSoN

Dr. Pallavi K Singh, NARC/HICAST

Date and Time: Poush 26 , Time 1:00 pm -3:00

Target: Undergrad students, 7th Sems Ag.

Jointly *Organized by*

Plant Genetics and Breeding Society of Nepal (PGaBSoN)

and

Directorate of Research and Training (DORT)

Himalayan College of Agricultural Sciences and Technology (HICAST)

Scopes of Plant Breeding and Biotechnology in Agriculture

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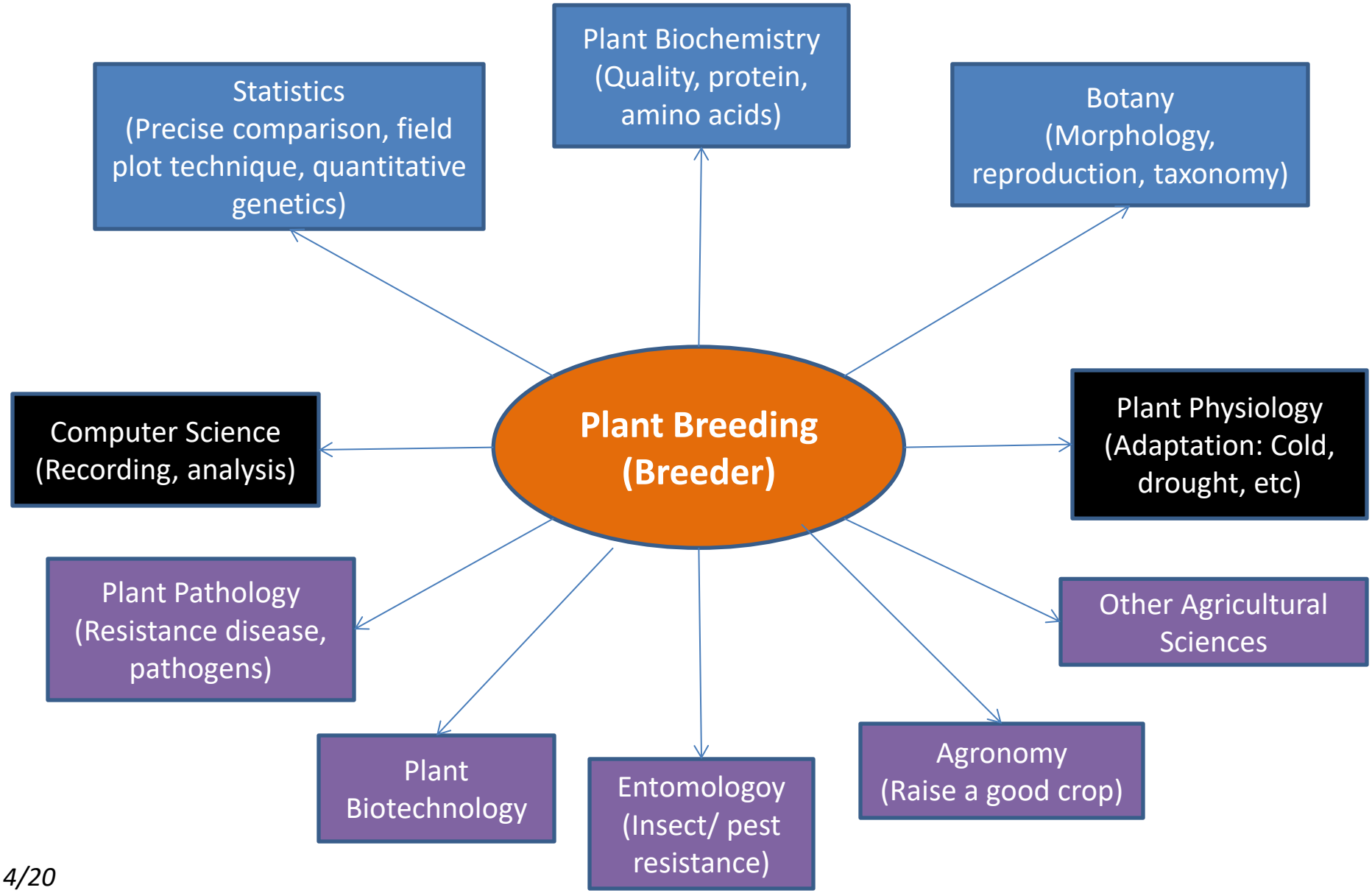
What ever you want? See the Market

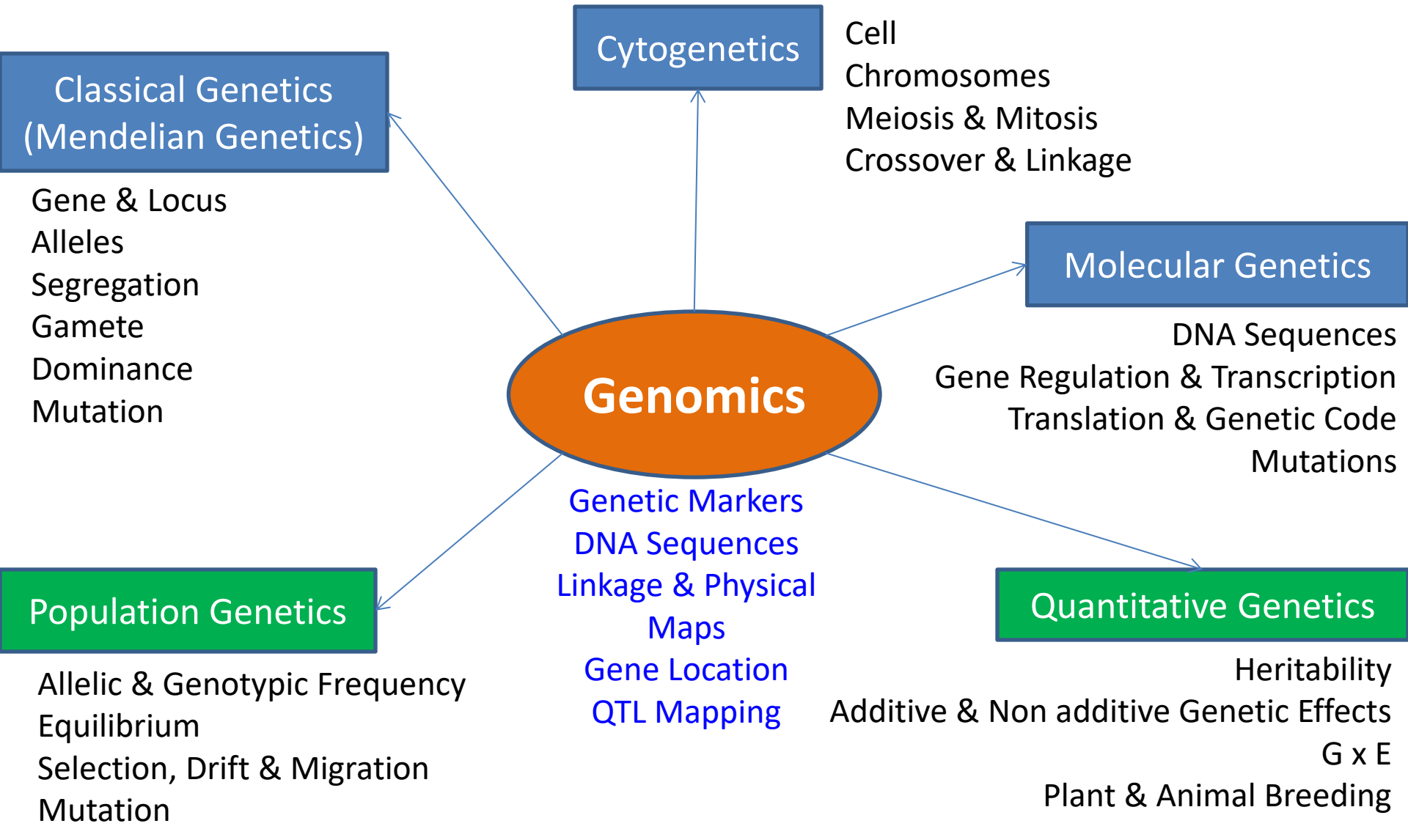
So many options
So many diversity

जे खोजे पनि, जस्तो
खोजे पनि, जति खोजेनि

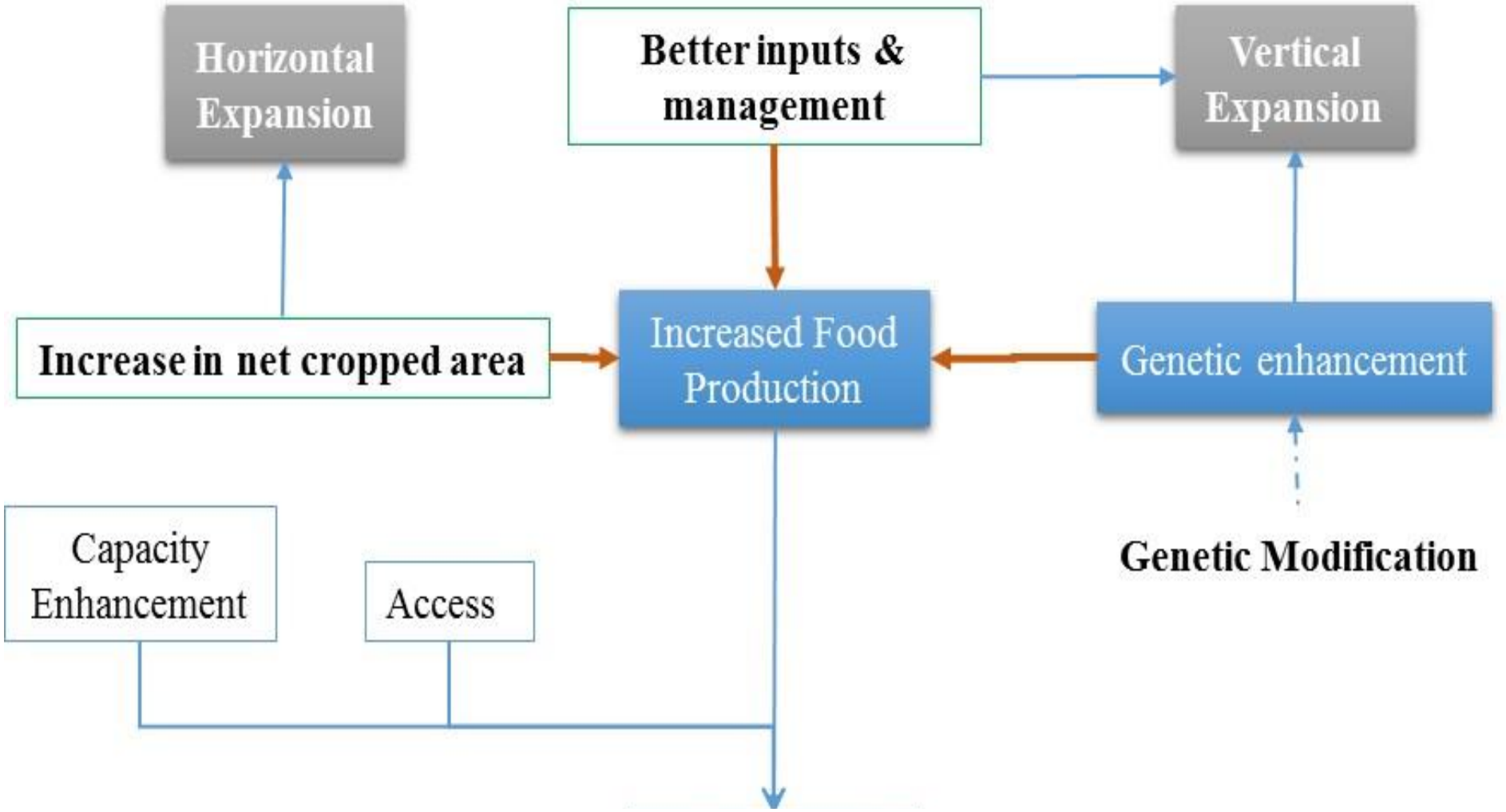
Plant Breeder as a Leader in Agriculture



Areas of Knowledge used in Breeding and Biotech



Major Scope



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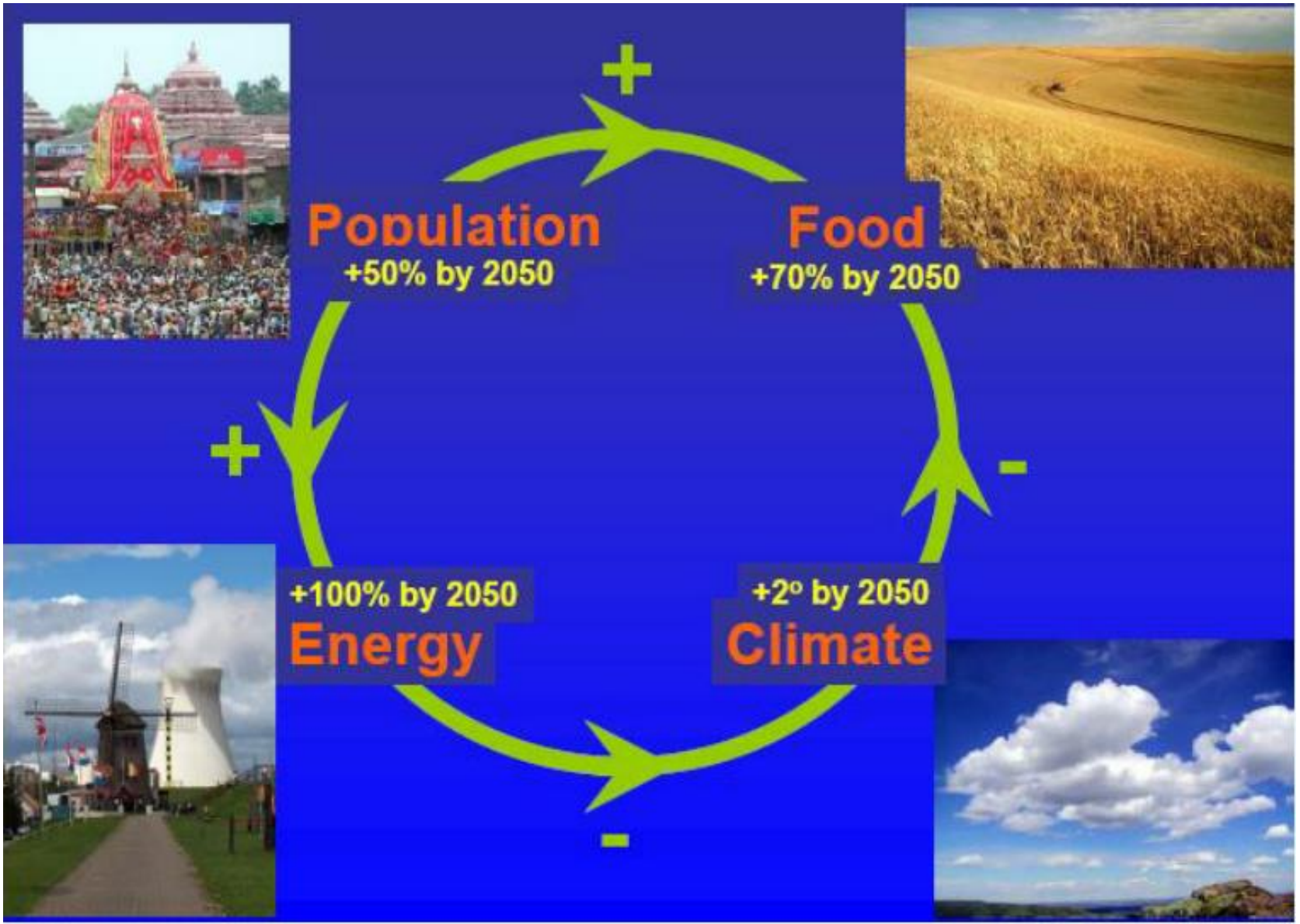
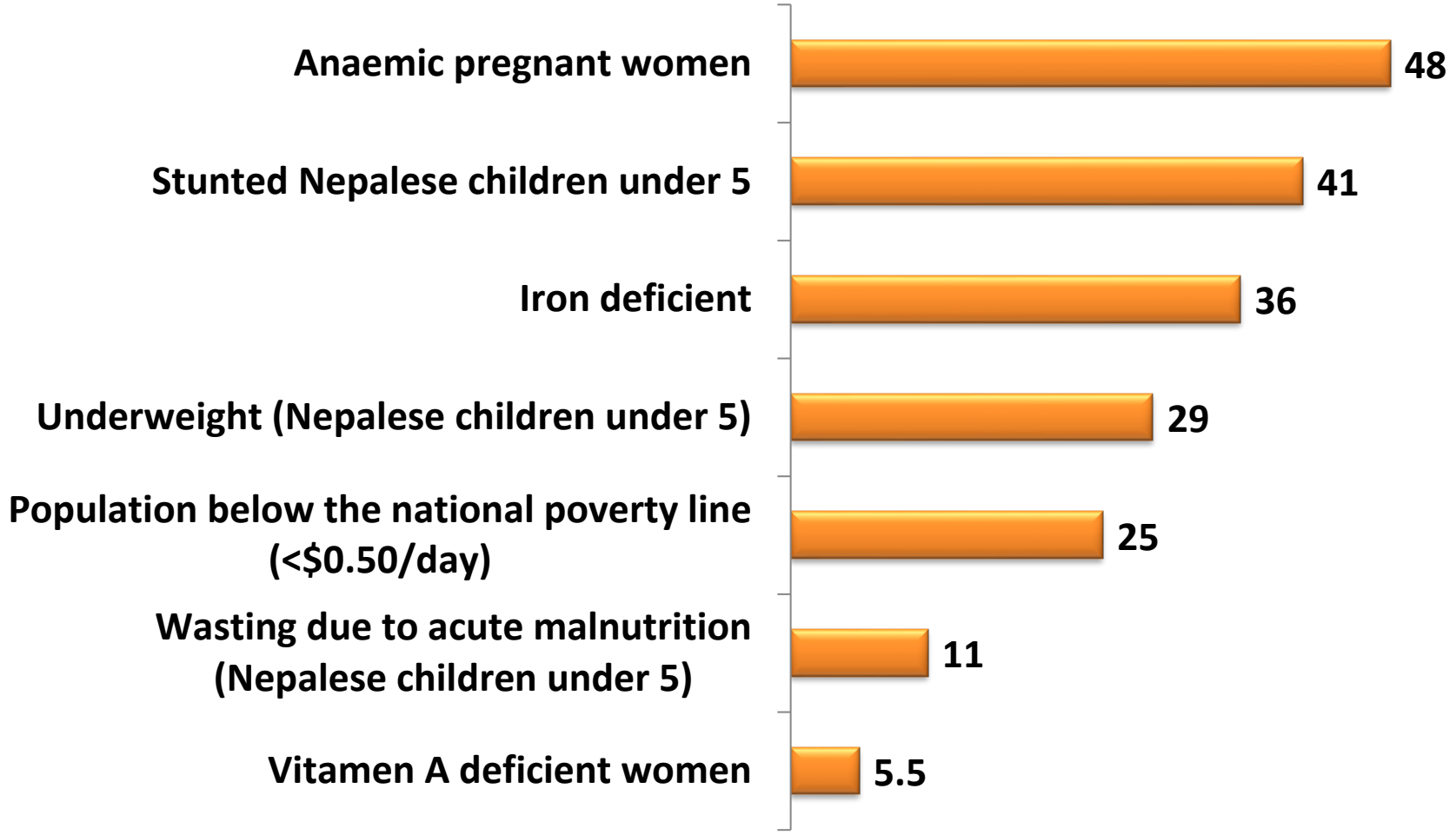
Challenges to Breeders = Opportunity



Situation and Gap Analysis

Hunger and Malnutrition: % people affected in Nepal

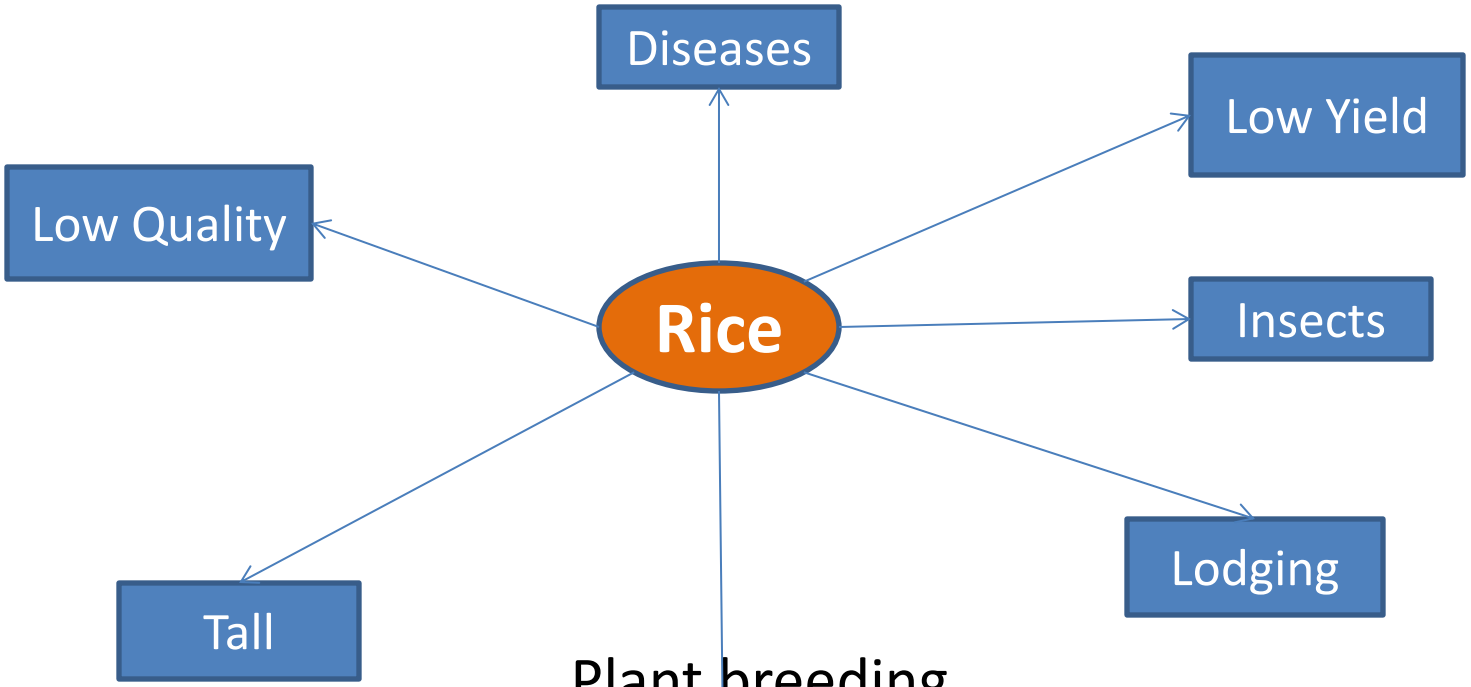


Population: 28.5 million

Why Plant Breeding and Biotech

- Art + Science + Business
- New genotypes (guarantee)
- Very easy to complex and advanced
- Advancing science
- Easy to get enrolled in higher level study (within or abroad
- Job?
- Recognition, award and respectful
- Patent and ownership
- Training opportunity
- Huge information (online database)
- Registration by Government of Nepal
- Any dispute?

Can Design Genotypes?



Plant breeding

Plant breeder ➡ **Crop engineer**

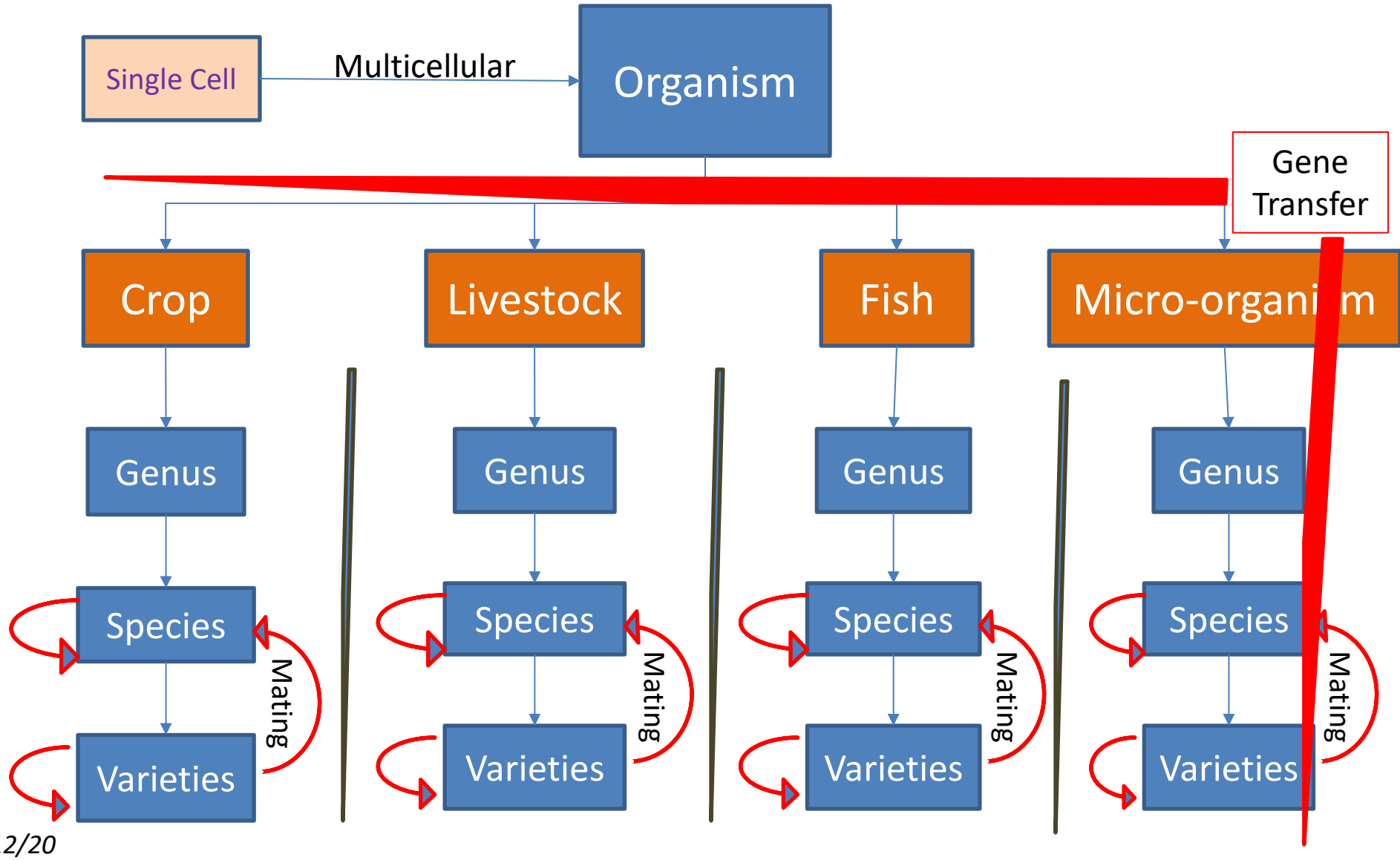
Improvement

New plant, desired variety ← **Application of other agricultural sciences**

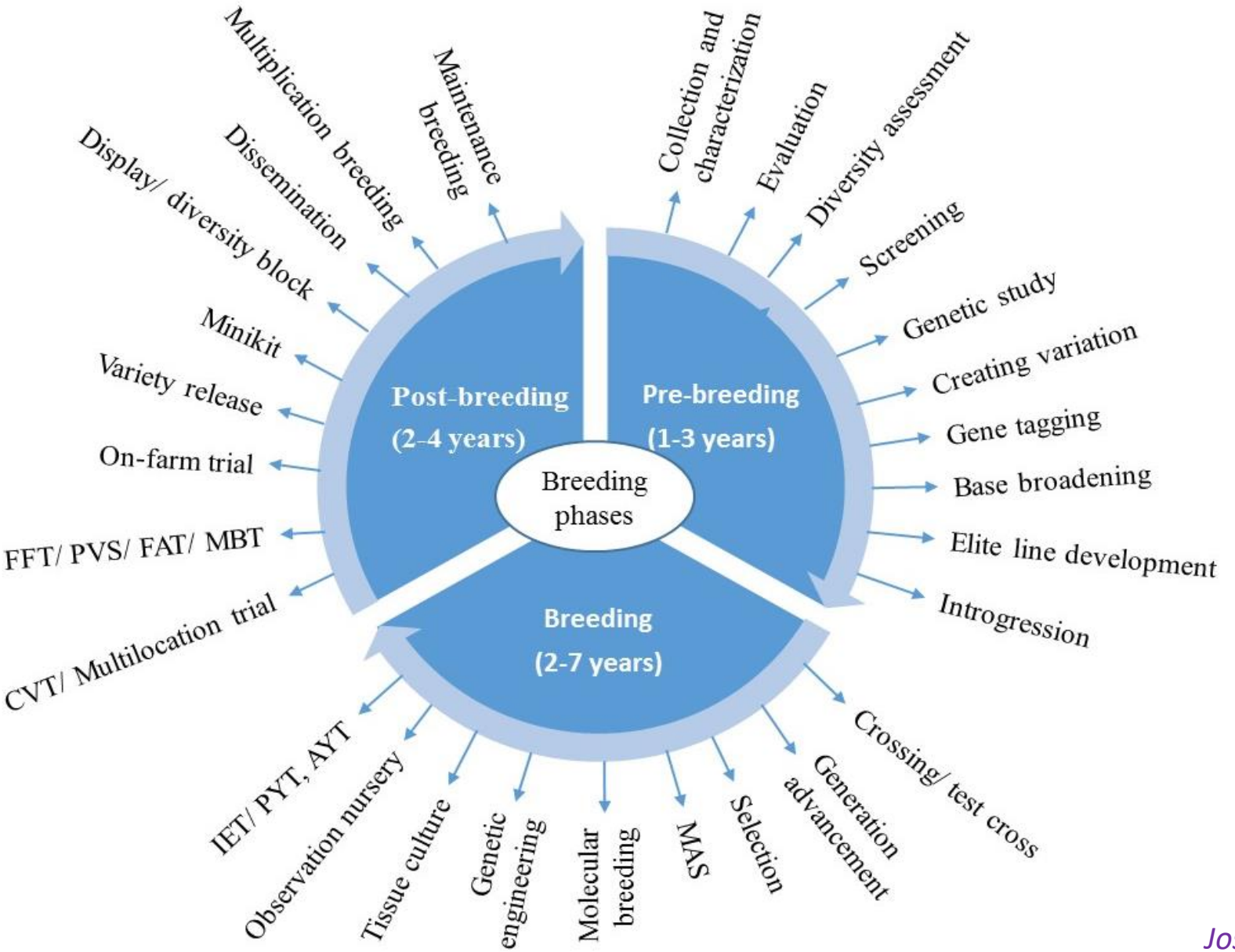
Can deal any Agricultural Problems

- Climate changes (drought, hot, cold stresses)
- Diseases and insect pests
- Low to high fertility land
- Submergence areas
- Malnutrition
- Virgin land
- Poor test and quality
- Storage problem
- etc

You can excel the Natural Evolution



Plant Breeding Phases and Activities in each Phase



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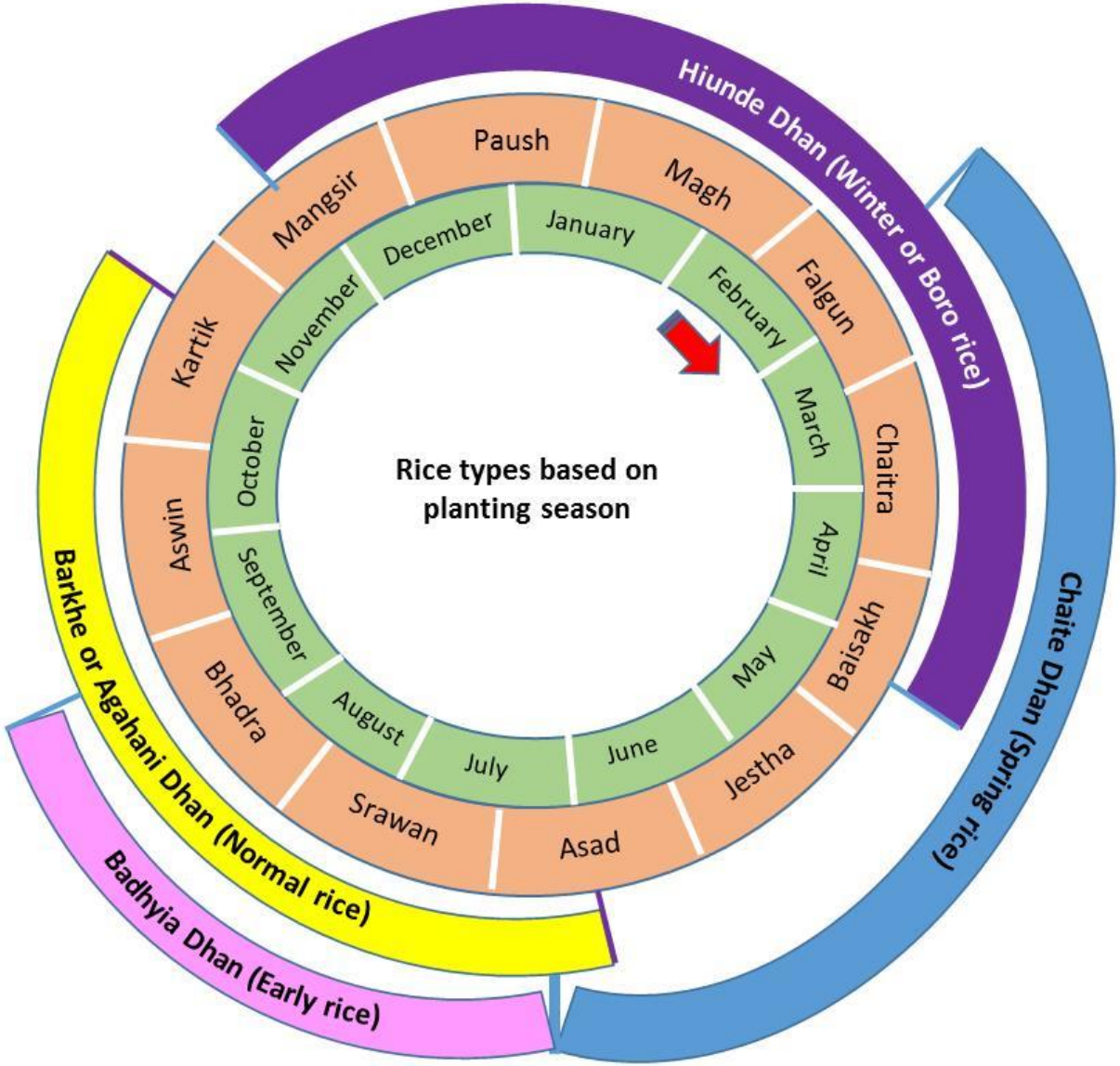
So many areas simply in a Rice



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Branches of Plant Breeding: So many areas within a subject

- Evolutionary breeding
- Analytical breeding
- Molecular breeding
- Crop breeding
- Crop improvement
- Heterosis breeding
- Resistance breeding
- Mutation breeding
- Polyploidy breeding
- Inbreeding
- Shuttle breeding
- Participator plant breeding (PPB)
- Landrace enhancement and conservation (LEC)
- Combination breeding
- Conventional breeding
- Classical breeding
- Backcross breeding
- Introgressive breeding
- Population breeding
- Transgressive breeding
- Quality breeding
- Stress resistance breeding
- Multiline breeding
- Maintenance breeding
- Space breeding
- Genetic engineering

Principles in Practices

- Plant improvement: Principles, methods and structure
  - Plant: Structure, Methods
  - Field visit + work
  - Lab visit + work
  - Computer assisted learning
  - Glasshouse
  - Data recording and analysis

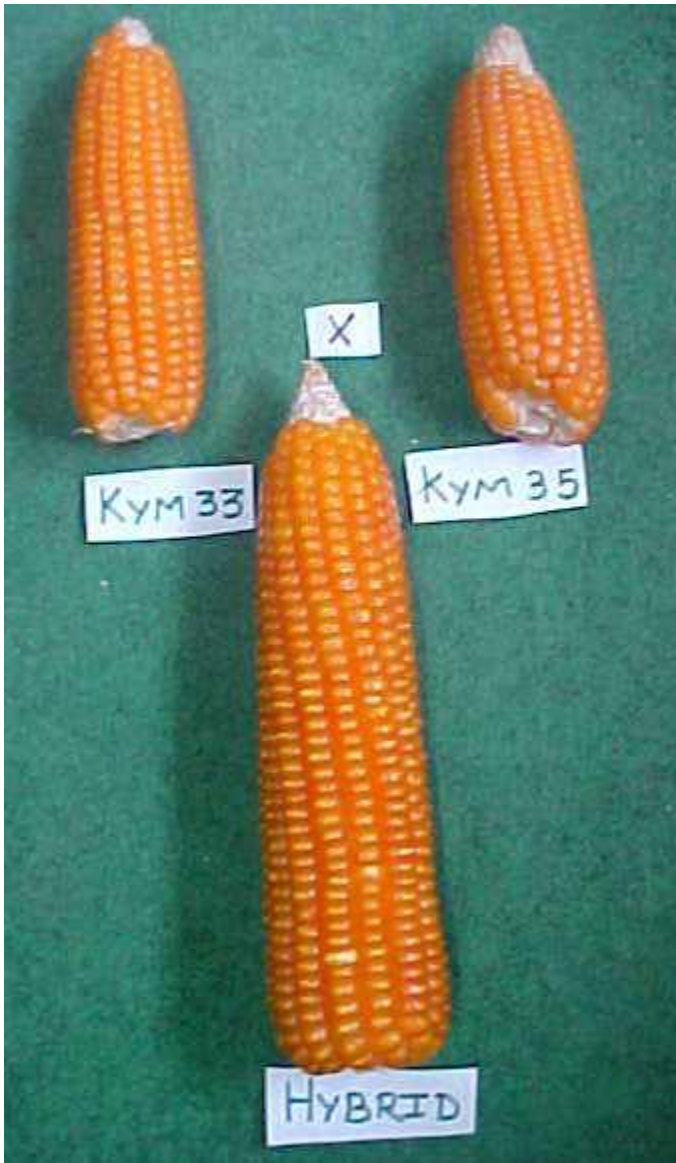
- To be a plant breeder
  - Introductory: General BSc
  - Decisive role: Elective course
  - Specialization: MSc, PhD

Students' Perception

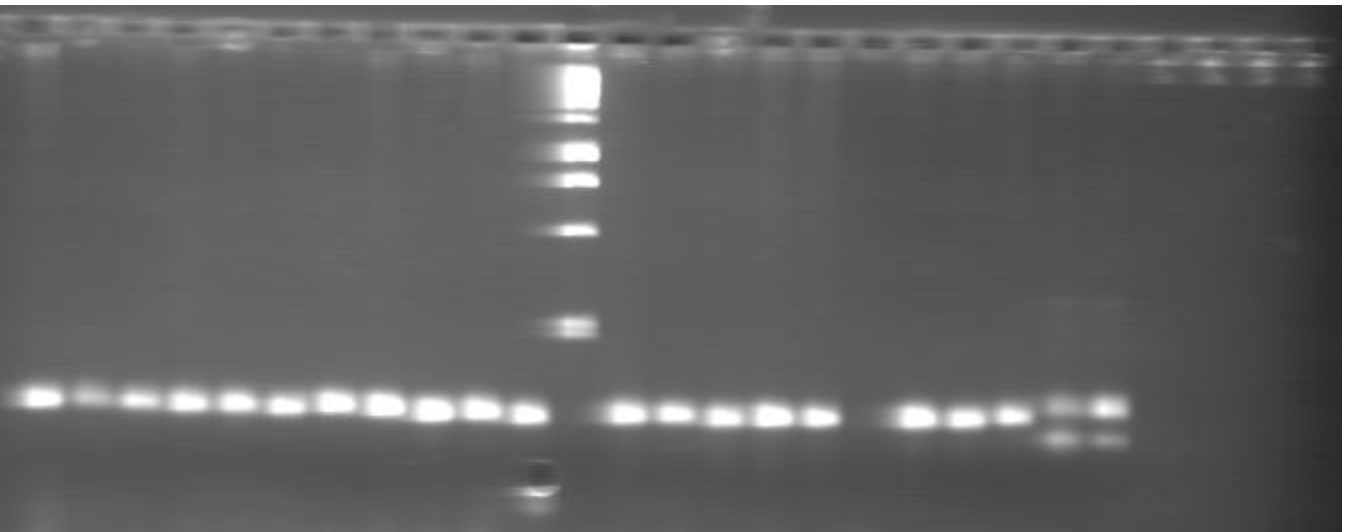
- Relatively difficult subject
- Low marks
- More statistical
- Multidisciplinary knowledge
- Many tools, techniques, sophisticated lab, field work
- Long time to get results
- No private breeding institutes
- Limited number of NGOs and INGOs in breeding and biotech
- Forum?

Students in Genetic Manipulation

Students: F1 Hybrid, Breeding in pot?



Students with High Tech Biotech

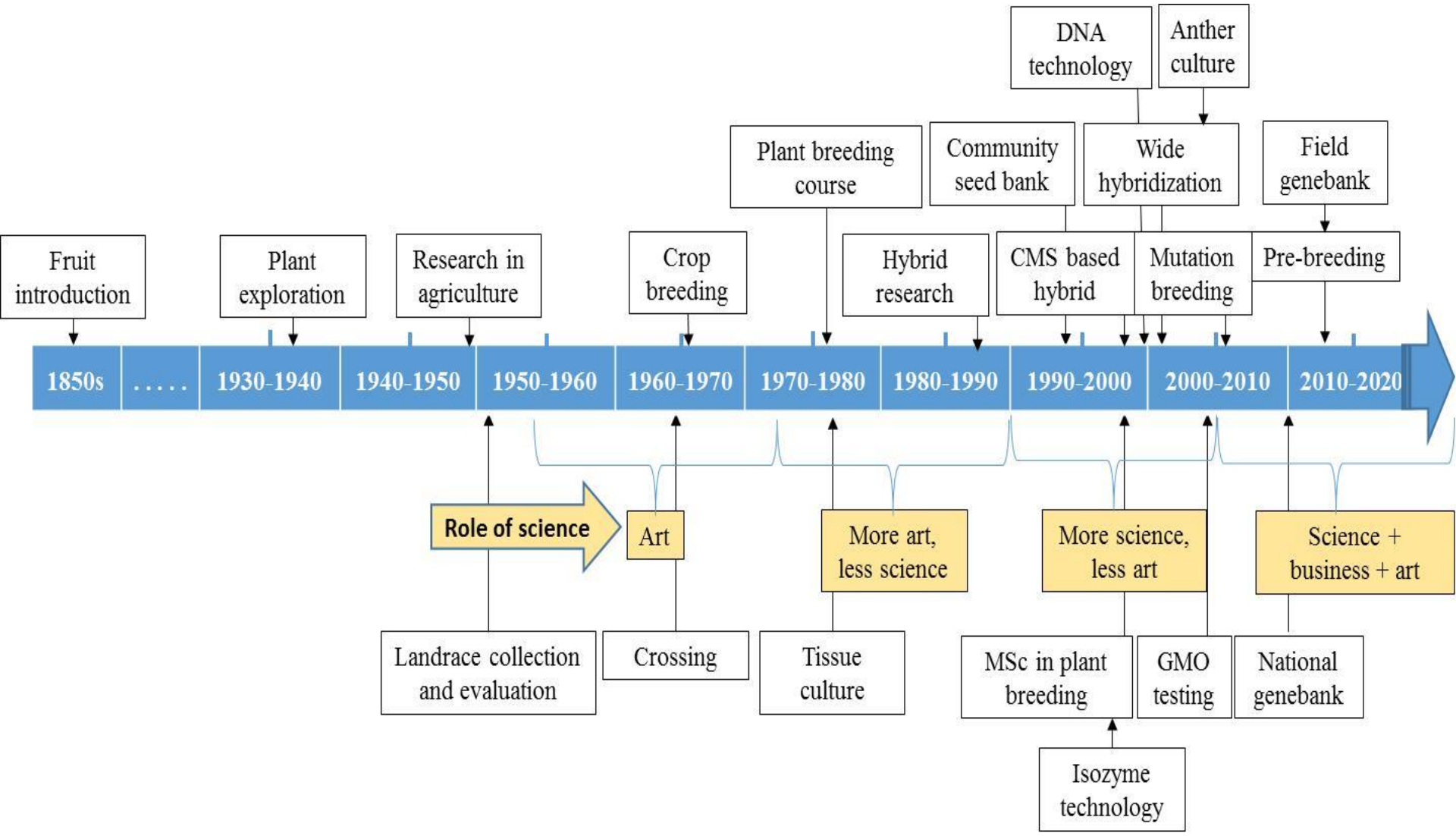


What History we have in Plant Breeding

- Main breeding methods: Introduction, pedigree, composite
- 35 different landraces (0.1%) of 17 crops used to develop 39 varieties

- Crop species in breeding: 13% (484 species)
- Dependency: 95-100% on foreign APGRs
- Breeders: About 50

Major Historical Events of Plant Breeding in Nepal



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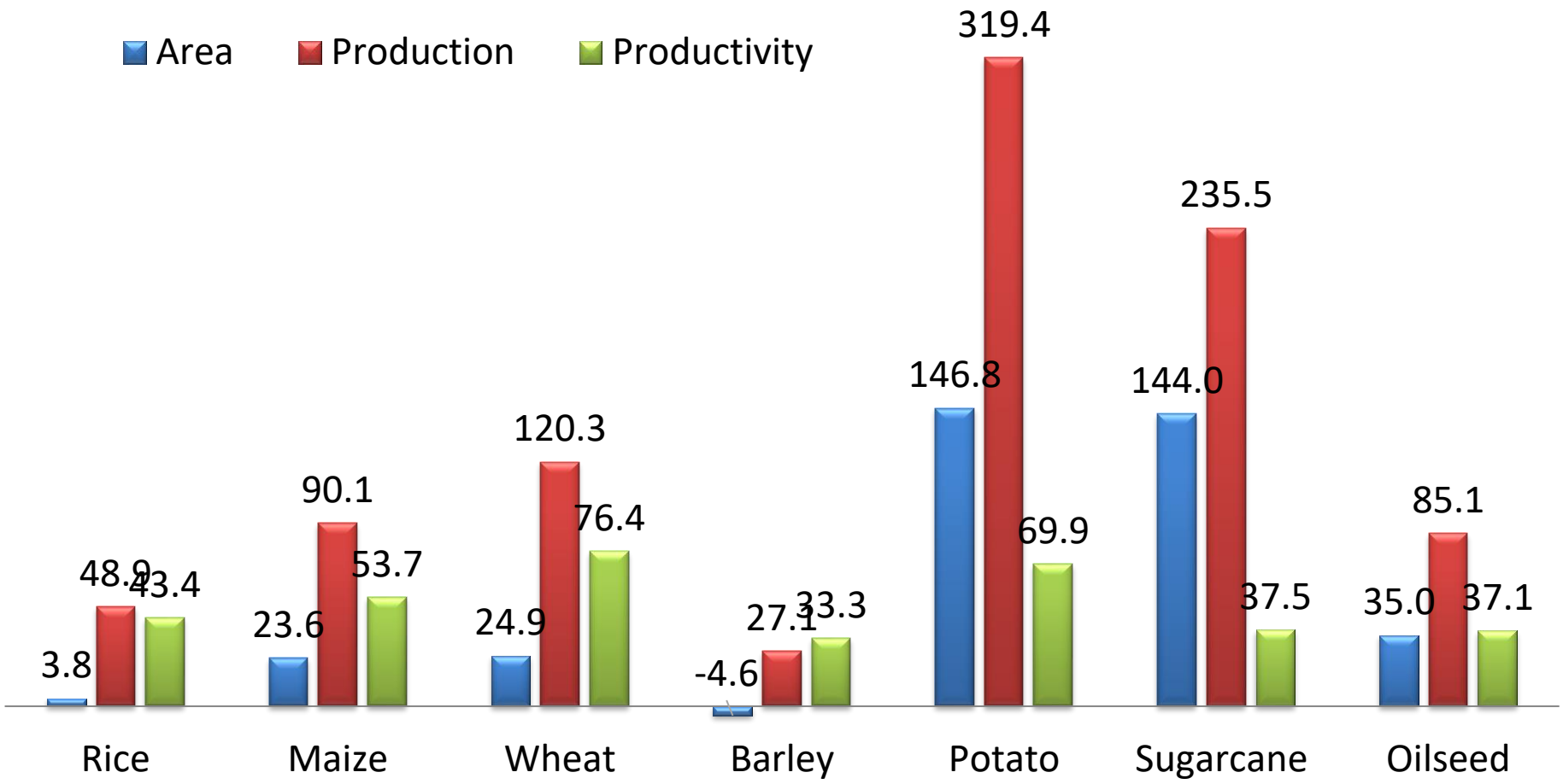
% Increment in Area, Production and Productivity over 25 years (1990-2014) in Nepal



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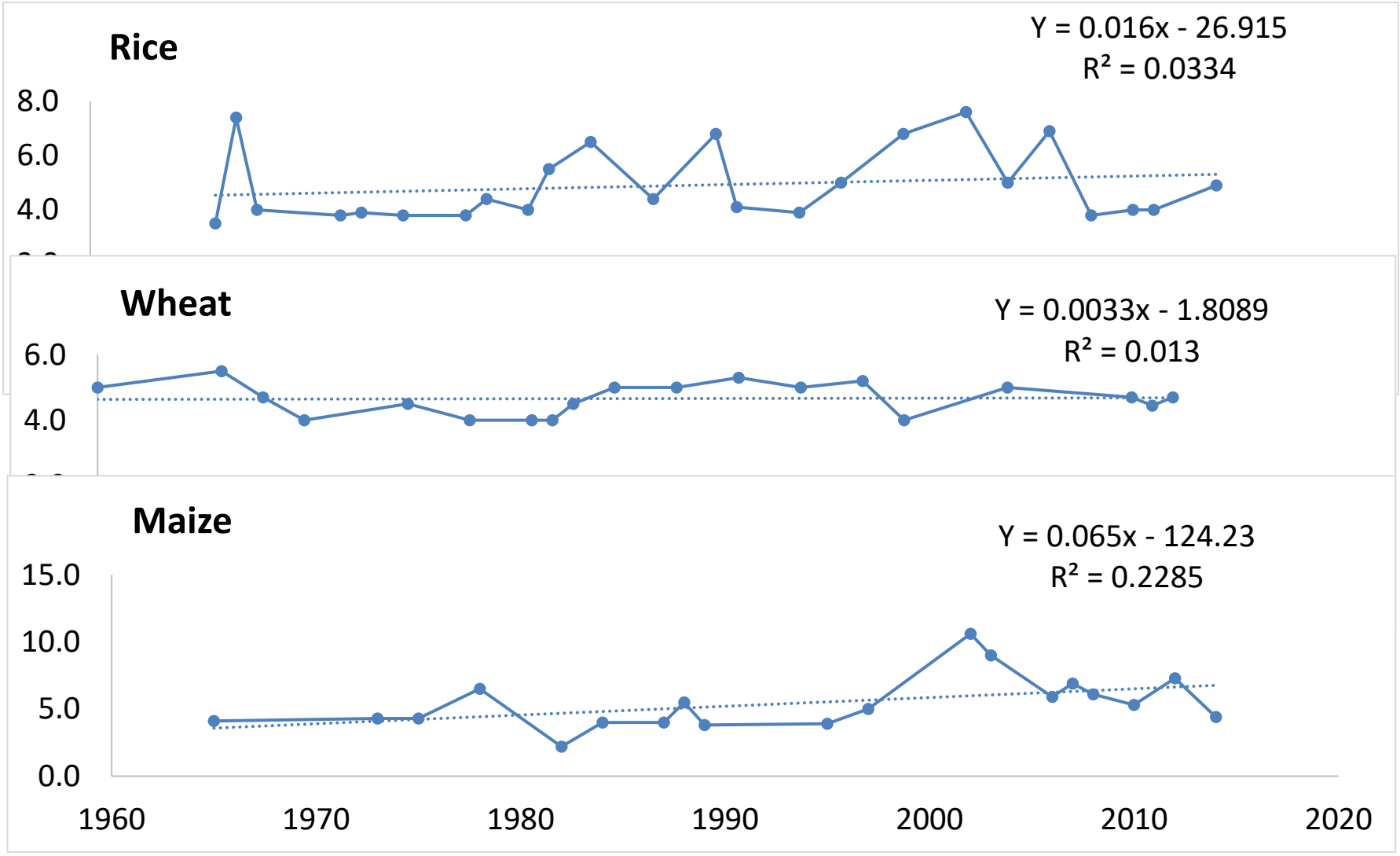
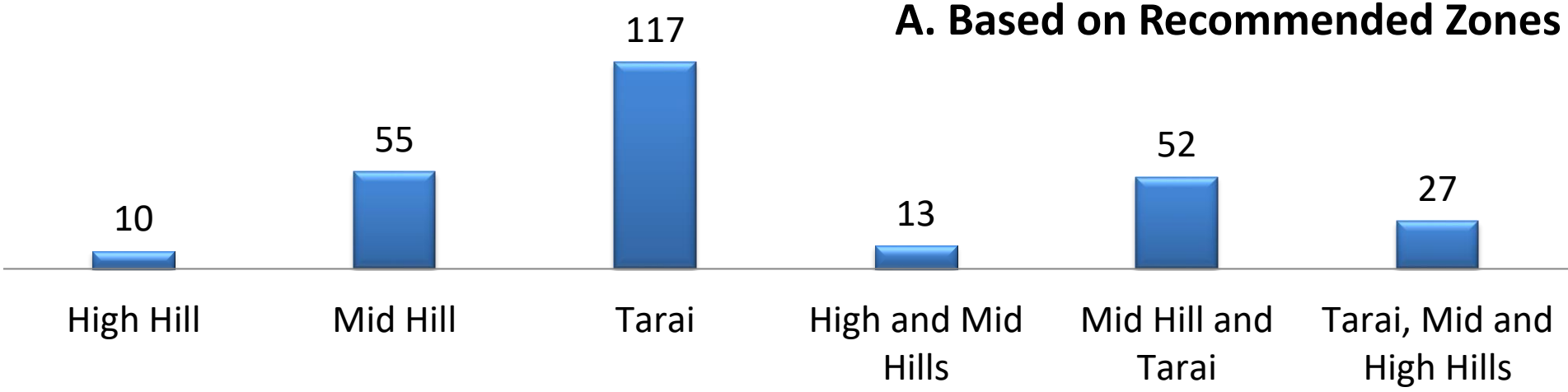
Yield potential of released varieties over the years (1960 to 2015 in X-axis and yield, t/ha in Y-axis)

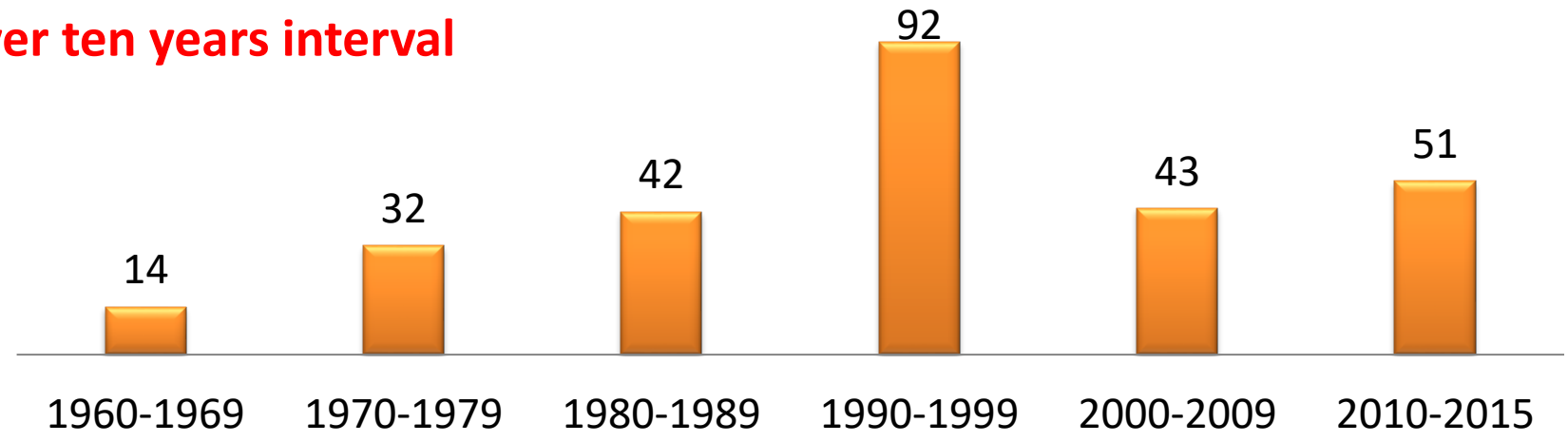


Released Varieties (Agroecozones and 10 years interval based)

A. Based on Recommended Zones



B Over ten years interval



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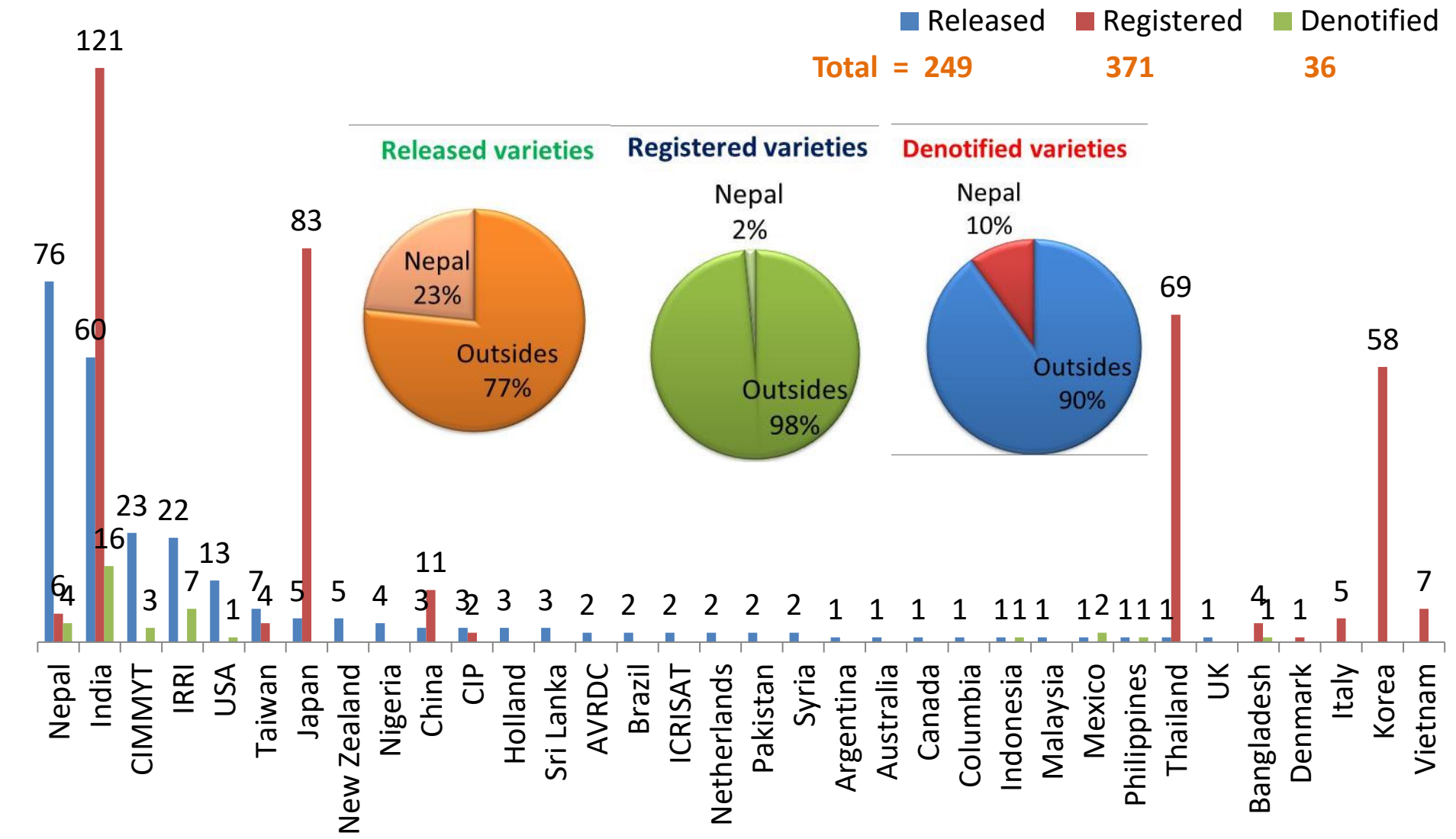
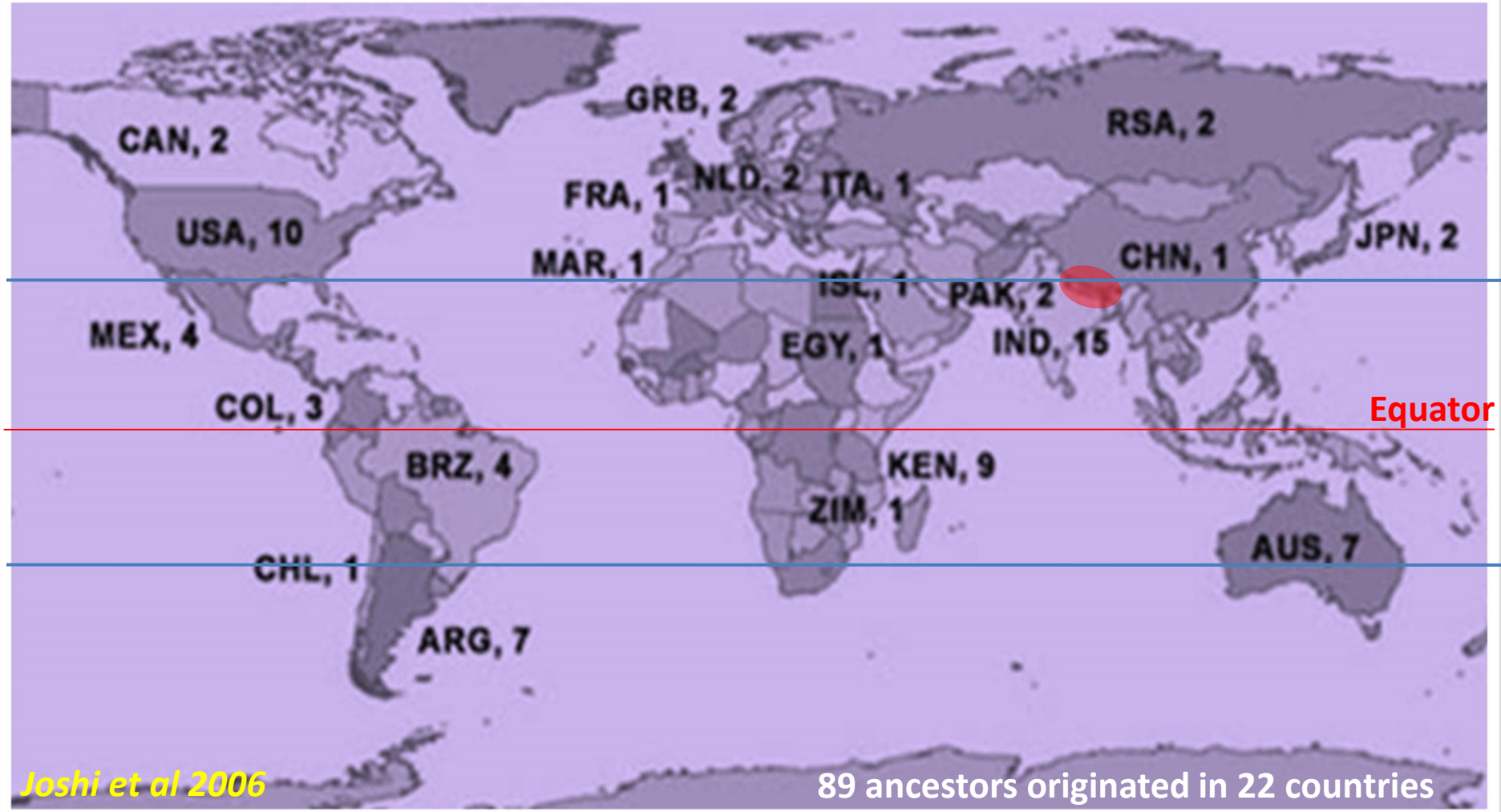
Origin of Crop Varieties



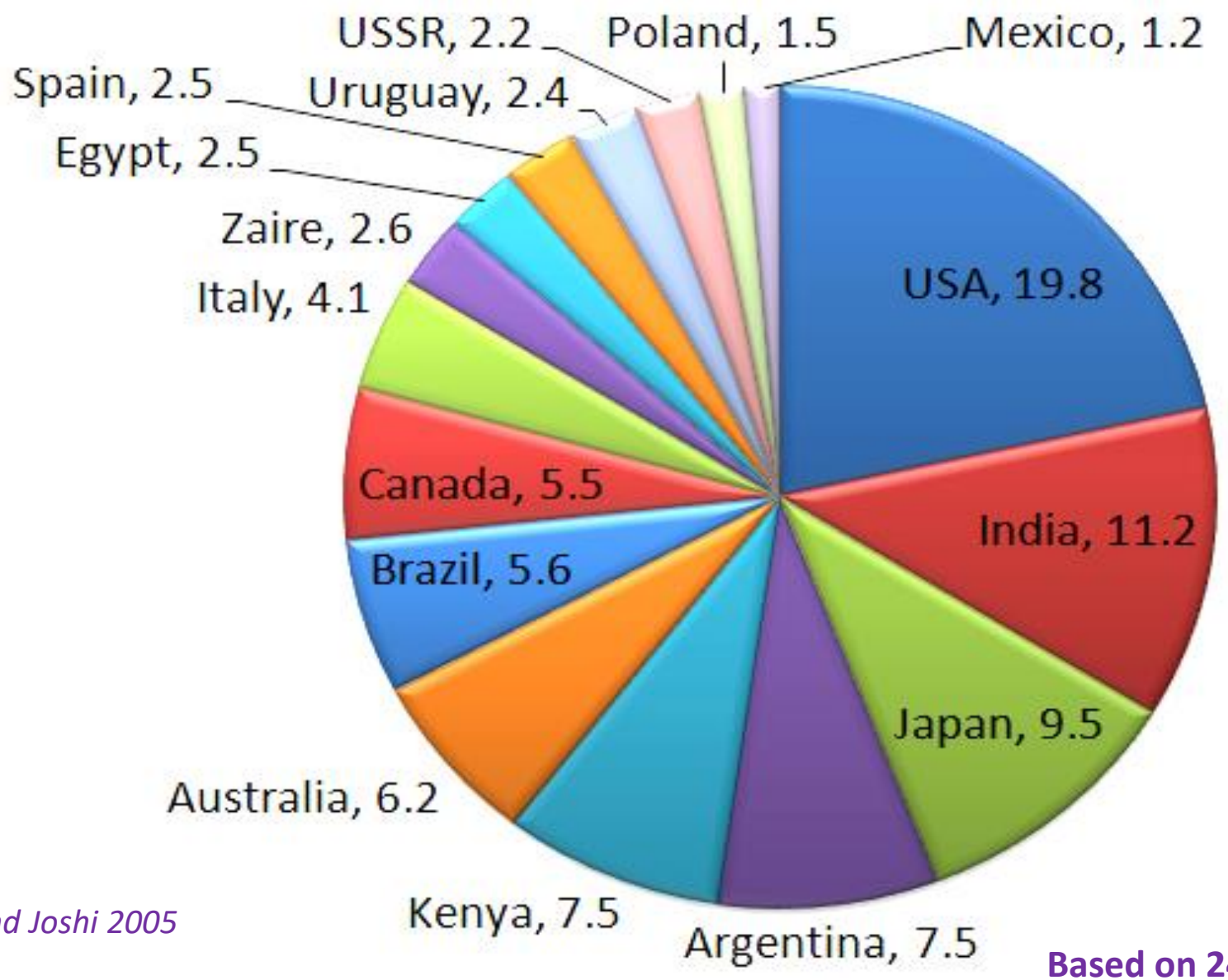
Joshi et al 2017

Origin of Ancestors of Wheat Varieties Released in Nepal

Based on 35 varieties



Country-wise Cumulative Contribution of Ancestors to Nepalese Wheat Varieties



Rosyara and Joshi 2005

Based on 24 varieties

Contribution of Crop Gene Pools: Pedigree Analysis

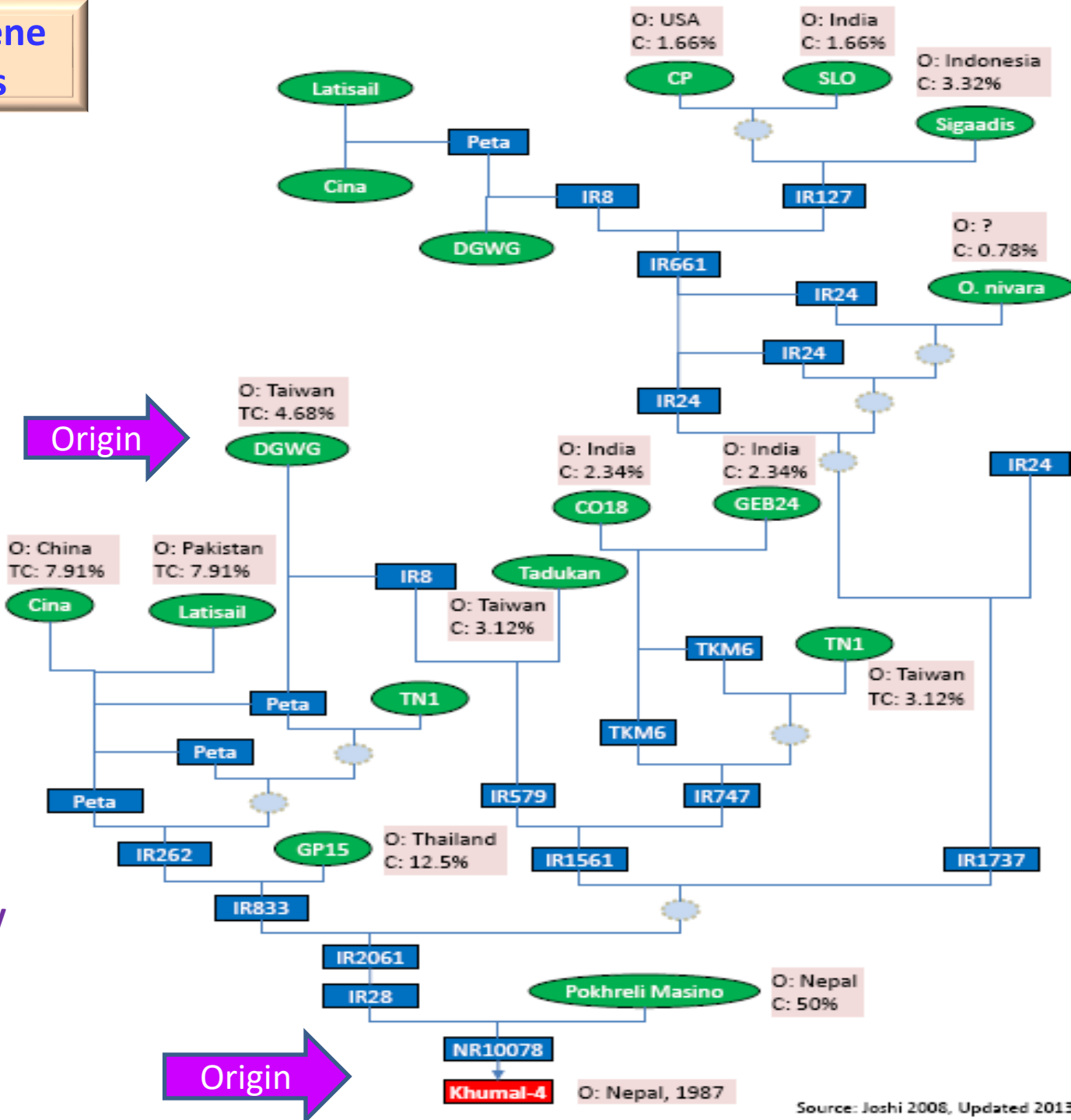
8 countries

1. USA
2. India
3. Indonesia
4. Taiwan
5. China
6. Pakistan
7. Thailand
8. Nepal

13 landraces

Source of genetic diversity

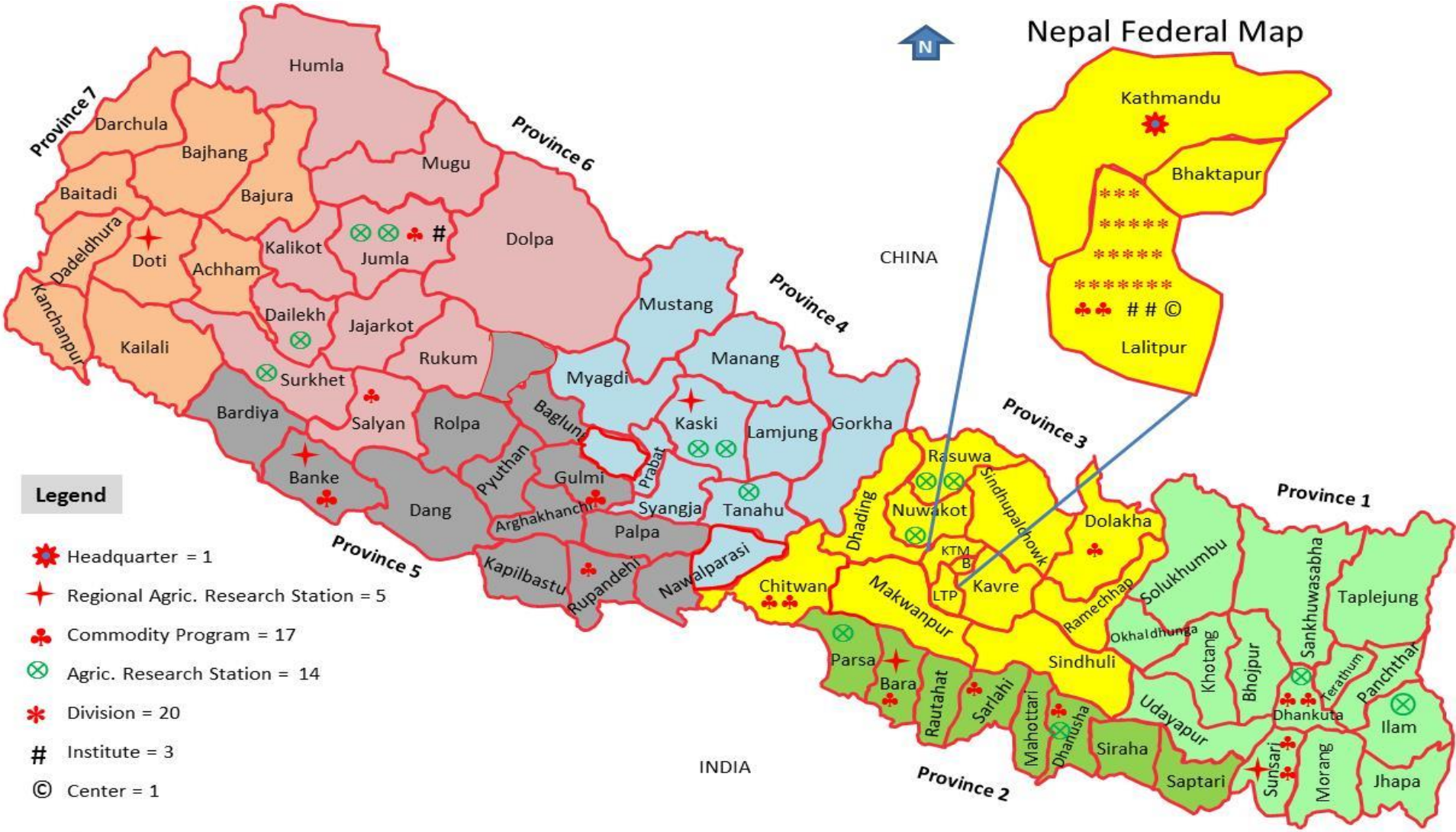
- Wild gene pool
- Cultivated gene pool
- Weed races



Breeding Institutes and Job Options

- Government organization
  - NARC
  - DoA
- NGO
  - LIBIRD
  - CEAPRED
  - FORWARD
- Private
  - Many seed companies
  - Own business
- University, College
  - IAAS
  - HICAST
  - AFU
- INGO
  - CIMMYT
  - IRRI
  - BI

NARC Stations for Breeders

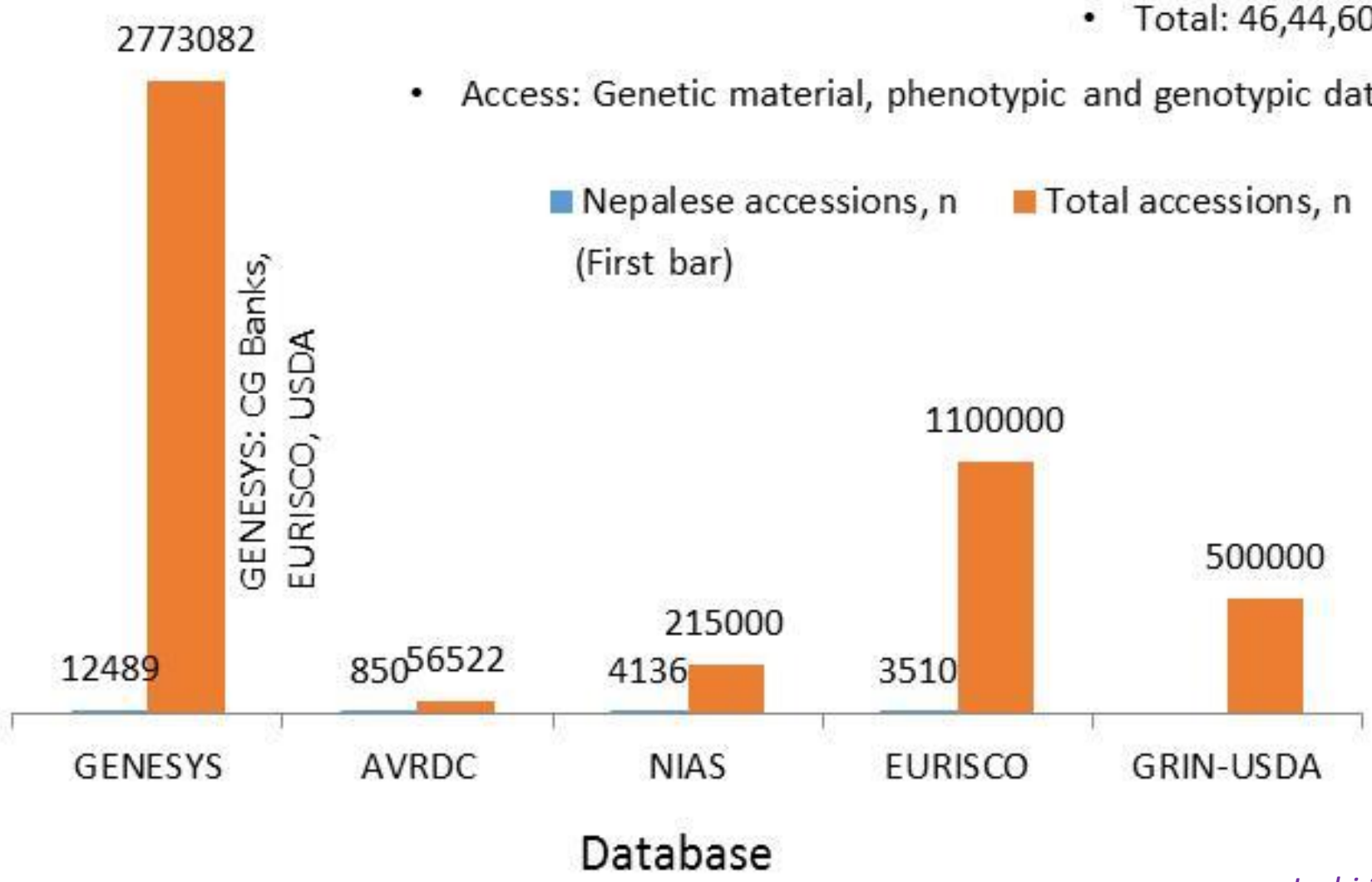


Revised
BKJ 2017

15 CGIAR Research Center: 8000 Scientists

Access to Crop Diversity for Breeders

- Total: 46,44,604
- Access: Genetic material, phenotypic and genotypic data



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National and International Obligation

- CBD and ITPGRFA
- SDG
- Zero Hunger by 2025
- ADS
- Seed Vision
- NARC Vision

ADS

MoAD (ADS) 2015-2035

1. Food and Nutrition Security
2. Poverty Reduction
3. Agricultural Trade Competitiveness
4. Higher and more equitable Income
5. Farmers' Rights ensured and strengthened

Inclusion

Sustainability

Private Sector, Cooperative Sector

Connectivity

Governance | Productivity | Profitable Commercialization | Competitiveness

Major Issues

- Genetics information of local crop landraces: Poorly documented
- Foundation of breeding for many crop species not established
- Hybridization in very limited crops and low in number
- Low priority for site specific varieties and heterosis breeding
- Advanced tools eg biotechnological tools, GIS, CAT, genomics and biometrics poorly applied
- Accessioning system not adopted (researched genotypes not available forever)


Many new crops and diverse environments,

Let's advance our knowledge on designing plant types that suit and meet specific need

Facilities in HICAST

- Learning environment, computer aided learning
- Professional teachers
- Books and references materials
- Access to national research centers, breeding institutes, gene pools

- Research and Training Directorate
- Department?
- Research + teaching labs and experiment + demo fields

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