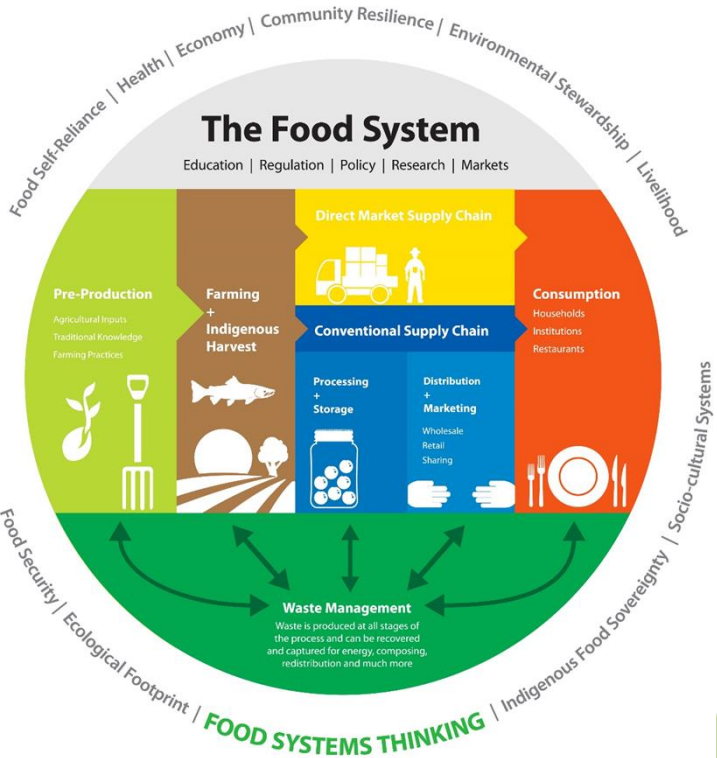
Theme 3: Keeping science relevant and future-focused

AN INTEGRATED CGIAR: INNOVATIONS IN SCIENCE, TECHNOLOGY, DEVELOPMENT AND THE SDGs

The CGIAR Portfolio 2017+



8 Agri-Food System programs

- Dryland Cereals and Legumes systems
- Fish agri-food systems
- Forests and Agroforestry landscapes
- Livestock agri-food systems
- Maize agri-food systems
- Rice agri-food systems
- Roots, tubers and bananas agri-food systems
- Wheat agri-food systems

Nutrition and Health

Policy, Institutions and Markets

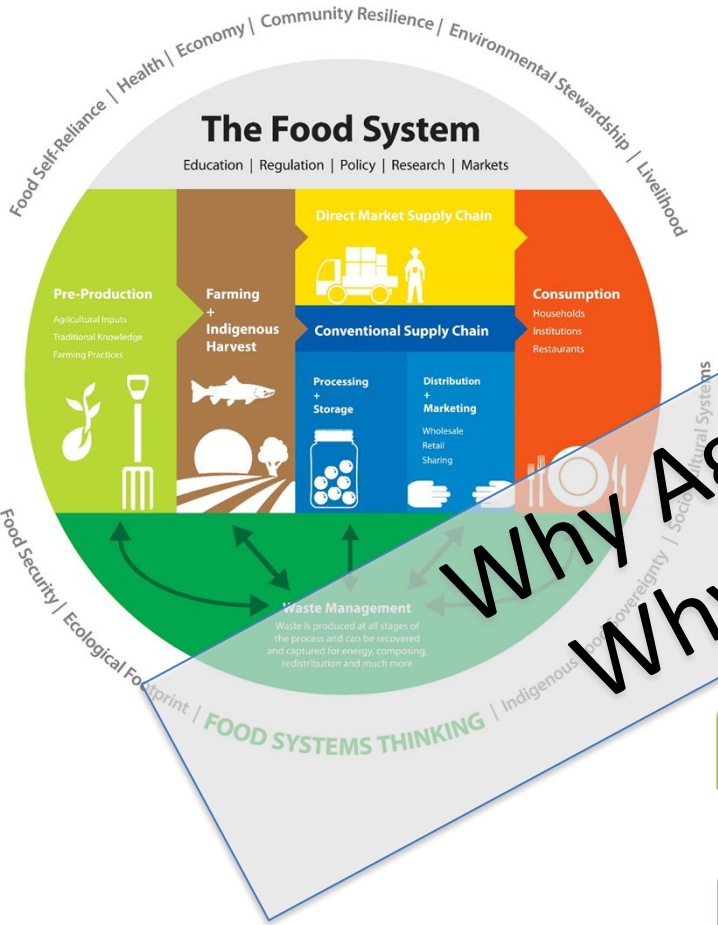
Water, Land and Ecosystems

Climate Change

3 Platforms

Genebanks	Genetic Gains	Big data & ICT

The CGIAR Portfolio 2017+



Why Agri-food Systems?
Why new Platforms?

8 Agri-Food System programs

- Dryland Cereals and Legumes systems
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3 Platforms

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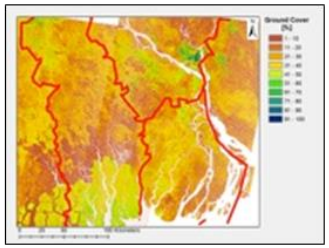
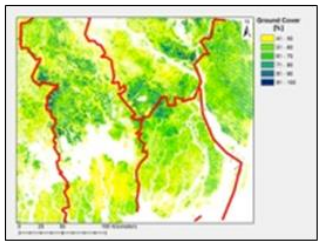
Livelihood approaches
are complex and diverse

Optimizing Agri-food systems

- Landscape targeting



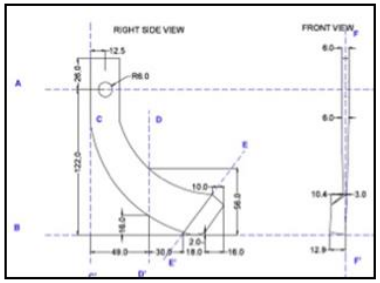


- Response farming, decision support

Courtesy of R. Buresh, IRRI

- Forgoing fallows and intensifying

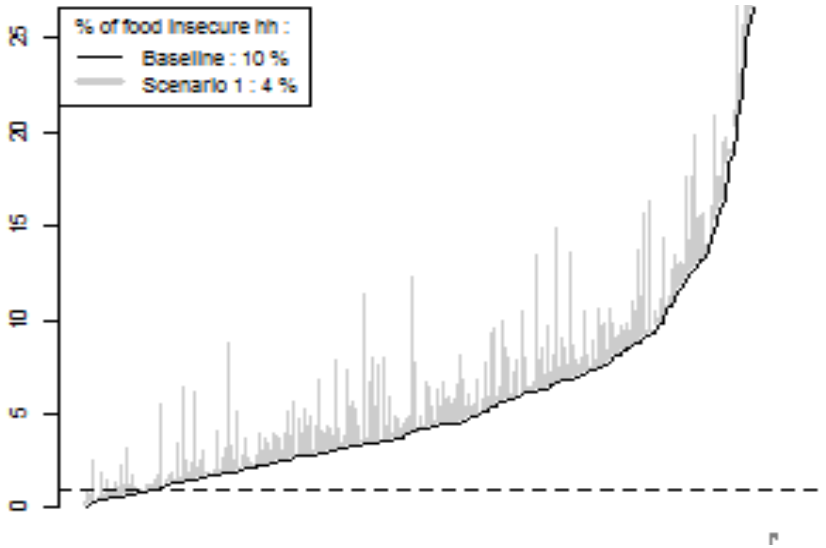
- Scale-appropriate farm machinery

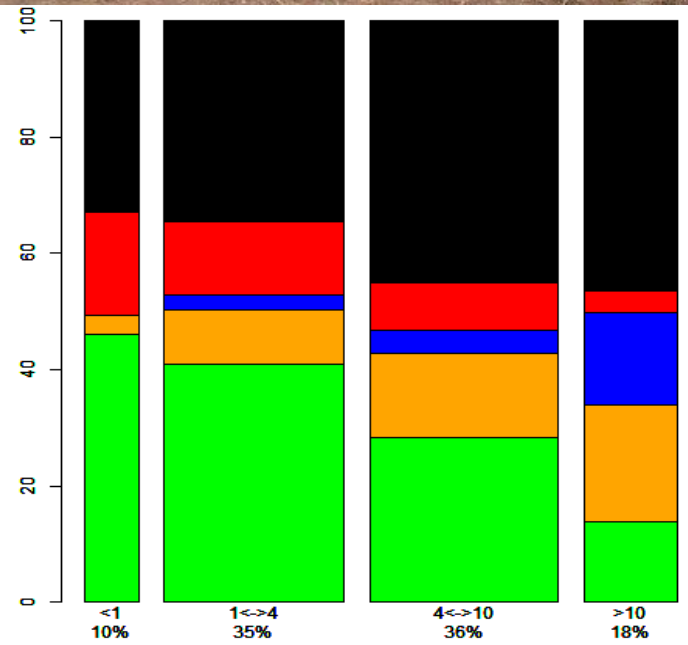


- Crop schedules and management

- Farm systems analysis, value chains

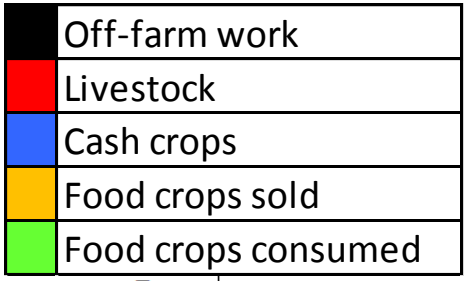
Testing interventions for their food security impact





Size of land holding

Contribution to food availability / security



Size of land holding

Successful intervention: robust benefits, scalable

11% Crop Yield Increase

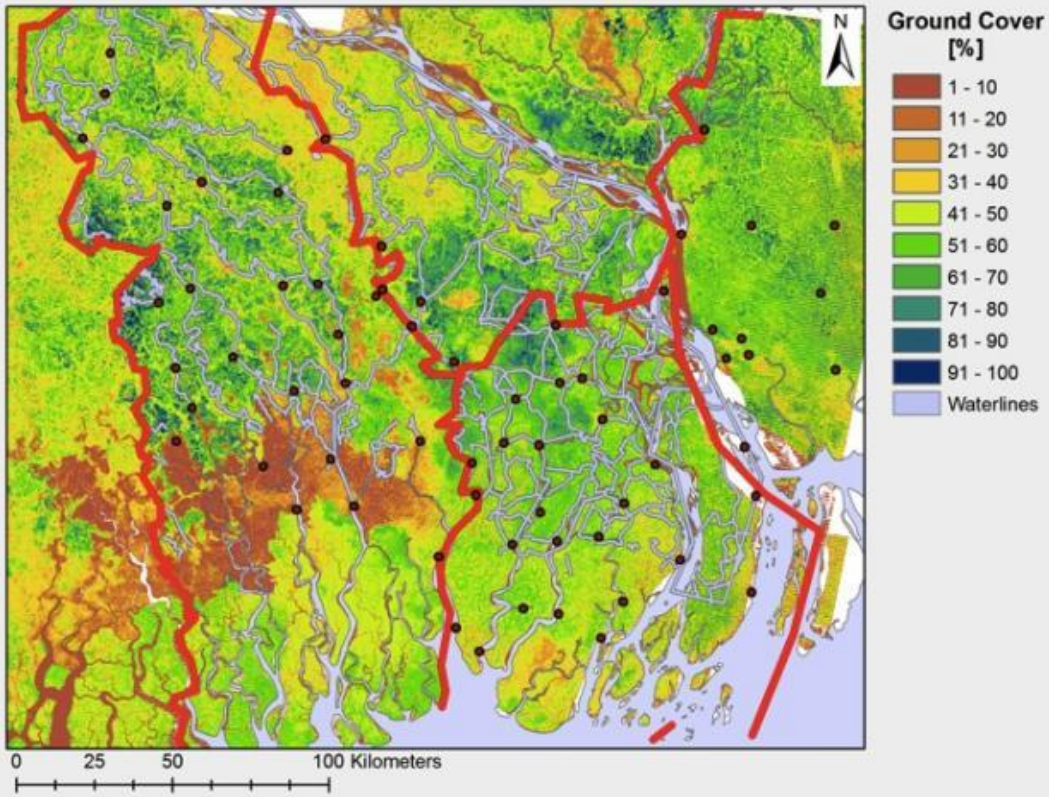
46% Energy Decrease

71% Irrigation Decrease

32% Profitability Increase

Scalable, impactful applications – data intensive

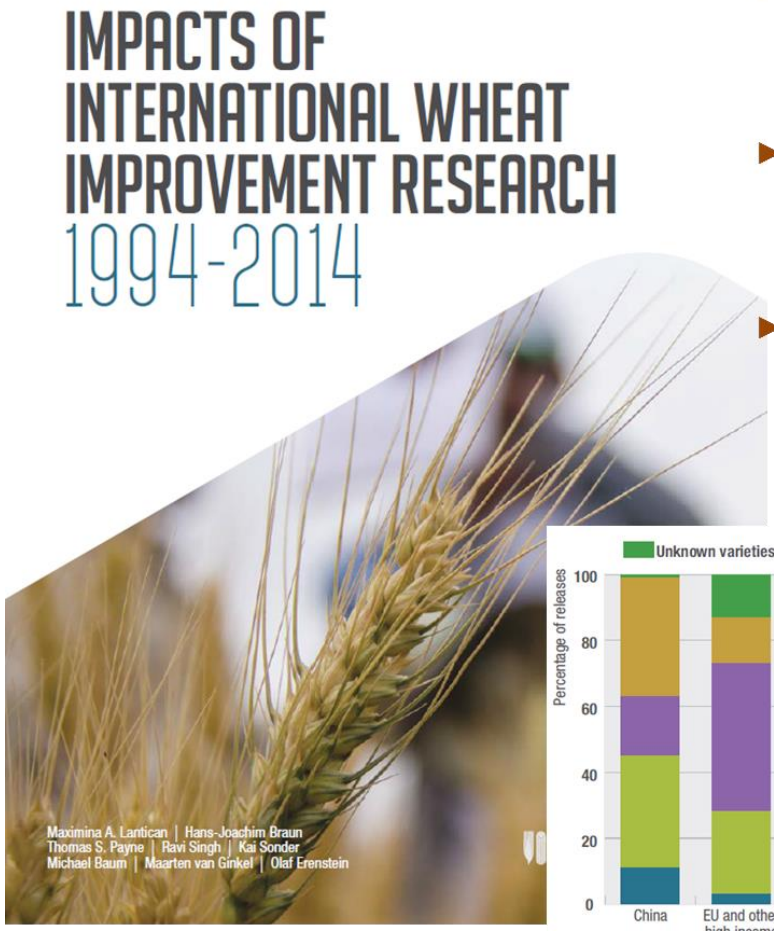
Surface water irrigation to intensify 83,000 ha of dry season land in southern Bangladesh



Bringing Big Data to Agriculture, and Agriculture to Big Data

CGIAR
Science for a food-secure future

Undoubtable component of Agri-food systems research: new germplasm



- CGIAR-related varieties sown on more than 100 million ha.
- Benefits range from US $2.2 to $3.1 billion [2010] per year, in added grain.
- Benefit-cost ratio on CG investment in wheat research: between 73:1 and 103:1.

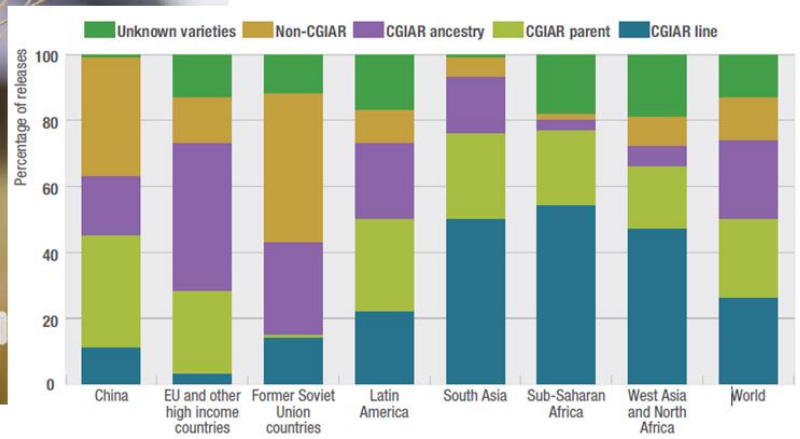


Figure 4.3. Spring bread wheat releases by region and origin, 1994-2014.

CGIAR Platform on Genetic Gains

Tools and services to accelerate genetic gains of breeding programs targeting the developing world

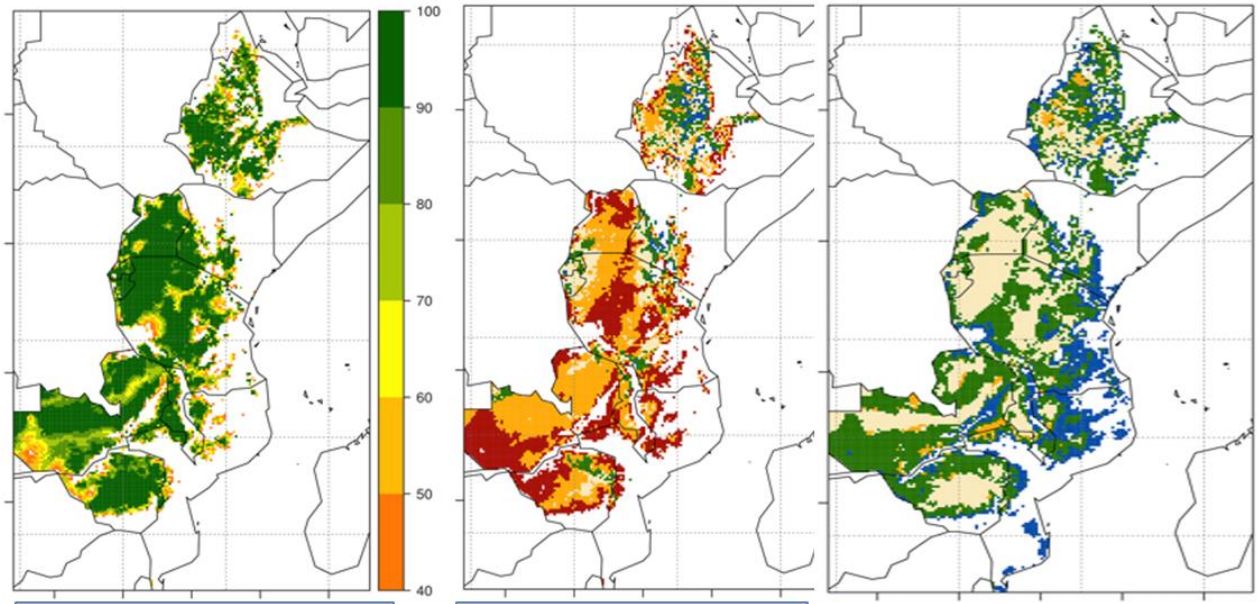
MARCH 2016

CGIAR

The CGIAR provides 94% of all germplasm distributed as part of the ITPGFA

The challenge

- **Meta-analysis:** 5% decrease in crop productivity for every 1° C degree of warming (Challinor et al. 2014)
- **Current breeding gains:** < 1% per annum
  (Fisher, Byerlee and Edmeades, 2012)
- **50-60% greater demands** (FAO 2012)



Current potential bean-growing area

The "Do-nothing" 2050 scenario

The improvement scenario

Sequencing Technology and Informatics will Revolutionize Future Breeding and Biotech Innovation

Rate of crop genome sequence production

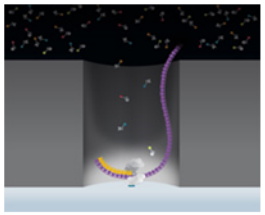
Genome per decade → *Genome per year* → *Genome per day* → *>100 genomes per day* → ***Greater Yield Gains***

ABI 3730

2001-2007

- *Roche 454*
- *Illumina*
- *SOLiD (Life Technologies)*
- *Helicos*
- *Pacific Biosciences*

2007-2014



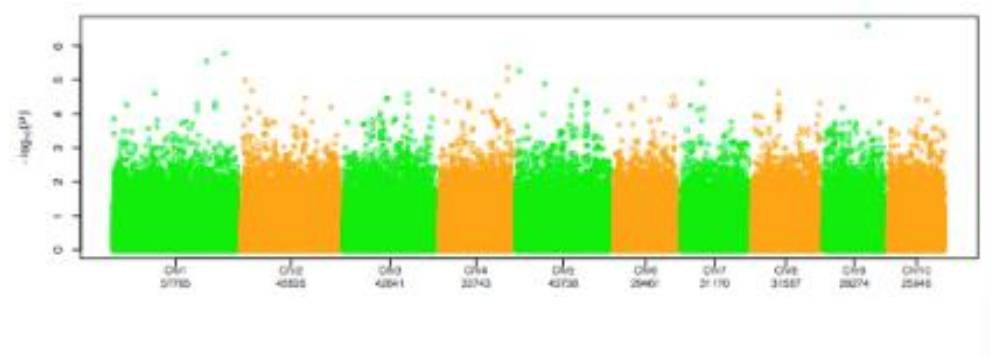
- *Roche 454*
- *Illumina*
- *SOLiD (Life Technologies)*
- *Helicos*
- *Pacific Biosciences*
- *Oxford Nanopore (Illumina)*
- *Ion Torrent*

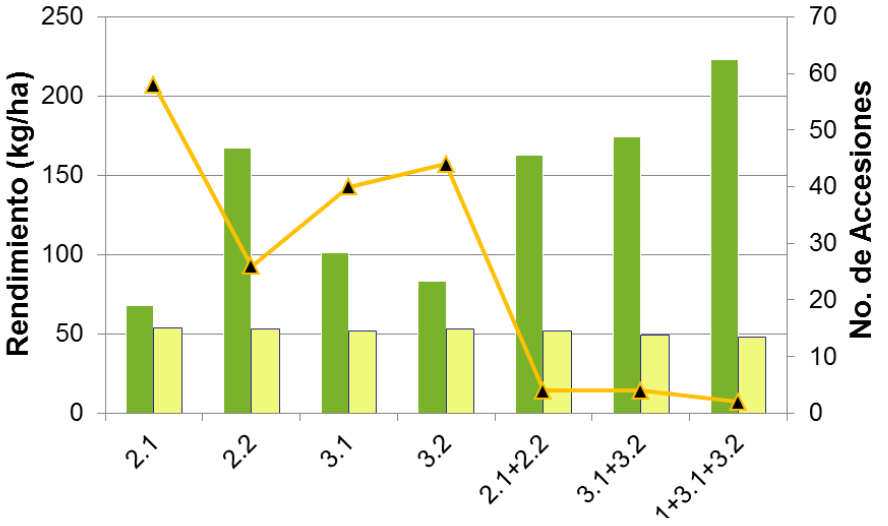
2014-2020

Thousands of genes per year → *Hundreds of thousands of genes per year* → *Millions of genes per year* → *Tens of millions of genes per year* → ***New options***

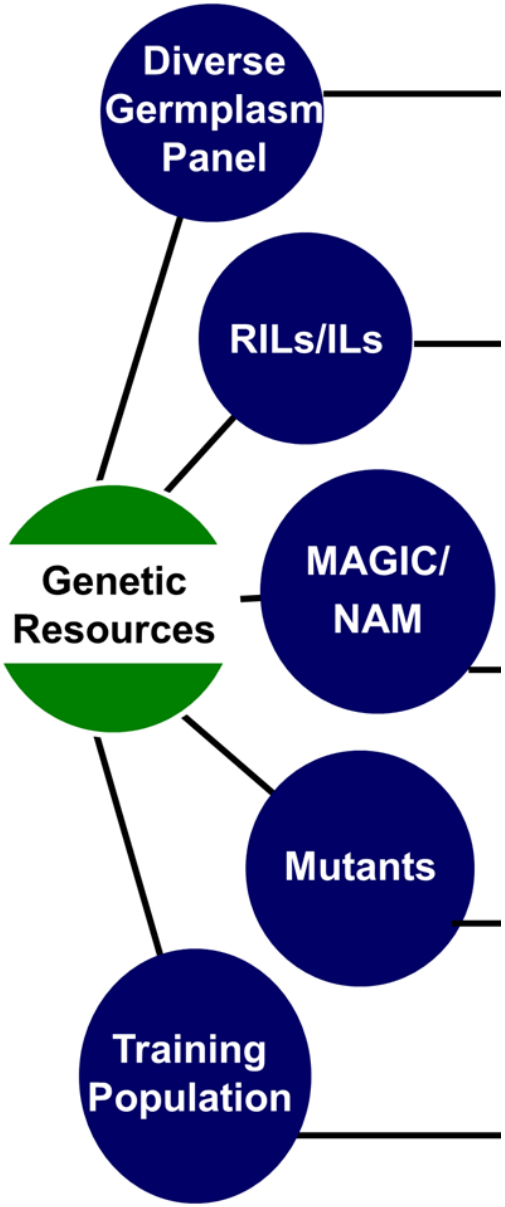
Rate of novel gene & allele discovery

Opening up the genebanks – from museums to supermarkets





Impact of allelic variations on yield



PLoS Biology 2014

Molecular breeding

- Drought tolerant chickpeas
- Scuba rice
- Biofortified crops
- Potato tuberization
- Fruit quality in banana
- Drought tolerant maize
- Durable rust resistant wheat

21+ CGIAR crops, 6 AFS Programs … 1 pipeline to accelerate … CGIAR + NARES + the private sector

1. PGR managers
2. Researchers
3. Pre-breeders

- Genebanks & passport data
- Genotyping/genomic data (GbS, Reseq.)
- Phenotypic data
- Geo-location data

…

Integrated data management system

1. Pre-breeders
2. Res. Plant Science
3. Breeders

- Mapping lines
- QTL discovery
- Gene discovery
- Trait performance
- SNP discovery
- DHs

…

Integrated pre-breeding activities

➢ Breeders
➢ Implementers/ technicians

- ✓ SNP validation
- ✓ MAS
- ✓ Gene pyramiding
- ✓ Multi-location field trials
- ✓ DHs

➢ Seed Res. & Implementers

- Seed delivery
- Seed Quality Control
- Seed technologies

…

- Pathogen detection
- Germination, vigor testing
- Seed lots homogeneity
- Logistic for seed distribution

➢ Multidisc. Res. (ecology, social sciences,…)

- ❖ Foresight
- ❖ Cropping systems
- ❖ Value chain
- ❖ Scaling out
- ❖ Post harvesting technologies
- ❖ Capacity building
- ❖ Other SAI approaches

Science partnerships

Development partnerships

21+ CGIAR crops, 6 AFS Programs … 1 pipeline to accelerate … CGIAR + NARES + the private sector

1. **PGR managers**
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Genetic Gains Platform
Identifying, enabling and becoming accountable for the mainstreaming of best practices

Scien partnerships
Development partnerships

The Sustainable Development Goals are quantitative

They require us to mainstream best practices across the CGIAR, NARES, civil society

agriculture,
forestry & fisheries

Department:
Agriculture, Forestry and Fisheries
REPUBLIC OF SOUTH AFRICA