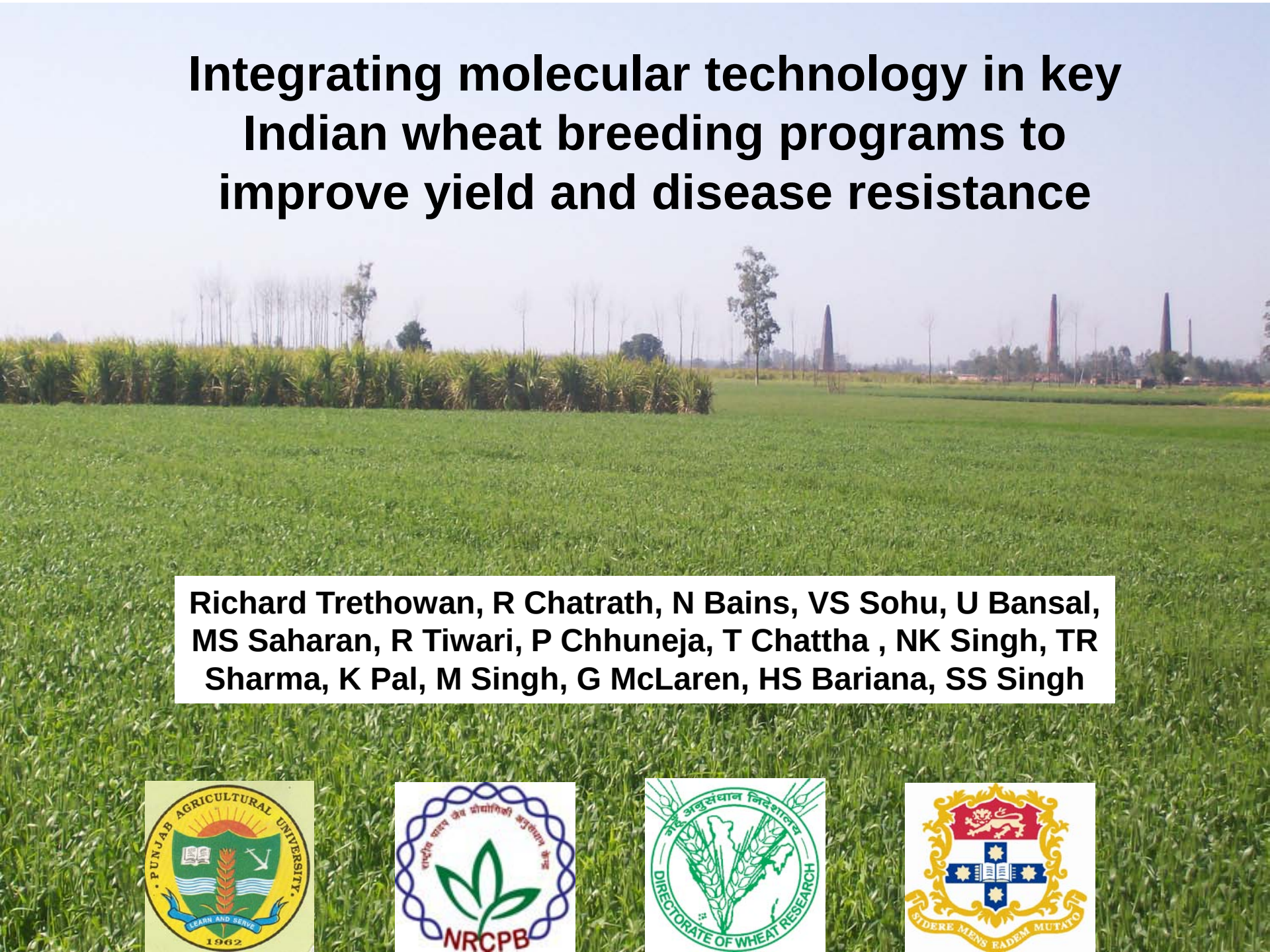
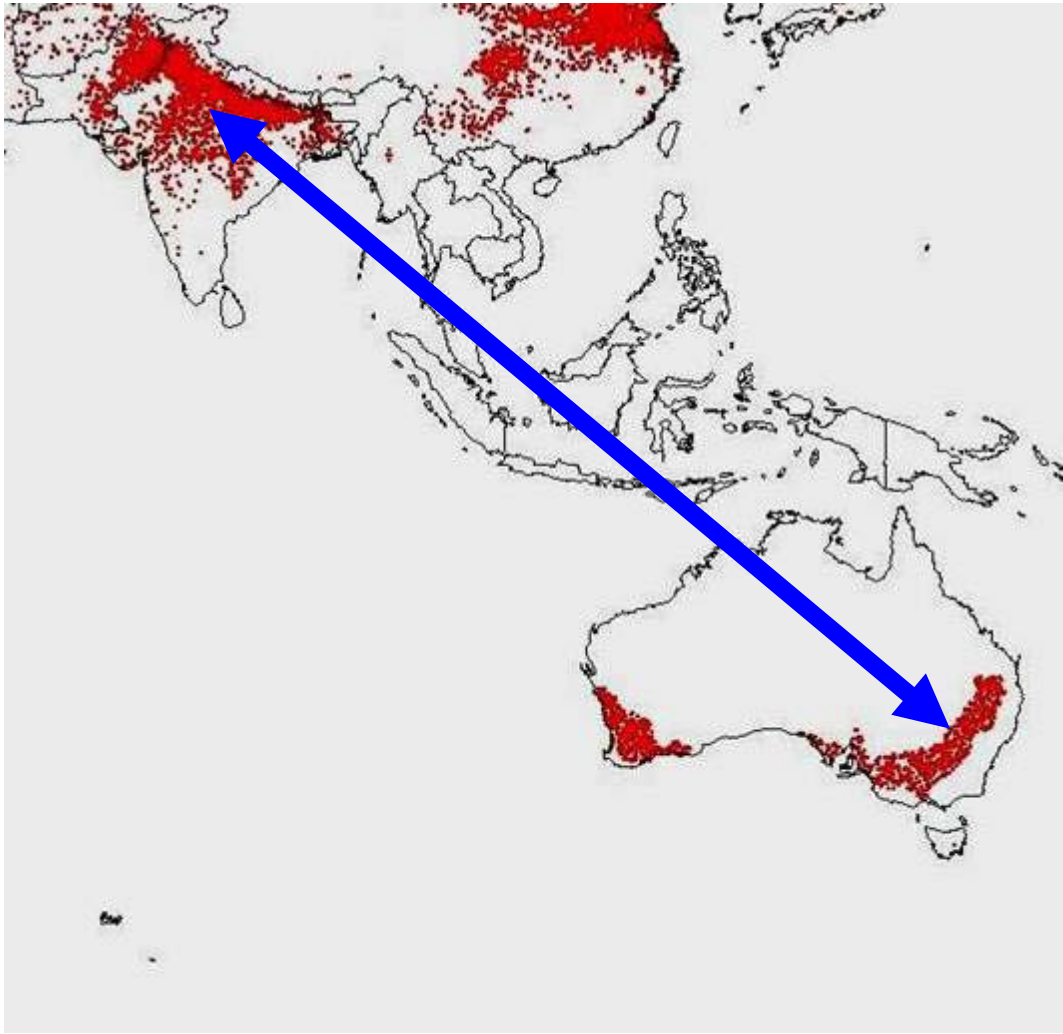
Integrating molecular technology in key Indian wheat breeding programs to improve yield and disease resistance



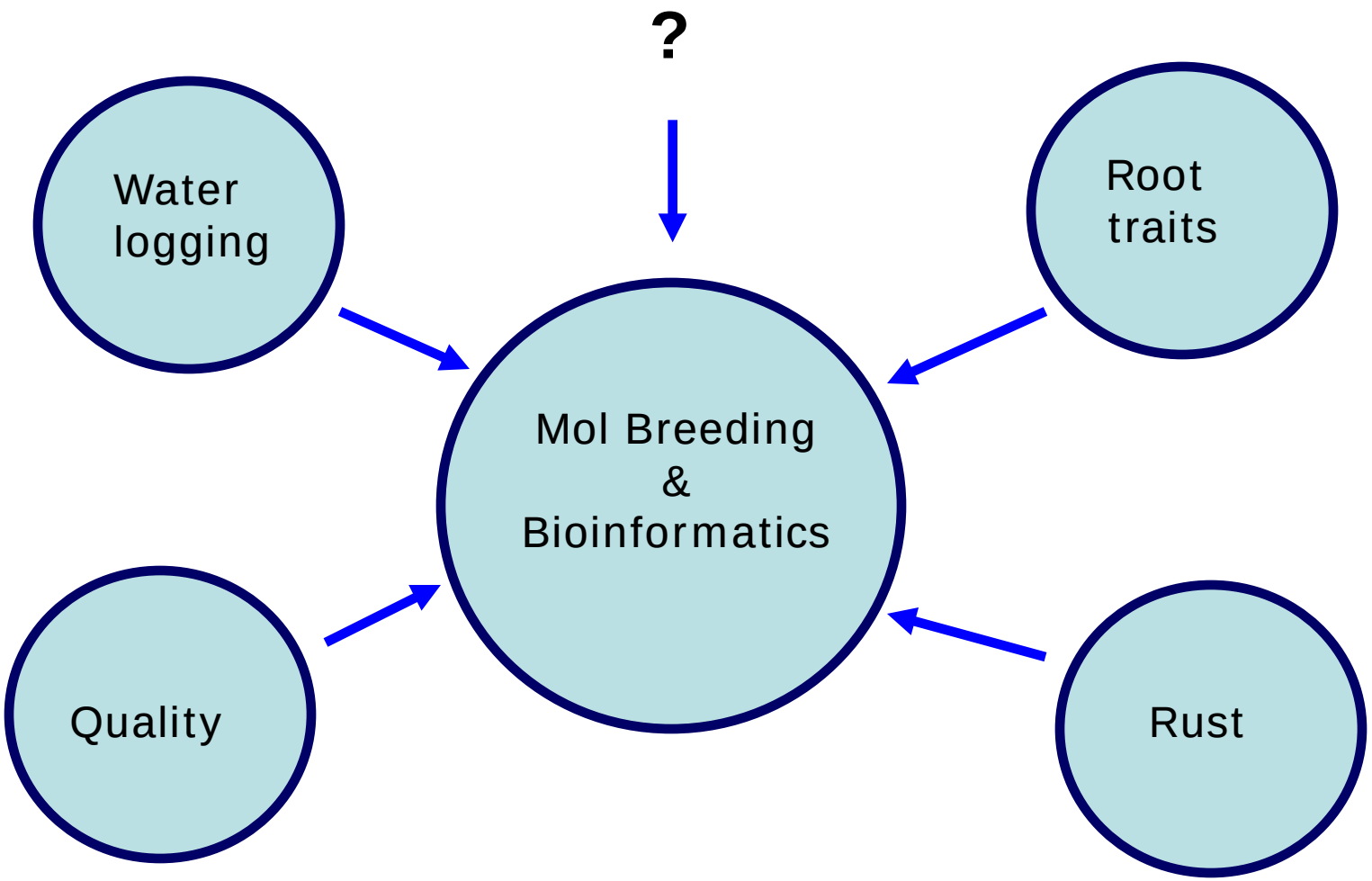
Richard Trethowan, R Chatrath, N Bains, VS Sohu, U Bansal, MS Saharan, R Tiwari, P Chhuneja, T Chattha , NK Singh, TR Sharma, K Pal, M Singh, G McLaren, HS Bariana, SS Singh

ACIAR/ICAR cooperation to enhance outcomes from wheat breeding

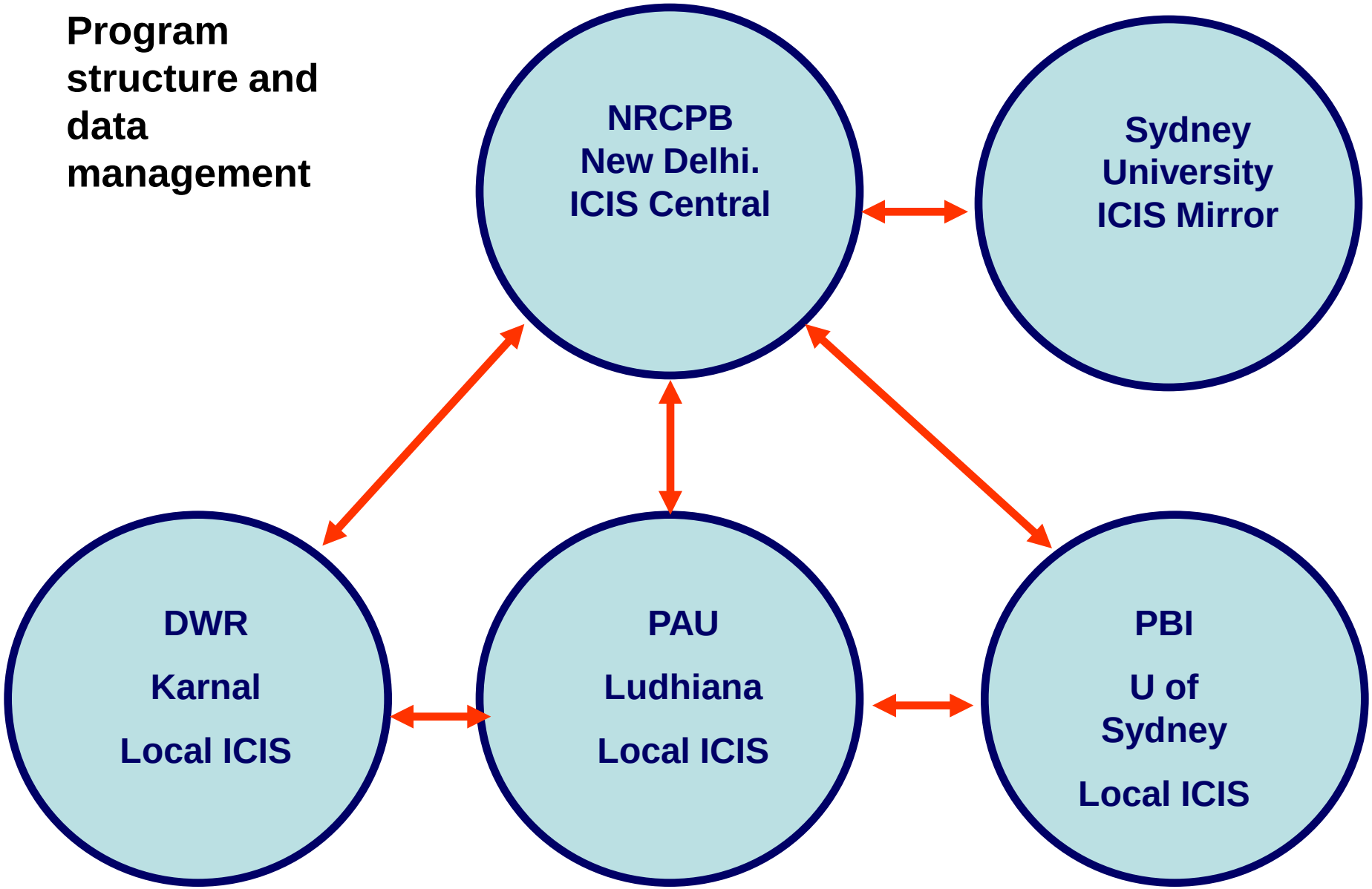
- History
- Spring wheat/adaptation
- Use of CIMMYT materials



ACIAR/ICAR Indo-Australian program on marker assisted breeding



Program structure and data management



- More effective selection and development of parents
- Modification of breeding program methods to optimize marker integration
- The development of an *Indo-Australian* germplasm
- Efficient management of data

Markers Available in wheat

Source: R Tiwari

Known gene profiles of Indo-Australian parental materials

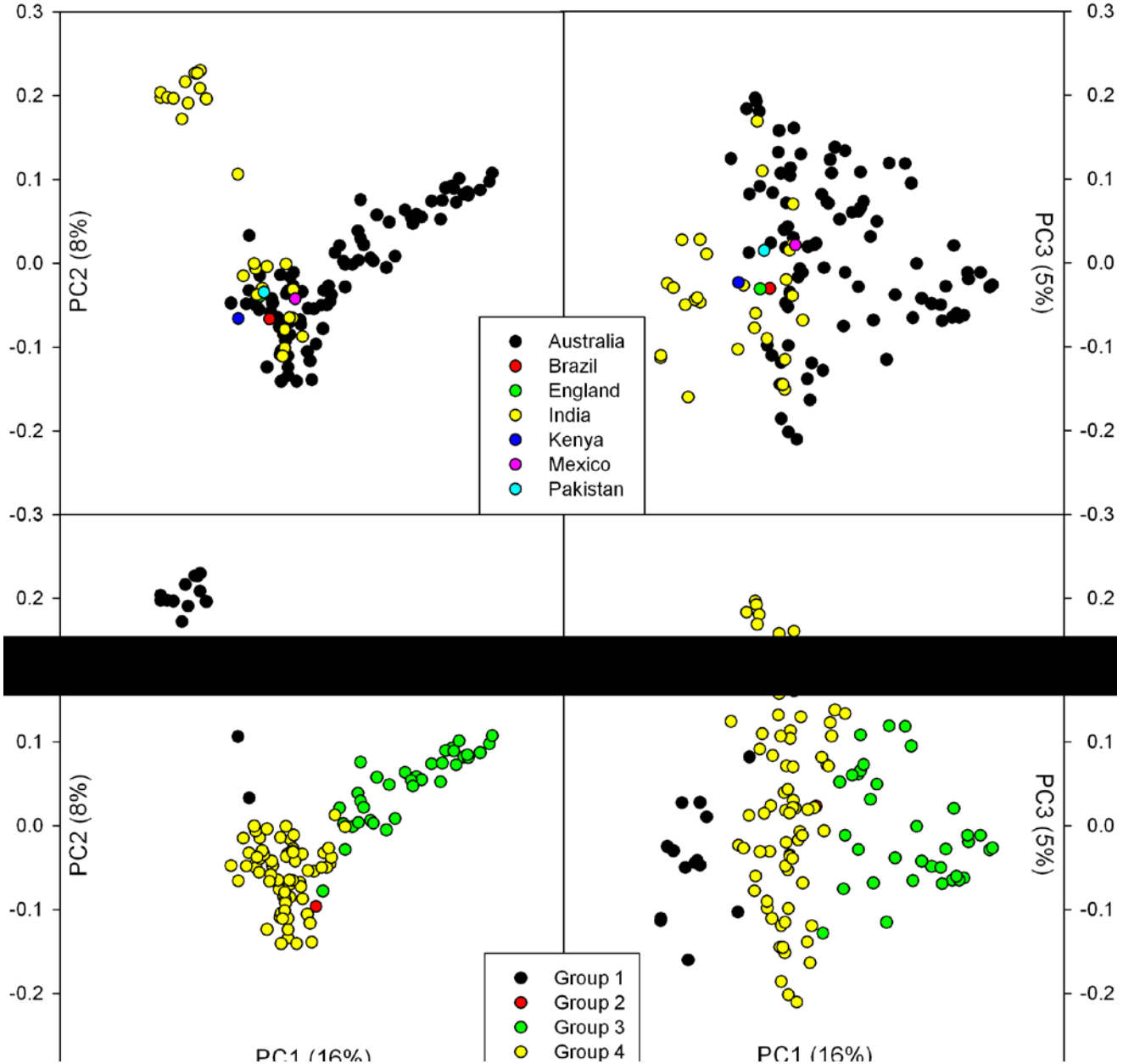
	Parents characterized	# of trait markers assessed	# traits measured
PBI	80	30	12
DWR	95	7	14
PAU	142	8	13

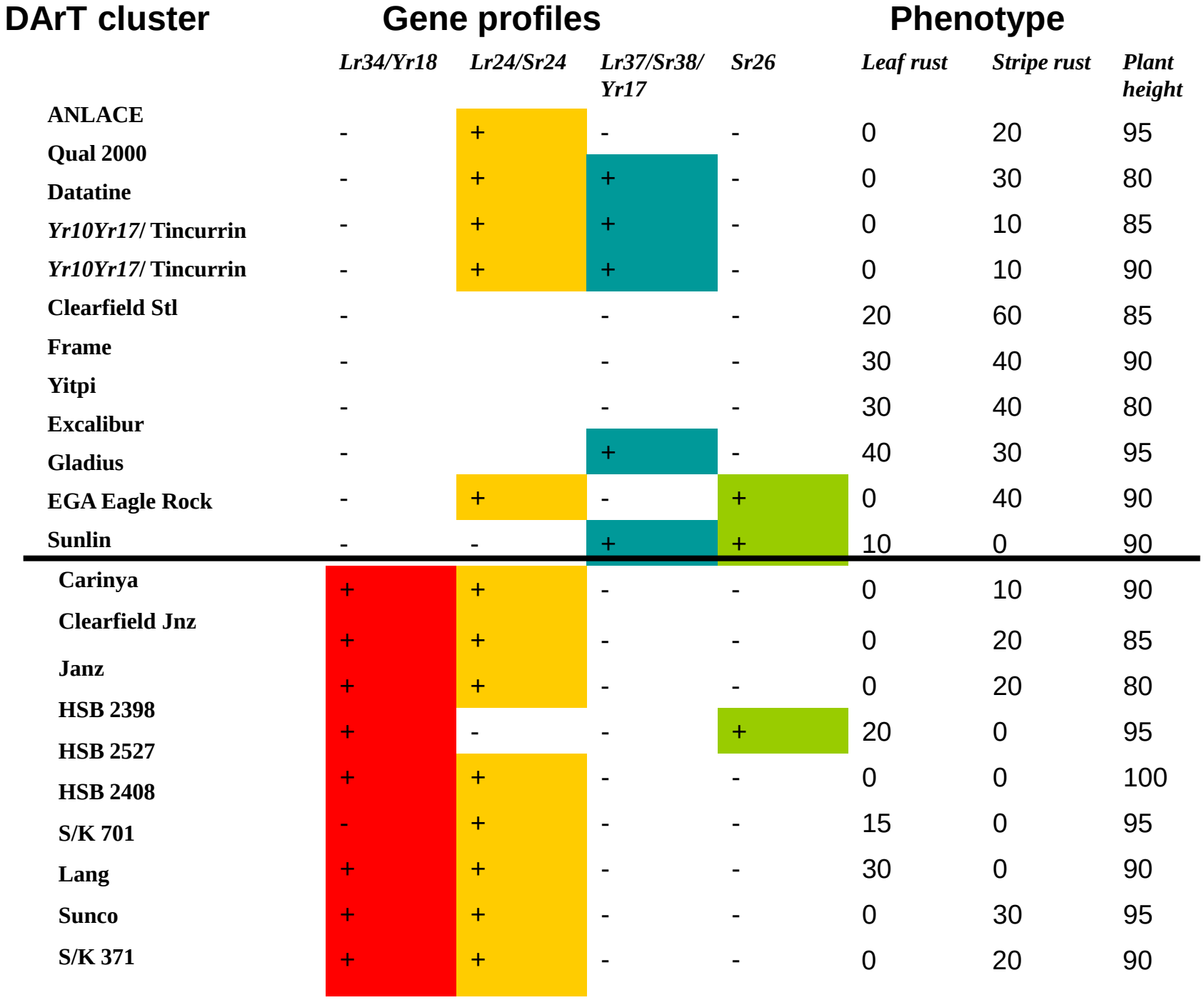
Equivalent to a data matrix of 52,878 observations

DArTs of the Indo-Australian parental set (180 genotypes; 1636 polymorphic clones)

Data matrix

294,486




DArT cluster
Gene profiles
Phenotype
Lr34/Yr18
Lr24/Sr24
Lr37/Sr38/ Yr17
Sr26
Leaf rust
Stripe rust
Plant height
ANLACE - + - - 0 20 95
Qual 2000 - + + - 0 30 80
Datatine - + + - 0 10 85
Yr10Yr17/ Tincurrin - + + - 0 10 90
Yr10Yr17/ Tincurrin - + - - 20 60 85
Clearfield Stl - - - 30 40 90
Frame - - - 30 40 80
Yitpi - + - 40 30 95
Excalibur - + - + 0 40 90
Gladius - - + + 10 0 90
EGA Eagle Rock + + - - 0 10 90
Sunlin + + - - 0 20 85
Carinya + + - - 0 20 80
Clearfield Jnz + - - + 20 0 95
Janz + + - - 0 0 100
HSB 2398 + - - 15 0 95
HSB 2527 + + - - 30 0 90
HSB 2408 - + - - 0 30 95
S/K 701 + + - - 0 20 90
Lang + + - - 0 0 90
Sunco + + - - 0 0 90
S/K 371 + + - - 0 0 90

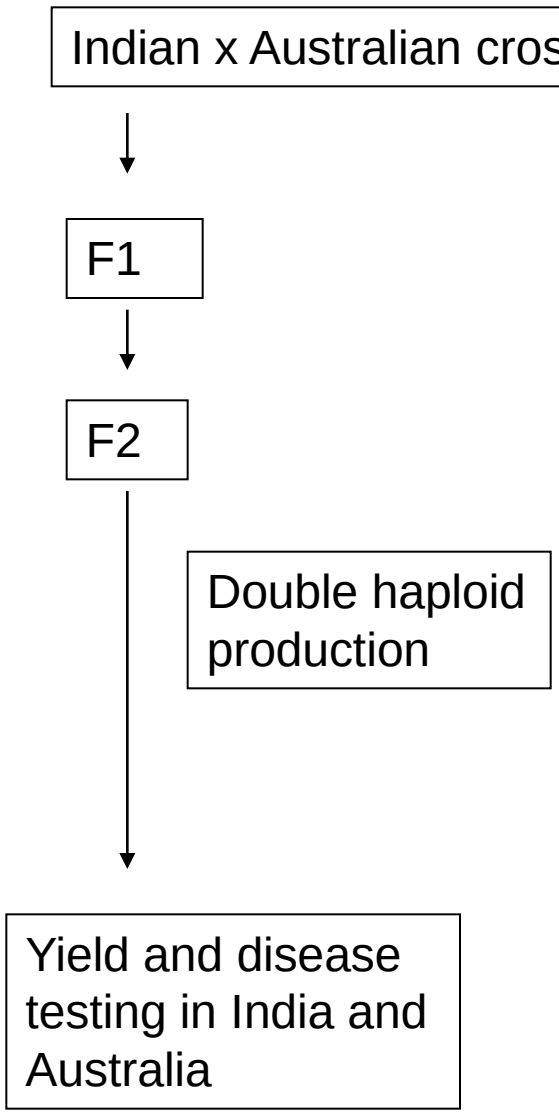
Types of Crosses using combined DArT and target rust gene data

Parents	***Foreground target genes***	**DArT grouping**
HD2733	*Lr34/Yr18; Lr28; Lr26*	1
C80.1/3*Sr2 Batavia	*Lr34/Yr18; Lr46/Yr29; Sr2; Lr19/Sr25*	4
DBW14	*Lr34/Yr18*	3
PBW175	*Lr34/Yr18; Sr2*	4
FLW6	*Sr24/Lr24; Sr2*	4
HSB3176	*Sr2; Sr26; Yr15; Yr24*	4

Marker Assisted Selection at DWR & PAU (number of assays)

	2007/08	2008/09	2009/10
Parents	1,020	1,292	3,966
Segregating material	800	6,598	10,500
Advanced lines		300	
Total	1,820	7,890	14,466

Basic breeding scheme (*Indo-Australian*)



Selected using background & foreground genotype + phenotype

F1 (MAS applied for target rust alleles if a complex F1)

F2 MAS for target alleles

Double haploids produced on those F2 plants positive for all target alleles

Confirm rust gene profile, genotype & field testing in India & Australia

Double haploids in India (progress at PAU)

- Up to 300 double haploid plants produced
- Targeting *Sr2, Sr24, Sr25, Sr22, Sr26, Sr36*

Types of data being generated

- Pedigrees
- Phenotypic data (eg yield, disease reaction)
- Genetic data
  - Markers for known genes (eg SSRs)
  - DNA fingerprints (eg DArTs)

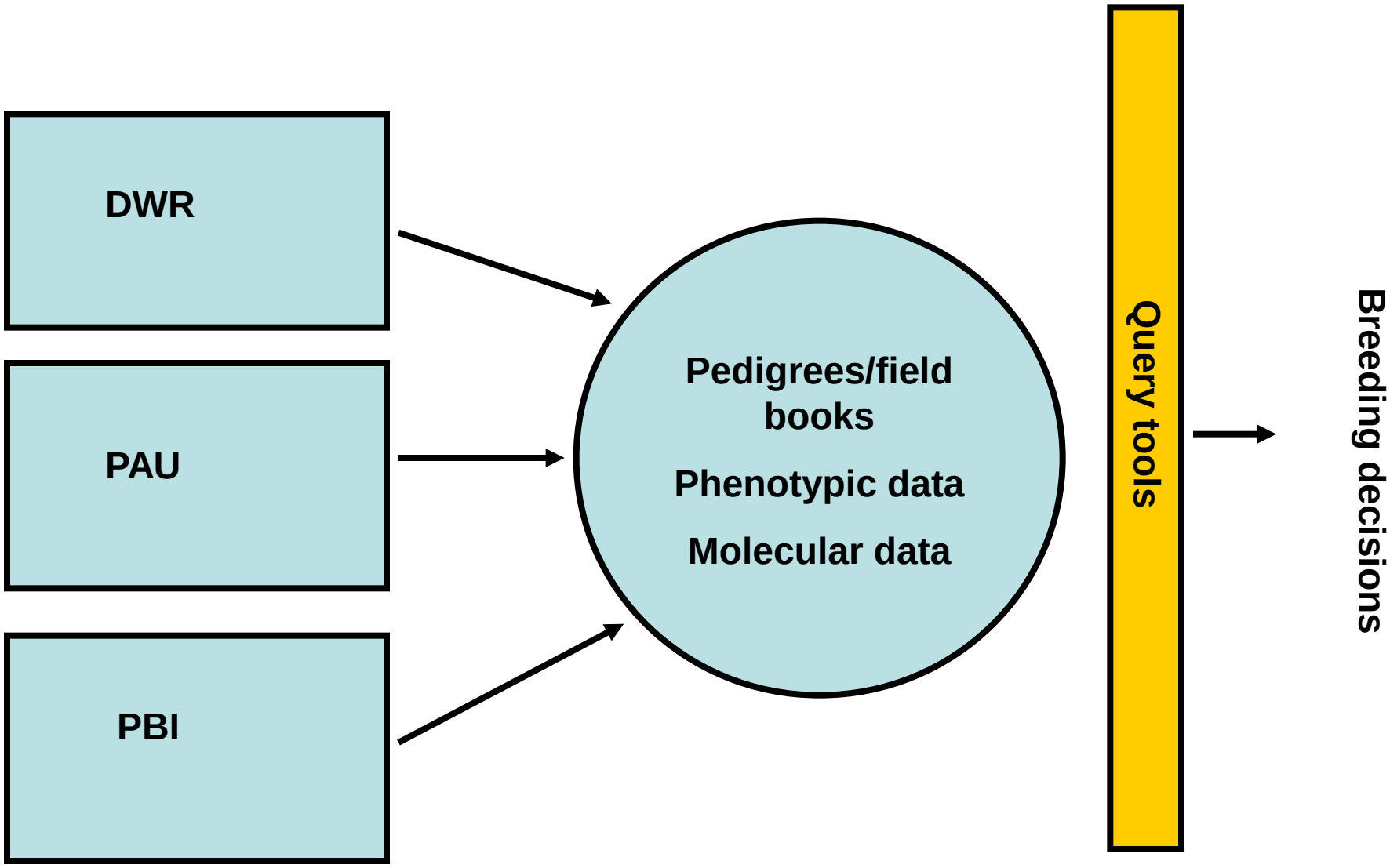
The International Crop Information System (ICIS) used to manage data

- Internationally developed and publicly available
- Molecular and phenotypic information can be combined in one database
- Added value of pedigree management and field book functions
- Web enabled but access to sensitive data can be partitioned

Structure of ICIS

- GMS (Genealogy Management System)
- DMS (Data Management System)
- GEMS (Gene Management System)

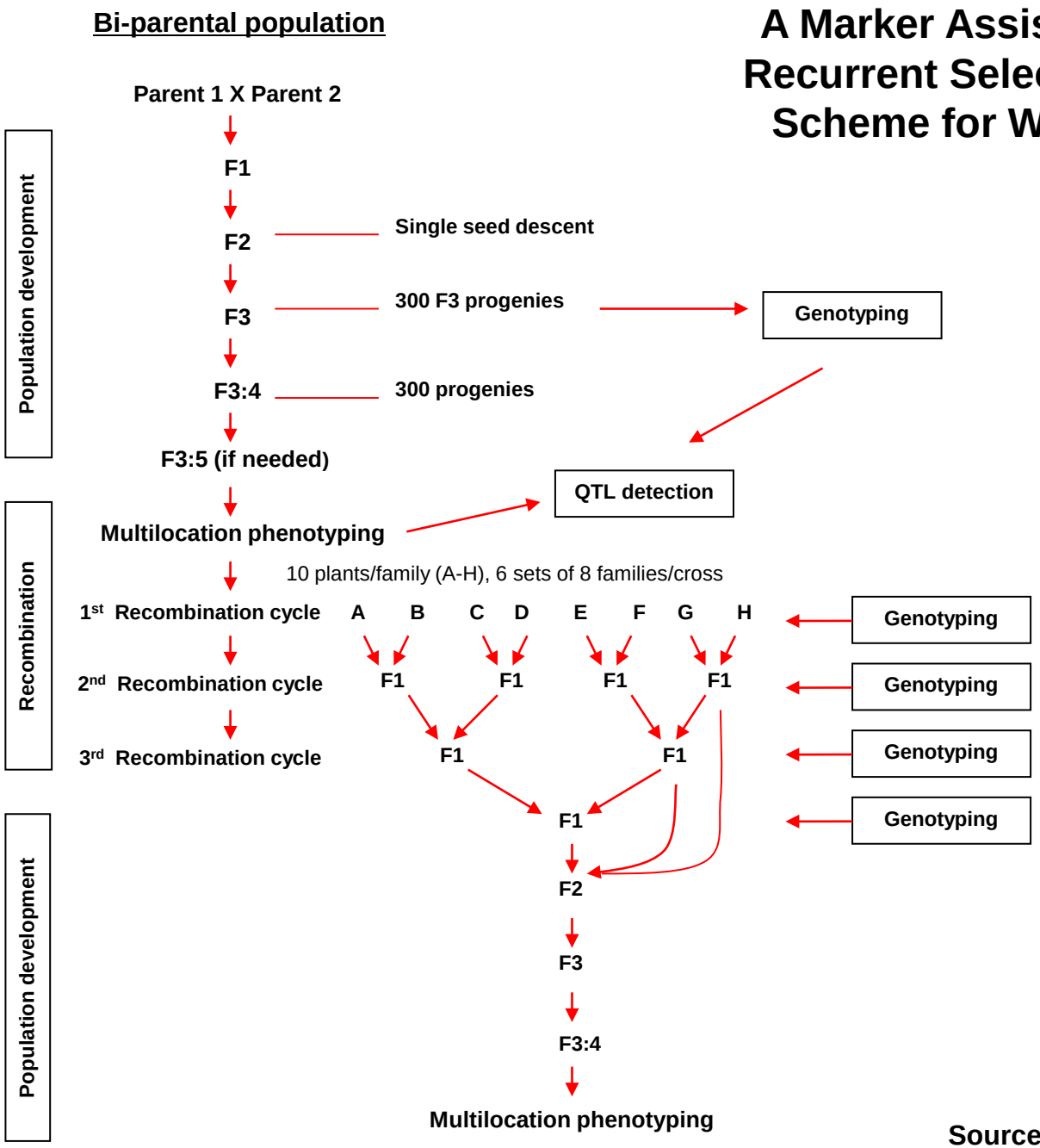
Progress in managing data within the Indo-Australian program



A step-up in complexity: improving yield in water limited environments

ICAR, CIMMYT, University of Sydney collaboration through the GCP

A Marker Assisted Recurrent Selection Scheme for WUE



Source: X Delannay

Acknowledgements

Teams at:

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