

A close-up photograph of rice plants with golden-brown panicles, serving as a background for the text.

Product management and delivery of GCP researches on QTL for rice disease resistance in Asia

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Two rice advanced backcross populations:

- **IRRI - ICABIOGRAD Bogor Indonesia:**

Donor: Oryzica Llanos-5 (Colombia, improved, upland indica, durable blast resistant, QTLs and 8 major genes)

Recurrent: Way Rarem (Indonesia, improved, upland indica, Al and Fe toxicity tolerant)

Trait package: Blast resistance & P-deficiency tolerance

- **IRRI - CRURRS Hazaribag Jharkand, India:**

Donor: Moroberekan (Africa, traditional, upland tropical japonica, durable blast resistant, QTLs and 6 major genes, drought tolerant)

Recurrent: Vandana (India, improved, upland tropical japonica-aus admixture, drought tolerant)

Trait package: Blast resistance & drought tolerance

Research Status:

- **Way Rarem/Oryzica Llanos-5**

QTL mapping for blast resistance has been done (BC_2F_2)

QTL mapping for P-deficiency tolerance is going on

Promising BC_2F_5 has been selected (blast & P-deficiency)

BC_3 and BC_4 advancing is going on

- **Vandana/Moroberekan**

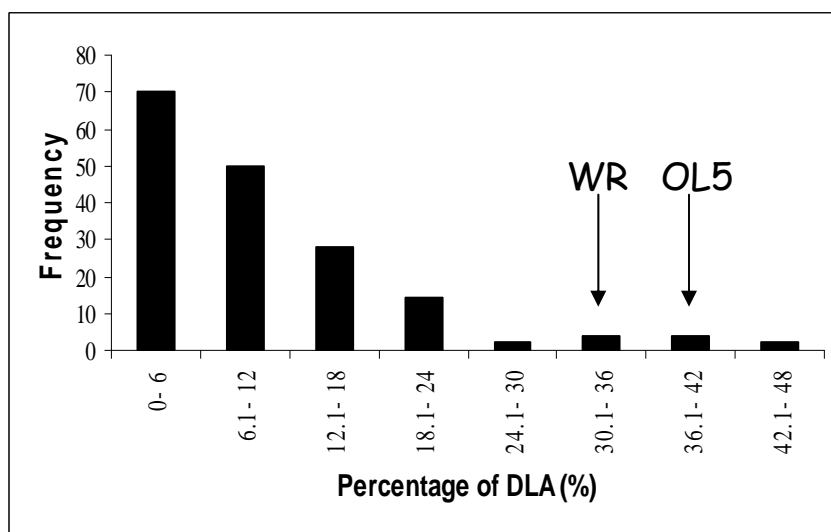
CG & QTL mapping for blast resistance has been done (BC_3F_3)

Promising intermated BC_3F_6 lines has been selected (blast & drought)

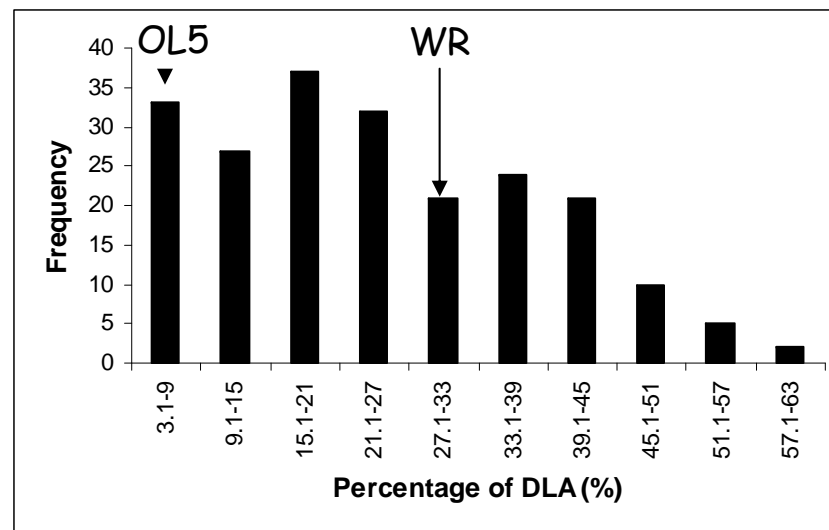
Evaluation by breeders of elite lines for eastern India is in progress

BC_4 advancing is on-going

Frequency distribution of response of Way Rarem/Oryzica Llanos-5 BC2F3 & BC2F4 populations to blast in the fields (Indonesia)

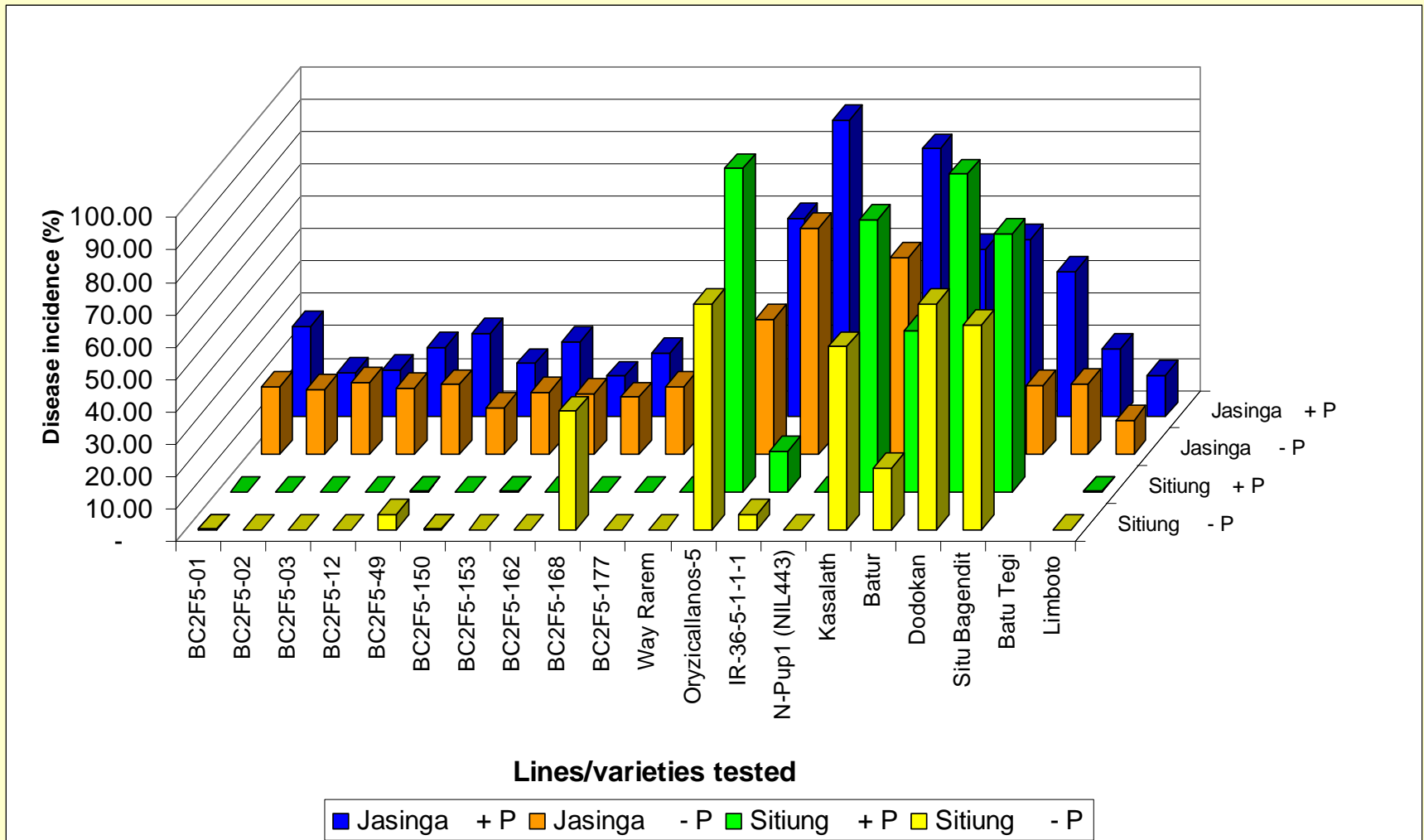


Sukabumi, West Java, 2003



Lampung, Sumatra, 2004

Response of promising Way Rarem/Oryzica Llanos-5 BC₂F₅ lines to blast at -P and +P conditions in Sitiung (West Sumatra) and Jasinga (West Java)



Performance of Way Rarem and Oryzica Llanos-5 in P-deficient soil



Way Rarem



Oryzica Llanos-5



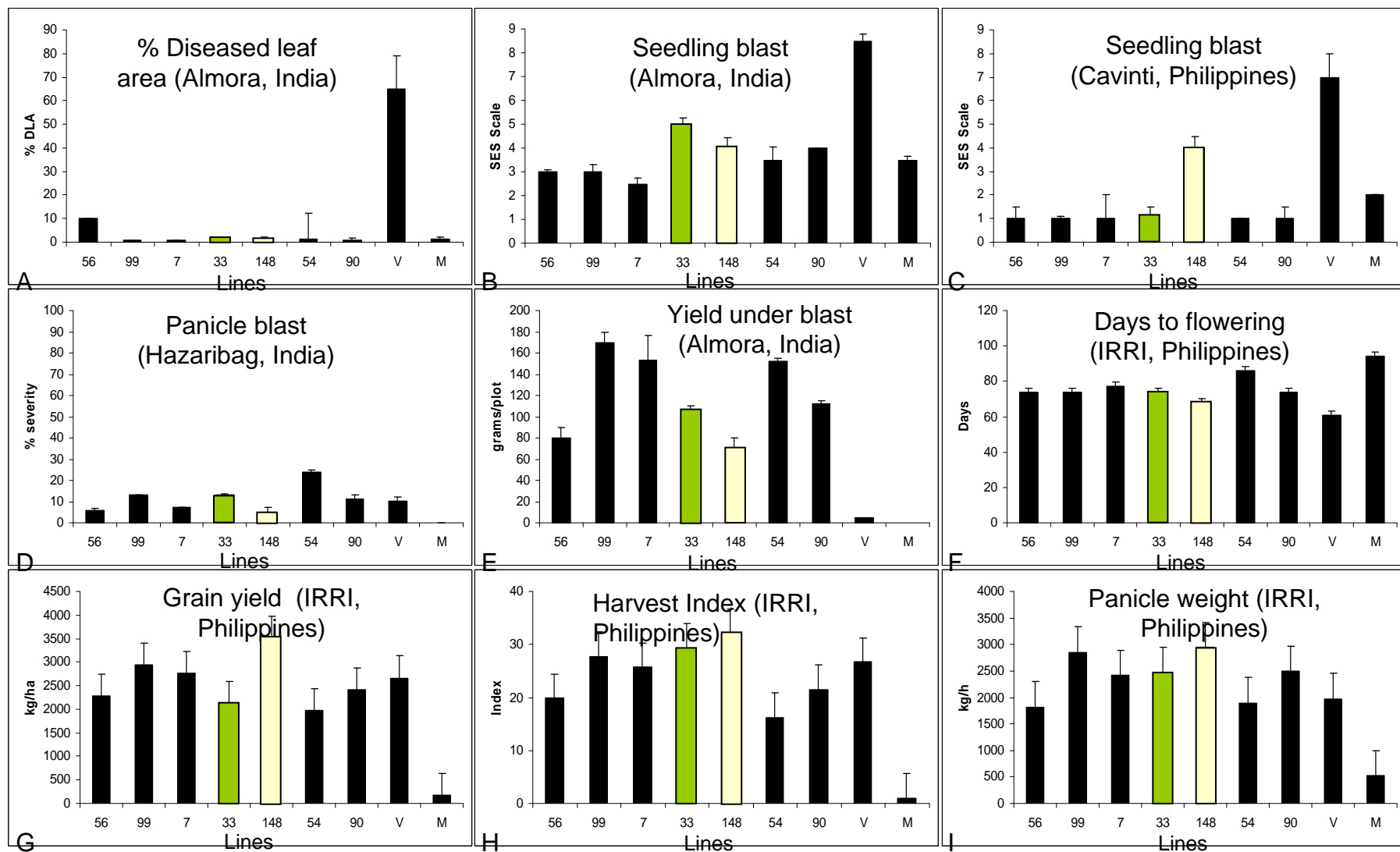
Kasalath (*Pup-1* donor)



Situ Bagendit (susceptible check)

Jasinga, West Java, 2007

Performance of promising Vandana/Moroberekan intermated BC₃F₆ lines under blast and drought stress



Target regions

- Way Rarem/Oryzica Llanos-5:
Uplands in Indonesia (~1.5 M ha) dominated by red yellow podzolic soils (problems of acidity, aluminum toxicity, phosphorus deficiency), with high rainfall (Sumatra, Kalimantan, Irian Jaya, West Java)
Uplands in other countries with similar characteristic
- Vandana/Moroberekan:
Drought-prone unbunded sloping uplands, mostly in eastern India (~5.2 M ha)
Drought-prone uplands in other countries

Output/Product:

- Elite lines derived from Way Rarem/Oryzica Llanos-5
 - Phosphorus tolerance (maybe different from *Pup-1*)
 - Blast resistance
- dQTL NILs in Way Rarem background
- Elite lines derived from Vandana/Moroberekan intermated population
 - Drought tolerance
 - Blast resistance
- dQTL NILs in Vandana background

Transfer plans: I. Development stage

- Identification of QTLs for P-deficiency tolerance in Way Rarem/Oryzica Llanos-5 population
- Identification of QTLs for drought tolerance in Vandana/Moroberekan population
- MAB for NILs development for each trait package (blast+P-deficiency, blast+drought)
- Multi-location trials of elite lines
- Funding support: on-going GCP Project (disease QTL), GCP Capacity Building Program (IRRI-ICABIOGRAD), NAIP-funded project (IRRI-CRURRS), NARS budget

ICAR-IRRI Upland Rice Shuttle Breeding Network

- Initiated in 2002, the network links 11 ICAR and university centers in the upland ecosystem of eastern India, where 5 million ha are subject to drought, weed pressure, and low fertility.
- Evaluation of promising materials in observational nurseries, replicated yield trials and PVS
- Trials are conducted at high replication under both low- and moderate-input management to identify stress-tolerant yet responsive varieties.
- Breeders meet annually to analyze results, plan, and exchange information.
- The network gives Indian breeders in this under-served ecosystem access to a large amount of breeding material and will result in a stream of improved germplasm for this unfavorable ecosystem.

Transfer plans: II. Farmer adoption stage

- Promising lines will be provided to INGER and for field tests in different countries
- Participatory selection: mother-baby trials in farmers' fields (promising lines, popular varieties, farmers' traditional varieties)

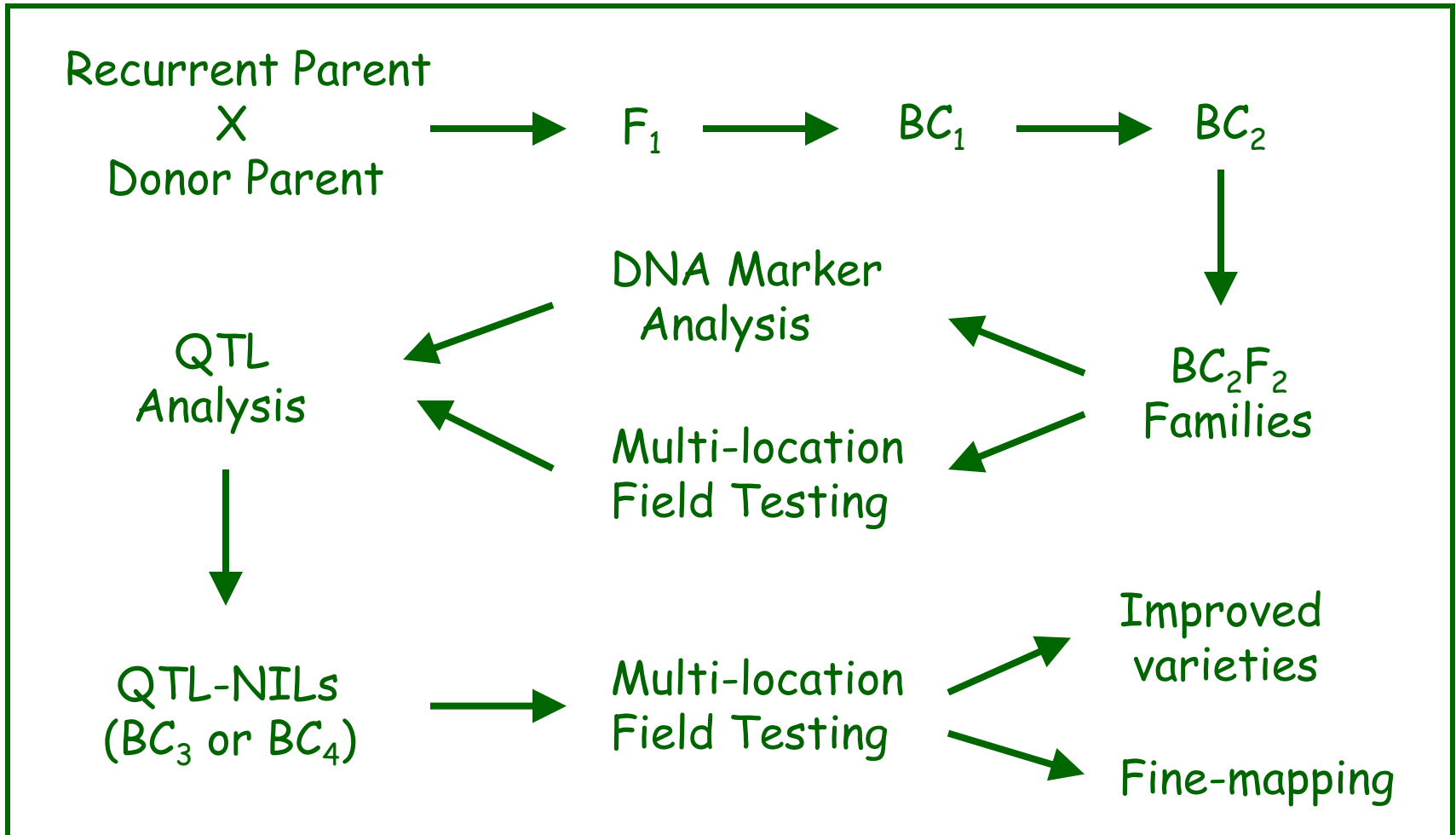
Constraints: I. Development stage

- Low polymorphism between two indica parents (Way Rarem & Oryzica Llanos-5)
- Low R^2 (10 - 20%)
- Reliability of phenotypic data (blast, P-deficiency, drought)
- Low integration between molecular genetics and plant breeding
- Lack of knowledge about characteristics of importance to farmers (stickiness, aroma, other cultural preferences)
- Lack of knowledge about characteristics of target environment
- Low cost-efficiency of molecular analysis (if we use SFP analysis, may still be expensive at the moment)
- Lack of funding in NARS

Constraints: II. Farmer adoption stage

- Upland rice farmers cannot get seed of new varieties
- Lack of seed production and distribution system
- Lack of collaboration with seed producer
- Lack of funding in NARS

Advanced backcross QTL strategy



(adapted from Tanksley and Nelson, 1996)