

## SP 3

# “Bridging genomics, genetic resources and breeding to improve wheat and barley production in Morocco”

### *Principal Investigator and Lead Institution:*

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### *Collaborating Scientists and Institutions:*

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**ICARDA:** Sripada M. Udupa

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**CIMMYT:** Susanne Dreisigacker



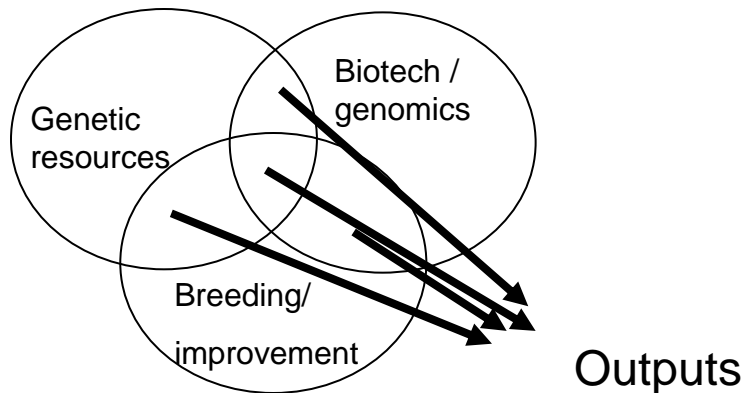
# Rationale, Objectives and Outputs

## Rationale:

Exploit germplasm, new genomics technologies, and tools  
for Better utilization of plant genetic resources and improving breeding efficiency and effectiveness  
to Broaden genetic base of wheat and barley  
for Improving productivity  
Thereby, enhancing the food security and income of local, resource-poor farming families

## Objectives:

1. Enhanced utilization of wheat and barley germplasm (GCP + others)
2. Mining the novel genes and alleles conferring tolerance to various biotic and abiotic stresses and improving end-use quality
3. Development of segregating populations for tagging of loci
4. Generation of new markers including candidate gene/allele-based molecular markers
5. Development of wheat breeding lines with improved yield, end-use quality and adaptability and enhanced tolerance to stresses through application of genomics tools in conventional breeding program
6. Empower Moroccan researchers, to implement new tools of genomics



## Outputs:

- New sources of resistance to stresses
- Mapping populations
- New markers for the stresses
- Improved germplasm

**Objective: 1 Enhanced utilization of wheat and barley germplasm using exotic/core collections and the reference sets developed by GCP to enable scientists to screen and use lines to broaden the genetic base**

*Rationale: Insect pests, pathogens, pathotypes, nature and extent of abiotic stresses could be different in Morocco.*

### ***Genetic diversity evaluated***

<u><b>Source</b></u>	<u><b>No. of lines received</b></u>
<b>Durum</b>	
Med. Collection	96
ICARDA accessions	250
<b>Bread</b>	
MEs, WWW, SYDERGRCP	400
Clermont Ferrand, France	48
<b>Barley</b>	
ICARDA	96
Moroccan	100

Drought  
Mild winter  
Heat  
H. Fly  
L Rust  
Y Rust  
STB  
R Rots  
G. Quality

**Objective 1:** Enhanced utilization of wheat and barley germplasm using exotic/core collections and the reference sets developed by GCP to enable scientists to screen and use lines to broaden the genetic base

## ***Useful genetic diversity identified***

**(Screening under “Hot Spots” and controlled conditions)**

### **TOL / Resistance in Durum wheat:**

Hessian fly: 1

Leaf rust resistant: 58

Root rots (C.C.) : 16

Salinity + drought (C.C.) : 20

### **Resistance in Bread wheat:**

Hessian fly: 7

Leaf rust: 11

Septoria: 13

### **Resistance in barley:**

Net Blotch: 27

Pow.mildew: 76

Stem gall midge: 24

Hessian fly: 47

**Objective 1:** Enhanced utilization of wheat and barley germplasm using exotic/core collections and the reference sets developed by GCP to enable scientists to screen and use lines to broaden the genetic base

## ***Useful genetic diversity utilized***

- Roor rot tolerance in durum wheat
- Leaf rust in durum and bread wheat
- Grain quality in durum and breadwheat

**Left to do: Screening of the GCP wheat reference sets**

- Expected to be received during November 2009
- The reference set will be screened for biotic and abiotic stresses during 2009-2010 cropping seasons

## Obj. 2. Development of mapping populations for tagging of loci involved in stress tolerance with molecular markers

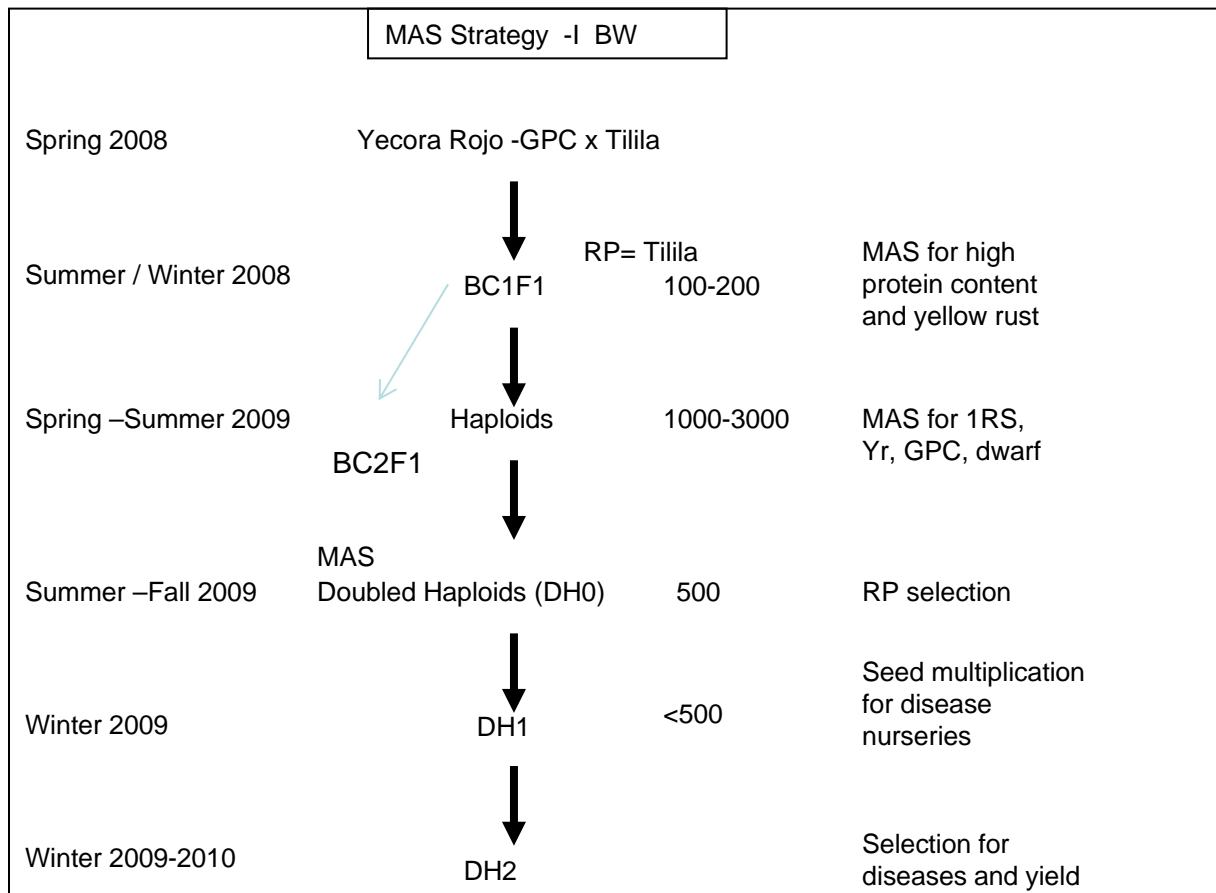
### Mapping Populations (~200-250 lines):

**Bread wheat:** 3 crosses made for RILs for drought tol , HF and Leaf rust

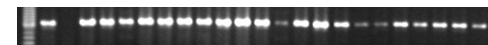
**Durum:**

<b>Crop</b>	<b>Cross name</b>	<b>Traits of interest</b>	<b>Status</b>
Durum Wheat	P(28V) 1 / E.Ital 206	Pigmentation	F3
Durum Wheat	P(28V) 16 / Rouille	Leaf rust resistance and drought	F3
Durum Wheat	RGN0027 / DON 11	Hessian fly resistance and drought tolerance	F3
Durum Wheat	DON 5 / IDYN 5	Hessian fly resistance, cooking quality	F3

# Obj. 3. Development of wheat breeding lines with improved yield, end-use quality and adaptability and enhanced tolerance to stresses through application of genomics tools in conventional breeding program



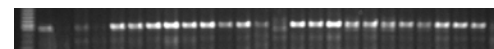
1RS translocation provide resistance to insects, diseases and reported improvements in yield potential and water-use efficiency (drought tolerance under certain backgrounds)



1RS: iag95



UHW89



GluD3 22

Conv BC strategy being followed in Durum For LR, grain quality.

## Obj. 4. Generation of new markers including candidate gene/allele-based molecular markers for enhancing the breeding strategies

### **Durum wheat**

**RILs derived from: Simeto x Levante**

**No. of lines: 180**

Objective: Mapping of root traits and drought tolerance traits

Agronomic evaluations: 2 seasons

Genotyping: 400 genomic SSR screened; 196 polymorphic

Genotyping of RILs will be completed end of 2009

### **Bread wheat**

1 RIL (CIMMYT) evaluated in Field

Two RILs are expected to be received from CIMMYT during November 2009. To be screened for STB and leaf rust resistance

**Obj. 5. Mining the novel genes and alleles conferring tolerance to various biotic and abiotic stresses and improving end-use quality from the germplasm collections of Morocco and the wheat reference set developed by GCP by using genomics tools**

## **Candidate genes involved in stress tolerance:**

- Marker/Primers information collected from literature
- New primers were designed for candidate genes
- These markers will be utilized for mapping and for characterization of sub-set of the reference collections

## **Obj. 6. Empower Moroccan researchers, young scientists and students to implement new tools of genomics in their breeding programs**

**Vision:** Create a new generation of molecular plant breeders  
(Conventional + Molecular Genetics)

### **Training:**

1. Three INRA scientists trained in molecular marker techniques
2. One INRA Scientist enrolled for Ph.D. with Univ. Bologna, Italy
3. Five undergraduates completed their internship training
4. Five master degree students completed their thesis research work

# Linkage with other GCP projects

- Breeder-friendly high-throughput phenotyping tools to select for wheat adaptive traits in drought-prone environments (G3008.08); PI: Francis Ogonnaya
- Precision phenotyping of the GCP spring wheat reference sample for drought (G4008.03); PI: Susanne Dreisigacker (**Screening Subset of BW ref.set for drought**)

# Product delivery and Impact

- Sources of resistance to biotic stresses
  - Bread wheat: resistance to HF, Lr, STB
  - Durum wheat: resistance to HF, Lr, Root rots
  - Barley: resistance to Net blotch, Powdery Mildew, H. Fly and Stem gall midge
- Sources of abiotic stresses tolerance: salinity, drought
- Improved germplasm: under process of development (using both conv and Mol. Tools)
- Impacts leading to varieties:
  - Sources deployed in breeding
  - Modern tools deployed in breeding



*Thank  
you for  
  
your  
attention*