



# Global Capacity Building in Plant Genetic Diversity & Marker-Assisted Breeding

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Sub-Program 5  
Capacity Building & Enabling Delivery  
GCP Annual Research Meeting  
29 Sep - 01 Oct 2005  
Rome



## Three training courses

Over 150 applicants  
61 from 29 countries selected



3. Americas  
Chile  
03-21 Oct  
25 participants  
9 countries  
(Marilyn)

2. Asia  
Thailand  
20 Aug-04 Sep  
20 participants  
10 countries  
(Subhash)

1. Africa  
Pretoria  
22 May - 01 Jun  
16 participants  
10 countries  
(Theresa)



## Course Objectives

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Develop *conceptual and practical skills in genetic diversity analysis, linkage mapping, QTL analysis and association mapping to facilitate marker-assisted breeding*

Empower practitioners to use *GCP knowledge, services and products*

Foster *collaborations* among participating scientists, the CGIAR & other GCP Consortium members, including mechanisms for *technical backstopping, re-training and problem solving* in the in the regions and establishment of *regional networks*



# Course Contents

Agreed among 3 Course Organizers

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**Unit 1: *Genetic Markers:*** DNA basics, Comparison of techniques, PCR, Laboratory demonstration of SSR, Criteria for selecting a suitable marker system. Use of *AlleloBin* software for optimal allele binning in micro-satellite markers.

**Unit 2: *Genetic Diversity Analysis:*** Sampling strategies, Basics of population genetics, Linkage disequilibrium, Measures of genetic distance and genetic diversity, Clustering and ordination methods, and Use of genetic diversity software.

**Unit 3: *Linkage Map Building:*** Designing a linkage mapping study for marker identification, Mendel's laws, Single-locus analysis, Two-locus analysis for estimation and detection of linkage, Linkage grouping, Locus ordering, Marker coverage and map density, Use of linkage mapping software.

**Unit 4: *Phenotyping:*** Importance of reliable phenotyping in marker identification, Planning a phenotyping study, Accuracy and precision, Basics of experimental design, Choosing an appropriate experimental design, Selection of environments and replications, Biometric analysis (including spatial analysis) of phenotyping data, Use of software for designing and analyzing phenotyping trials.

**Unit 5: *Marker Identification through QTL Analysis and Association Mapping:*** The key idea behind identifying trait-linked markers, Basics of quantitative genetics in relation to different mapping populations, Single-marker analysis, Multiple-marker analysis without a linkage map, Interval mapping, Composite interval mapping, Significance thresholds, Estimation of key MAS parameters, Resampling techniques (cross-validation and bootstrapping), Association mapping to identify markers in a breeding population and diverse germplasm, Use of software for QTL analysis and association mapping.

**Unit 6: *Applications:*** Applications in plant genetic diversity, marker-aided selection, Resources for scientists, cost-benefit analysis of marker vs phenotypic selection.



Pretoria, South Africa  
22 May - 01 Jun

FABI (Forestry & Agricultural Biotechnology Institute)  
University of Pretoria  
ACGT (African Centre for Gene Technologies)





## Resource People

### Organizers:

Theresa Fulton  
Institute for Genomic Diversity  
Cornell University, USA

Karl Kunert  
Forestry & Ag Biotech Institute  
Pretoria, South Africa

### Resource People:

Sharon Mitchell  
Institute for Genomic Diversity  
Cornell University, USA

Chris Cullis  
Case Western University  
Ohio, USA

Zhikang Li  
CAAS  
Beijing, China

Zander Myburgh  
University of Pretoria  
Pretoria, South Africa

M Carmen de Vicente  
GCP/IPGRI



# Participants

< 65 applications received from  
17 countries

16 participants

★ Representing 10 African countries

Women underrepresented?  
Only 18% of applicants

10 came as teams: to facilitate future  
collaborations and resource and  
knowledge sharing





# Agenda: Mix of activities

## Lecture/Seminars:

Basics of DNA  
Genetic Diversity  
Molecular Markers (types, comparisons)  
Genetic mapping  
QTL analysis  
Marker assisted selection  
other





## Agenda, contd....

### Laboratories:

DNA extractions

PCR

Electrophoresis gels

Microsatellites





## Agenda, contd

### *Computer labs:*

Use of public databases  
Designing primers  
Linkage mapping  
QTL discovery





## Agenda, contd

### Field trips and group breaks:

Pannar Seeds

Inqaba Biotech (sequencing facility)

Sterkfontein caves

National park reserve





## Course Evaluation Results

Question	5 (high)	4	3	2	1 (low)
1 how well did the course meet its objectives	4	11	3		
2 balance between different topics	2	7	9		
3 balance between theory/lectures and practical work	3	6	7	2	
4 amount of new information provided	10	4	4		
5 overall length of course/time allocated to each part of the course	1	10	6	1	
6 suitability of teaching methods used for the subject	4	9	4	1	
7 quantity and quality of equipment available to participant	7	8	2	1	
8 quality of presentations by instructors	7	9	2		
9 number of participants	16		2		
10 instructor/trainee interactions	10	2	6		
11 interactions with other participants	6	6	6		
12 relevance of course content to your work	7	10	1		
13 degree of interest generated by the course	9	9			
14 overall effectiveness of the course	3	10	5		
15 quality and quantity of information received prior to training course	1	3	8	5	
16 course organization-travel, financial arrangements, etc		4	5	6	



## Results: Back to the Real World

- Minimum of 6 research proposals written
- 3 new collaborations started with FABI and a participant (one from Uganda, Ethiopia, and Namibia)
- Two GCP travel grant awarded (Uganda participant)



# Kasetsart University, Thailand

20 Aug - 04 Sep





## Resource Persons

12 - 5 F, 7 M

NAME	E-MAIL	Institution		Gender
C Tom Hash	<a href="mailto:c.hash@cgiar.org">c.hash@cgiar.org</a>	ICRISAT India		Male
Hugo Volkaert	<a href="mailto:hugo.v@ku.ac.th">hugo.v@ku.ac.th</a>	BIOTEC / KU Thailand		Male
Julapark Chunwongse	<a href="mailto:julapark.c@ku.ac.th">julapark.c@ku.ac.th</a>	KU Thailand, <i>Course Co-Organizer</i>		Male
K Rupa Sridevi	<a href="mailto:r.kanchi@cgiar.org">r.kanchi@cgiar.org</a>	ICRISAT India		Female
M Carmen de vincete	<a href="mailto:c.devincente@cgiar.org">c.devincente@cgiar.org</a>	GCP/IPGRI Colombia, <i>SP5 Leader</i>	Keynote 5	Female
Morakot Tanticharoen	<a href="mailto:morakt@biotec.or.th">morakt@biotec.or.th</a>	BIOTEC Thailand	Keynote 4	Female
Orarat Mongkolporn	<a href="mailto:orarat.m@ku.ac.th">orarat.m@ku.ac.th</a>	KU Thailand		Female
Paula Bramel	<a href="mailto:p.bramel@cgiar.org">p.bramel@cgiar.org</a>	IITA Tanzania		Female
Subhash Chandra	<a href="mailto:s.chandra@cgiar.org">s.chandra@cgiar.org</a>	ICRISAT India, <i>Course Organizer</i>		Male
Sutat Sriwatanapongse	<a href="mailto:baa05thai@yahoo.com">baa05thai@yahoo.com</a>	BIOTEC Alliance Association, Thailand	Keynote 1	Male
Theerayut Toojinda	<a href="mailto:theerayut@dna.kps.ku.ac.th">theerayut@dna.kps.ku.ac.th</a>	BIOTEC Thailand		Male
Vincent Vadez	<a href="mailto:v.vadez@icrisat.org">v.vadez@icrisat.org</a>	ICRISAT India		Male
VP Prasanth	<a href="mailto:stat@cgiar.org">stat@cgiar.org</a>	ICRISAT India		Male
Zhikang Li	<a href="mailto:z.li@cgiar.org">z.li@cgiar.org</a> ; <a href="mailto:lizh@caas.net.cn">lizh@caas.net.cn</a>	CAAS/IRRI China	Keynote 2, 3	Male



## Participants

20 from 10 Asian countries (8 F, 12 M) out of 86

NAME	Country	Gender	
Suhaila Rahman	Bangladesh	Female	
Fu Fengling	China	Female	
Changming Lu	China	Male	
M S Uma	India	Female	
Manikanda Boopathi Narayanan	India	Male	
Panca Jarot Santoso	Indonesia	Male	
I Putu Darsana	Indonesia	Male	
Sentoor Kumeran Govindasamy	Malaysia	Male	
Mya Thuzar	Myanmar	Female	
Malik Ashiq Rabbani	Pakistan	Male	
Hayde Flandez-Galvez	Philippines	Female	
Piyada Thipyapong	Thailand	Female	
Triwitayakorn Kanokporn	Thailand	Female	
Sermsawat Tunlaya-anukit	Thailand	Male	
Thitaporn Sukahotu	Thailand	Female	
Somwung Anusonpornpurm	Thailand	Male	
Taweesak Pulam	Thailand	Male	
Rawitat Pulam	Thailand	Male	
Le Viet Dung	Vietnam	Male	



## Hands-on Genotyping Lab





# Lectures and Computer Labs

Unit 1 - Unit 6

DVD available for all Sessions





## Field Visits and Excursion





## Course Evaluation Results: *Unit-wise*

	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Average
Unit 1	4.40	4.00	4.10	3.70	4.20	4.37	4.16	4.21	4.21	4.00	4.16	4.05	4.26	4.14
Unit 2	3.70	3.60	3.65	3.85	3.55	3.45	3.75	3.60	4.00	3.70	4.05	3.85	3.75	3.73
Unit 3	3.95	3.58	4.00	4.05	3.74	3.95	3.79	4.06	4.00	3.84	4.00	4.05	3.84	3.91
Unit 4	3.94	3.72	3.56	4.17	3.50	3.71	3.50	3.83	4.11	3.89	4.06	3.83	3.78	3.81
Unit 5	4.55	4.20	4.25	4.55	3.90	4.20	4.21	4.30	4.40	4.30	4.40	4.50	4.50	4.33
Unit 6	4.35	3.95	3.83	4.05	3.80	4.15	4.35	4.35	4.35	4.05	4.40	4.40	4.15	4.17
Overall Av	4.15	3.84	3.90	4.06	3.78	3.97	3.96	4.06	4.18	3.96	4.18	4.11	4.05	4.02

01. How well did the Unit meet its objectives?
02. *Balance between different topics*
03. Balance between theory/lectures and practical work
04. *Amount of new information provided*
05. Length of Unit, Time allocated to each part of the Unit
06. *Suitability of teaching methods used for the subject*
07. Quantity and quality of equipment available to participant
08. *Quality of presentations by instructors*
09. Instructor/trainee interactions
10. *Interactions with other participants*
11. Relevance of Unit contents to your work
12. *Degree of interest generated by the Unit*
13. Overall effectiveness of the Unit





## Collaborations, Network

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- Several collaborations initiated among participants and with resource persons, including with the local host BIOTEC / KU
- Several collaborative projects for possible IFS funding expected from participants in next two weeks
- An Asia Region Network, called **AgBioAsia** ([www.yahogroups.com/groups/AgBioAsia](http://www.yahogroups.com/groups/AgBioAsia)) established to foster *collaborations, technical backstopping, re-training* and *problem solving* in Asia region
- Participants made aware of GCP knowledge, services and products that are available and that will be available from SP1-SP5 in future



## Putting it together ...

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- The two courses met the objectives well
- Very positive evaluations from participants, however ...
- Quality & quantity of pre-course information needs to improve



## Constraints

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- **Logistics of reimbursements due to currency issues in Africa**

Many African countries would not allow outside currencies, and in S. Africa, exchanging currencies was difficult, but many people did not have bank accounts to which money could be transferred either

- **Politics of travel between countries in Africa**

Due in part to the refugee issues and visa requirements

- **Food for vegetarians!**



## Lessons learnt

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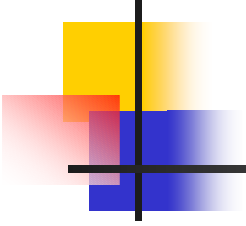
- Start with very basic concepts: Many had misconceptions even at very basic levels
- Don't assume that all know even basics of lab techniques and computers
  - *Redesign application form contents* to help objectively select participants according to stipulated *level* and specified *contents* of the course: *Maximize impact ...*
  - *Provide more detailed information on pre-requisites in course announcement.*
  - *Ask for justification for fulfilling pre-requisites*
  - *Clearly specify the intended audience for the course*
- Start per diem process in Africa before the course
- The *team idea* adopted in Africa (inviting participants as teams) worked well as team members already knew at least one participant they seemed to feel more comfortable to speak, and many have pursued collaborative efforts since their return
- Having a *pre-course meeting of the organizers and resource people* went a long way towards making the program cohesive and people feeling like a team



## Lessons learnt ...

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- Resource Persons: *Critical for impact and success*
  - Good researchers are not necessarily good teachers ...
  - Communicating to a heterogeneous group is challenging ...
  - Select researchers with good teaching experience & communication skills



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Thank You