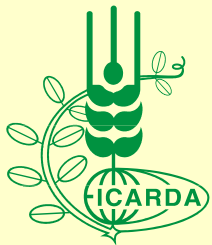


Quality of participation and quality of science in participatory plant breeding

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Topics

- ICARDA's Involvement in Participatory Plant Breeding
- Science in Participatory Plant Breeding (experimental designs, data collection and analysis, science-sharing)
- Quality of Participation (Women participation)
- Institutionalization of Participatory Plant Breeding
- The future



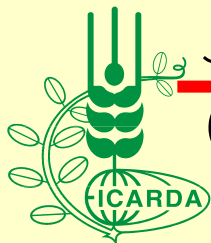
Participatory Plant Breeding at ICARDA



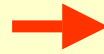
Participatory Breeding Projects

Country	Year	Support
Syria phase 1	1996-1999	BMZ
Syria phase 2	2000- on going	CORE(*)
Tunisia	1997-2000	} IDRC
Morocco	1997-2000	
Yemen	1999- ongoing	SWPRGA
Eritrea	1999- ongoing	DANIDA/ITALY
Egypt	2000- ongoing	WB/OPEC/ITALY
Jordan	2000- ongoing	IDRC

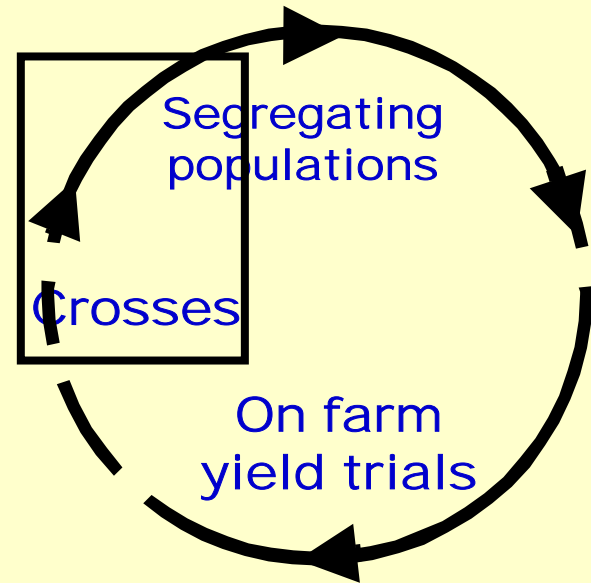
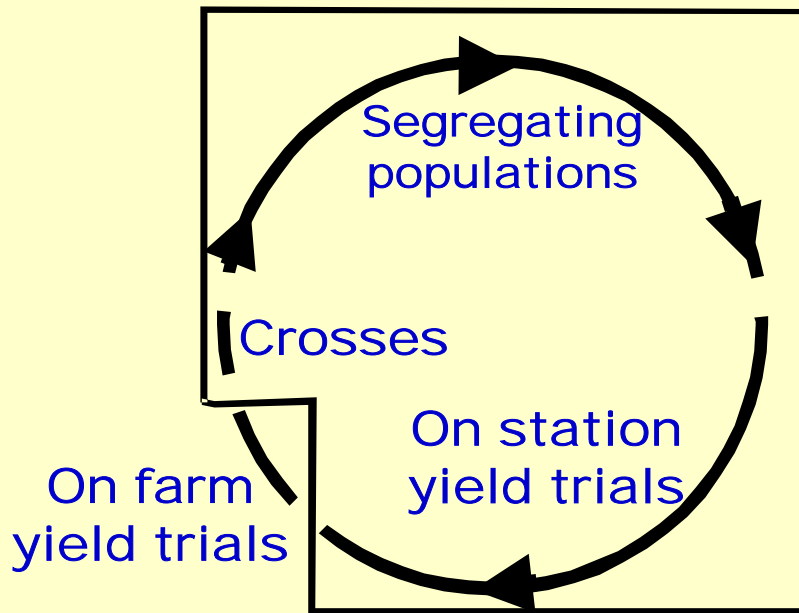
(*) Donor's directed funds from Italy



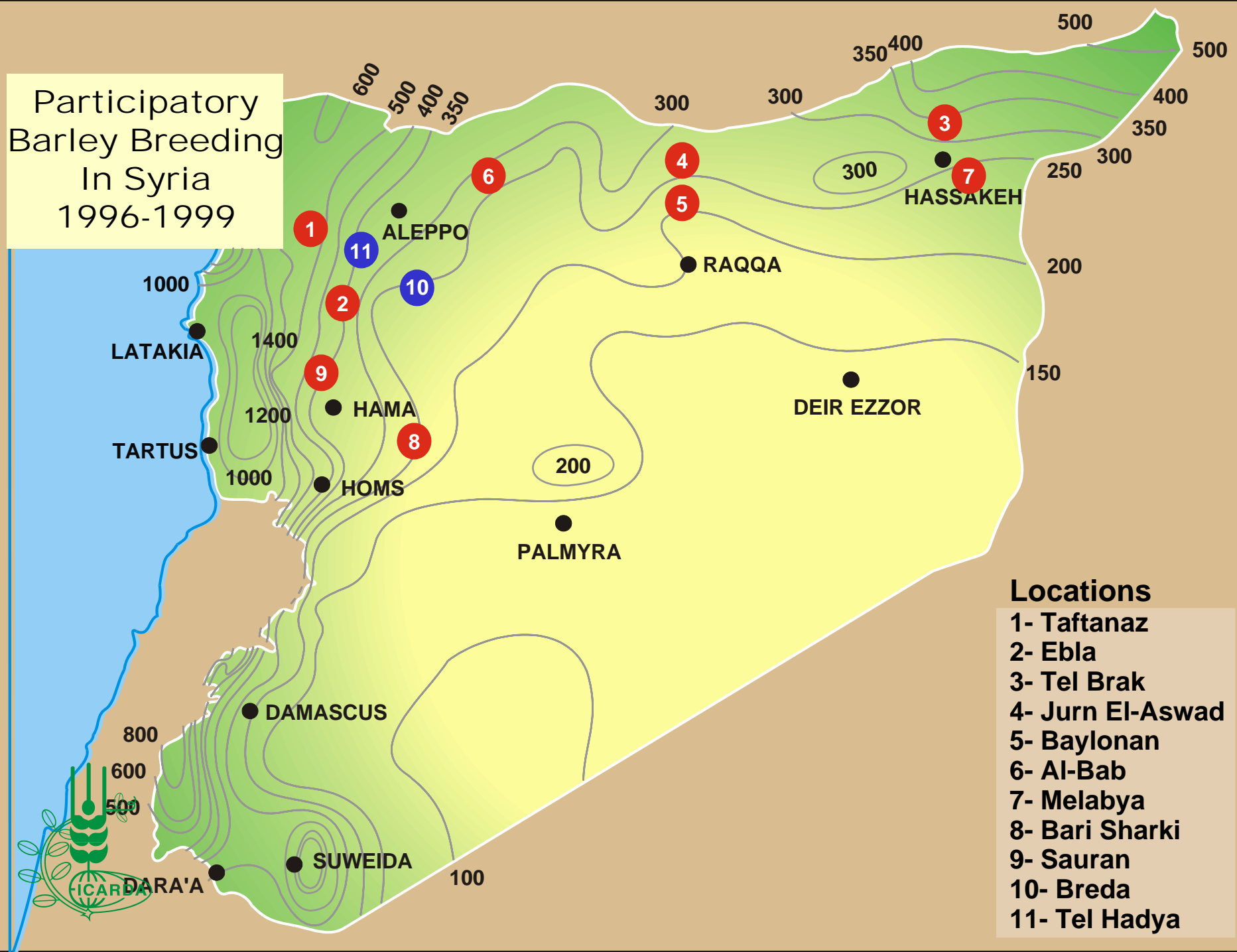
A centralized-non
participatory plant
breeding program



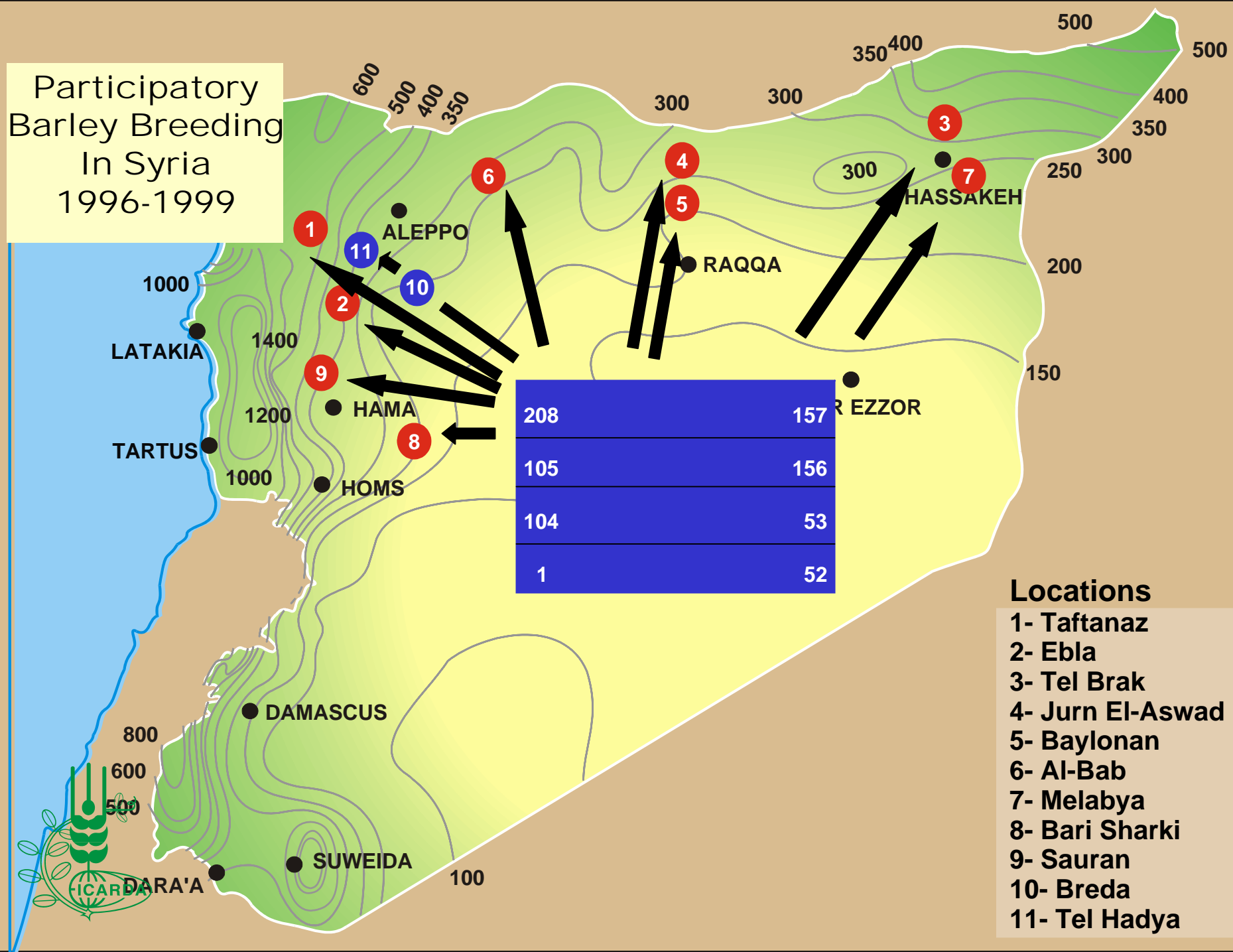
A decentralized-
participatory plant
breeding program



Participatory
Barley Breeding
In Syria
1996-1999



Participatory Barley Breeding In Syria 1996-1999



Locations

- 1- Taftanaz
- 2- Ebla
- 3- Tel Brak
- 4- Jurn El-Aswad
- 5- Baylonan
- 6- Al-Bab
- 7- Melabya
- 8- Bari Sharki
- 9- Sauran
- 10- Breda
- 11- Tel Hadya

PPB in Syria-first phase

The farmers and one breeder did the selection in 1997 both in the farmers fields and in the two research stations

The same process was repeated in 1998 and 1999 on the lines selected in 1997 and 1998, respectively

Therefore, the first phase was a linear process



Intermediate impacts of the first phase

Increased farmers' awareness of plant breeding



Quantity and quality of requests increased
Requests to extend PPB to other crops

Demonstration that farmers' selection is at least as efficient as breeder's selection



Dissemination of PPB to other NARS (Tunisia, Morocco, Eritrea, Jordan, Egypt, Yemen)

Demonstration that farmers' can handle large number of lines/populations

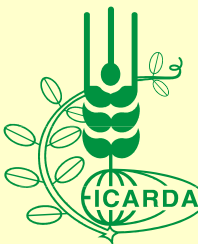


Move from linear to cyclic processes

New selection criteria, depending on environment



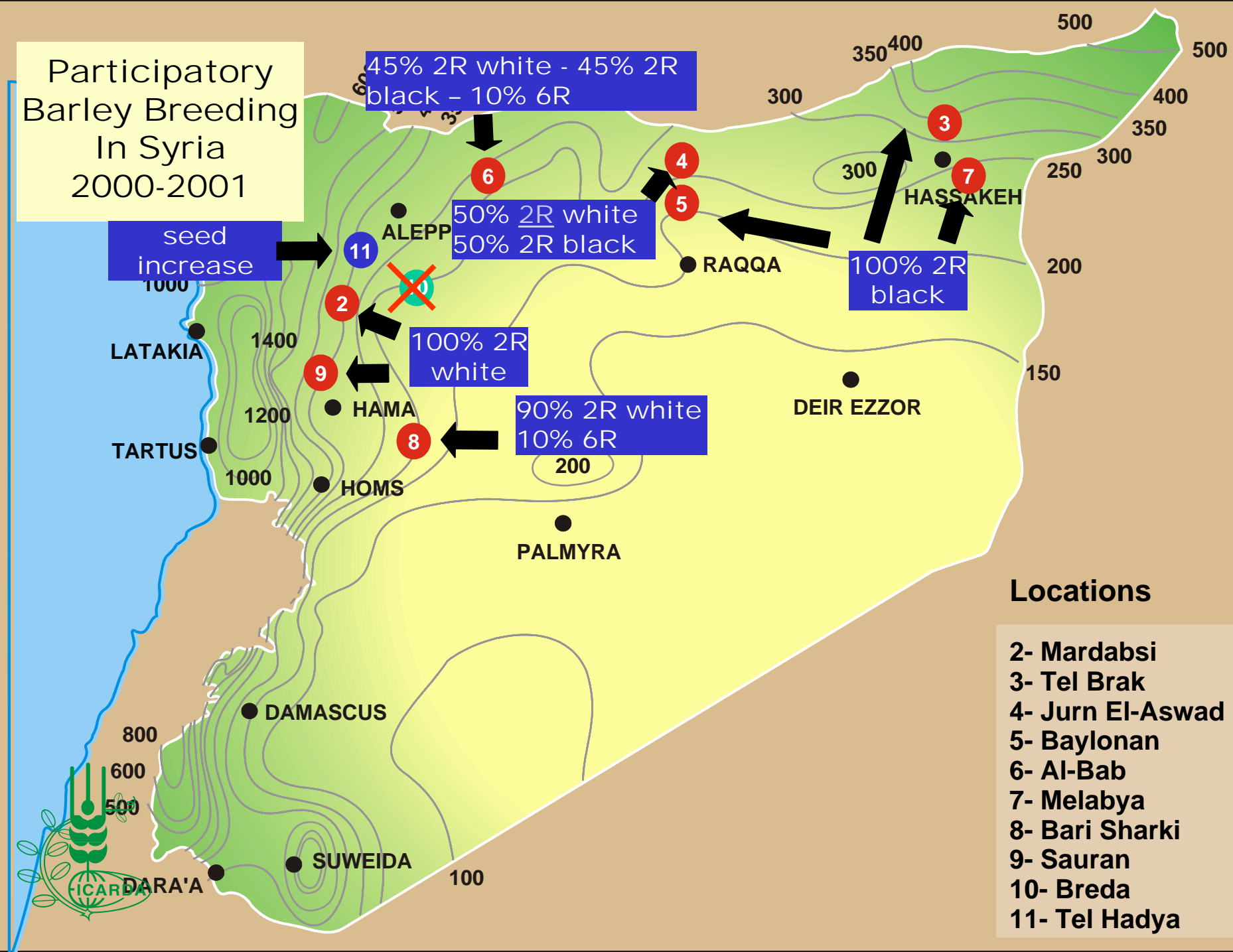
Decentralization (the example of Morocco)



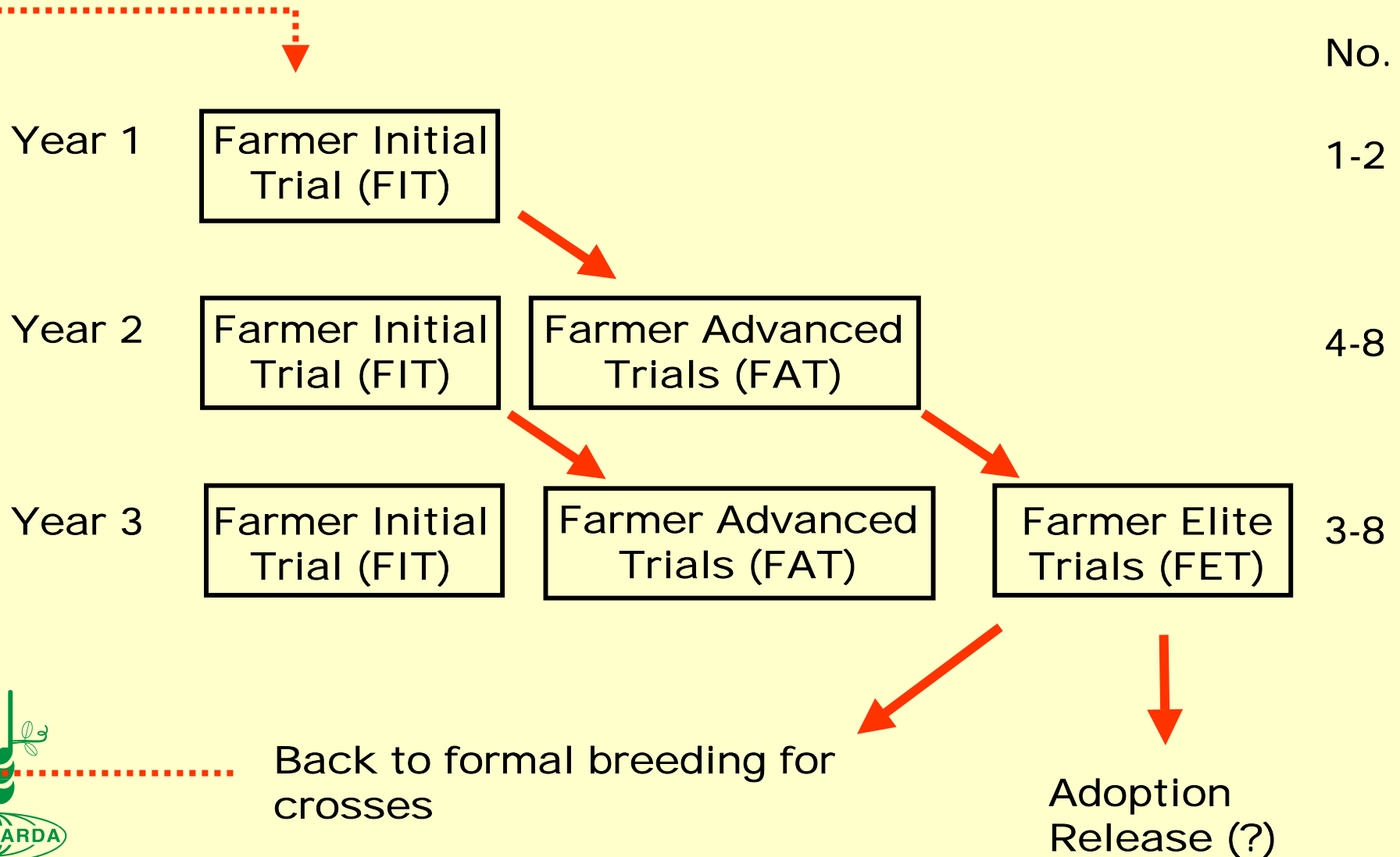
From a linear to a cyclic process



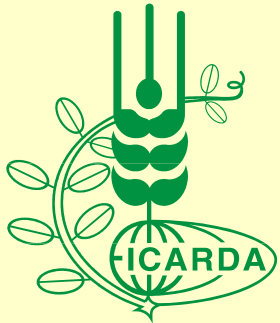
Participatory
Barley Breeding
In Syria
2000-2001



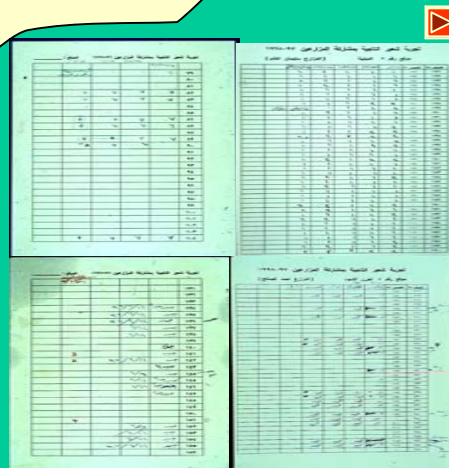
The Model



Science and Participation in Selection



Year 1



Four sheets of data collection forms, likely for agricultural yield or farmer selection, with handwritten entries in Arabic. A small red play button icon is visible in the top right corner of the top-right sheet.

Data analysis

FIT

Farmers' selection

200



Discussion of data
and final selection

تجربة شعير انتاجية بمشاركة المزارعين ٩٧-١٩٩٨

موقع رقم ٧ الميلية (المزارع سليمان التاتم)

اسم المزارع	اسم الصنف	تجربة متقدمة	رقم القطعة في العام الماضي ٢٠٠٠	سبب التخاب في العام الماضي ٢٠٠٠	ترتيب التخاب المزارع	النتاج التخاب المزارع	وزن حبة ١٠٠٠	النتاج التخاب المزارع	ترتيب التخاب المزارع	النتاج التخاب المزارع	الرقاد	طول السيلة	طول القبات
عبد الكريم	DD-٢١/Hml/ArabiAswad	١	٨	FSEL	٣,٦	٣٧,٨	١٠,٧	٣٢	٧٩١	٢,٠	٧,٠	٧,٠	٦٧,٠
عبد الكريم	Moroc-٧٧/WI٢١١/Ci-١	٢	١٥	GY	٣,٥	٤٤,٥	١٥,٢	١٦	١٥١٢	١,٠	١,٠	١,٠	٥٤,٠
عبد الكريم	H spont ٤١٠١/Tadmor	٣	٤	FSEL	٣,٧	٣٣,٨	١٥,٤	١٦	١٥١٢	٢,٠	١,٠	١,٠	٦٠,٠
عبد الكريم	Zanbaka/SLB١٠٠٠٠٨١	٤	٣١	FSEL	٣,٦	٤٥,٢	١٥,٢	٨	١٥٢٨	٤,٠	١,٠	١,٠	٦٠,٠
عبد الكريم	Bonita/H spont ٤١٠٣	٥	١٤	FSEL	٣,٦	٤٥,٢	١٥,٢	٨	١٥٢٨	٢,٠	١,٠	١,٠	٦٤,٥
عبد الكريم	ArabiAbiad	٦	٣٥	CHECK	٣,٥	٤٣,٢	١٥,٢	٤	١٥٢٢	٢,٠	١,٠	١,٠	٤٨,٥
عبد الكريم	SLB١٠٠٠٠٨١/SLB٢٠٠٠٧٤	٧	٣٥	GY (A and B)	٣,٥	٤٣,٢	١٥,٢	٤	١٥٢٢	٢,٠	١,٠	١,٠	٥١,٠
عبد الكريم	Roho/H/Zanbaka/H spont ٤١٠٥	٨	٢٤	FSEL	٣,٥	٤٣,٢	١٥,٢	٤	١٥٢٢	٢,٠	١,٠	١,٠	٤٨,٥
عبد الكريم	SLB ٥٠٠٠٩١/H spont ٤١٠٥	٩	٣٣	GY (A and B)	٣,٥	٤٣,٢	١٥,٢	٤	١٥٢٢	٢,٠	١,٠	١,٠	٥١,٠
عبد الكريم	SLB ٥٠٠٠٩١/H spont ٤١٠٥	١٠	٢٢	FSEL	٣,٥	٤٣,٢	١٥,٢	٤	١٥٢٢	٢,٠	١,٠	١,٠	٥١,٠
عبد الكريم	SLB ٥٠٠٠٩٢/H spont ٤١٠٥	١١	٢٢	FSEL	٣,٥	٤٣,٢	١٥,٢	٤	١٥٢٢	٢,٠	١,٠	١,٠	٥١,٠
عبد الكريم	SLB ٥٠٠٠٩٢/H spont ٤١٠٥	١٢	٢٢	FSEL	٣,٥	٤٣,٢	١٥,٢	٤	١٥٢٢	٢,٠	١,٠	١,٠	٥١,٠
عبد الكريم	SLB ٥٠٠٠٩٢/H spont ٤١٠٥	١٣	٢٢	FSEL	٣,٥	٤٣,٢	١٥,٢	٤	١٥٢٢	٢,٠	١,٠	١,٠	٥١,٠
عبد الكريم	SLB ٥٠٠٠٩٢/H spont ٤١٠٥	١٤	٢٢	FSEL	٣,٥	٤٣,٢	١٥,٢	٤	١٥٢٢	٢,٠	١,٠	١,٠	٥١,٠
عبد الكريم	SLB ٥٠٠٠٩٢/H spont ٤١٠٥	١٥	٢٢	FSEL	٣,٥	٤٣,٢	١٥,٢	٤	١٥٢٢	٢,٠	١,٠	١,٠	٥١,٠
عبد الكريم	SLB ٥٠٠٠٩٢/H spont ٤١٠٥	١٦	٢٢	FSEL	٣,٥	٤٣,٢	١٥,٢	٤	١٥٢٢	٢,٠	١,٠	١,٠	٥١,٠
عبد الكريم	SLB ٥٠٠٠٩٢/H spont ٤١٠٥	١٧	٢٢	FSEL	٣,٥	٤٣,٢	١٥,٢	٤	١٥٢٢	٢,٠	١,٠	١,٠	٥١,٠
عبد الكريم	SLB ٥٠٠٠٩٢/H spont ٤١٠٥	١٨	٢٢	FSEL	٣,٥	٤٣,٢	١٥,٢	٤	١٥٢٢	٢,٠	١,٠	١,٠	٥١,٠
عبد الكريم	SLB ٥٠٠٠٩٢/H spont ٤١٠٥	١٩	٢٢	FSEL	٣,٥	٤٣,٢	١٥,٢	٤	١٥٢٢	٢,٠	١,٠	١,٠	٥١,٠
عبد الكريم	SLB ٥٠٠٠٩٢/H spont ٤١٠٥	٢٠	٢٢	FSEL	٣,٥	٤٣,٢	١٥,٢	٤	١٥٢٢	٢,٠	١,٠	١,٠	٥١,٠
عبد الكريم	SLB ٥٠٠٠٩٢/H spont ٤١٠٥	٢١	٢٢	FSEL	٣,٥	٤٣,٢	١٥,٢	٤	١٥٢٢	٢,٠	١,٠	١,٠	٥١,٠
عبد الكريم	SLB ٥٠٠٠٩٢/H spont ٤١٠٥	٢٢	٢٢	FSEL	٣,٥	٤٣,٢	١٥,٢	٤	١٥٢٢	٢,٠	١,٠	١,٠	٥١,٠
عبد الكريم	SLB ٥٠٠٠٩٢/H spont ٤١٠٥	٢٣	٢٢	FSEL	٣,٥	٤٣,٢	١٥,٢	٤	١٥٢٢	٢,٠	١,٠	١,٠	٥١,٠
عبد الكريم	SLB ٥٠٠٠٩٢/H spont ٤١٠٥	٢٤	٢٢	FSEL	٣,٥	٤٣,٢	١٥,٢	٤	١٥٢٢	٢,٠	١,٠	١,٠	٥١,٠
عبد الكريم	SLB ٥٠٠٠٩٢/H spont ٤١٠٥	٢٥	٢٢	FSEL	٣,٥	٤٣,٢	١٥,٢	٤	١٥٢٢	٢,٠	١,٠	١,٠	٥١,٠
عبد الكريم	SLB ٥٠٠٠٩٢/H spont ٤١٠٥	٢٦	٢٢	FSEL	٣,٥	٤٣,٢	١٥,٢	٤	١٥٢٢	٢,٠	١,٠	١,٠	٥١,٠
عبد الكريم	SLB ٥٠٠٠٩٢/H spont ٤١٠٥	٢٧	٢٢	FSEL	٣,٥	٤٣,٢	١٥,٢	٤	١٥٢٢	٢,٠	١,٠	١,٠	٥١,٠
عبد الكريم	SLB ٥٠٠٠٩٢/H spont ٤١٠٥	٢٨	٢٢	FSEL	٣,٥	٤٣,٢	١٥,٢	٤	١٥٢٢	٢,٠	١,٠	١,٠	٥١,٠
عبد الكريم	SLB ٥٠٠٠٩٢/H spont ٤١٠٥	٢٩	٢٢	FSEL	٣,٥	٤٣,٢	١٥,٢	٤	١٥٢٢	٢,٠	١,٠	١,٠	٥١,٠
عبد الكريم	SLB ٥٠٠٠٩٢/H spont ٤١٠٥	٣٠	٢٢	FSEL	٣,٥	٤٣,٢	١٥,٢	٤	١٥٢٢	٢,٠	١,٠	١,٠	٥١,٠
عبد الكريم	SLB ٥٠٠٠٩٢/H spont ٤١٠٥	٣١	٢٢	FSEL	٣,٥	٤٣,٢	١٥,٢	٤	١٥٢٢	٢,٠	١,٠	١,٠	٥١,٠
عبد الكريم	SLB ٥٠٠٠٩٢/H spont ٤١٠٥	٣٢	٢٢	FSEL	٣,٥	٤٣,٢	١٥,٢	٤	١٥٢٢	٢,٠	١,٠	١,٠	٥١,٠
عبد الكريم	SLB ٥٠٠٠٩٢/H spont ٤١٠٥	٣٣	٢٢	FSEL	٣,٥	٤٣,٢	١٥,٢	٤	١٥٢٢	٢,٠	١,٠	١,٠	٥١,٠
عبد الكريم	SLB ٥٠٠٠٩٢/H spont ٤١٠٥	٣٤	٢٢	FSEL	٣,٥	٤٣,٢	١٥,٢	٤	١٥٢٢	٢,٠	١,٠	١,٠	٥١,٠
عبد الكريم	SLB ٥٠٠٠٩٢/H spont ٤١٠٥	٣٥	٢٢	FSEL	٣,٥	٤٣,٢	١٥,٢	٤	١٥٢٢	٢,٠	١,٠	١,٠	٥١,٠
عبد الكريم	SLB ٥٠٠٠٩٢/H spont ٤١٠٥	٣٦	٢٢	FSEL	٣,٥	٤٣,٢	١٥,٢	٤	١٥٢٢	٢,٠	١,٠	١,٠	٥١,٠
عبد الكريم	SLB ٥٠٠٠٩٢/H spont ٤١٠٥	٣٧	٢٢	FSEL	٣,٥	٤٣,٢	١٥,٢	٤	١٥٢٢	٢,٠	١,٠	١,٠	٥١,٠
عبد الكريم	SLB ٥٠٠٠٩٢/H spont ٤١٠٥	٣٨	٢٢	FSEL	٣,٥	٤٣,٢	١٥,٢	٤	١٥٢٢	٢,٠	١,٠	١,٠	٥١,٠
عبد الكريم	SLB ٥٠٠٠٩٢/H spont ٤١٠٥	٣٩	٢٢	FSEL	٣,٥	٤٣,٢	١٥,٢	٤	١٥٢٢	٢,٠	١,٠	١,٠	٥١,٠
عبد الكريم	SLB ٥٠٠٠٩٢/H spont ٤١٠٥	٤٠	٢٢	FSEL	٣,٥	٤٣,٢	١٥,٢	٤	١٥٢٢	٢,٠	١,٠	١,٠	٥١,٠

Selection by farmers is based on visual selection and on the results of the analysis of quantitative data



Quality of participations: visits and meetings

On average two informal visits (during winter-spring), one group selection session, and two meetings:

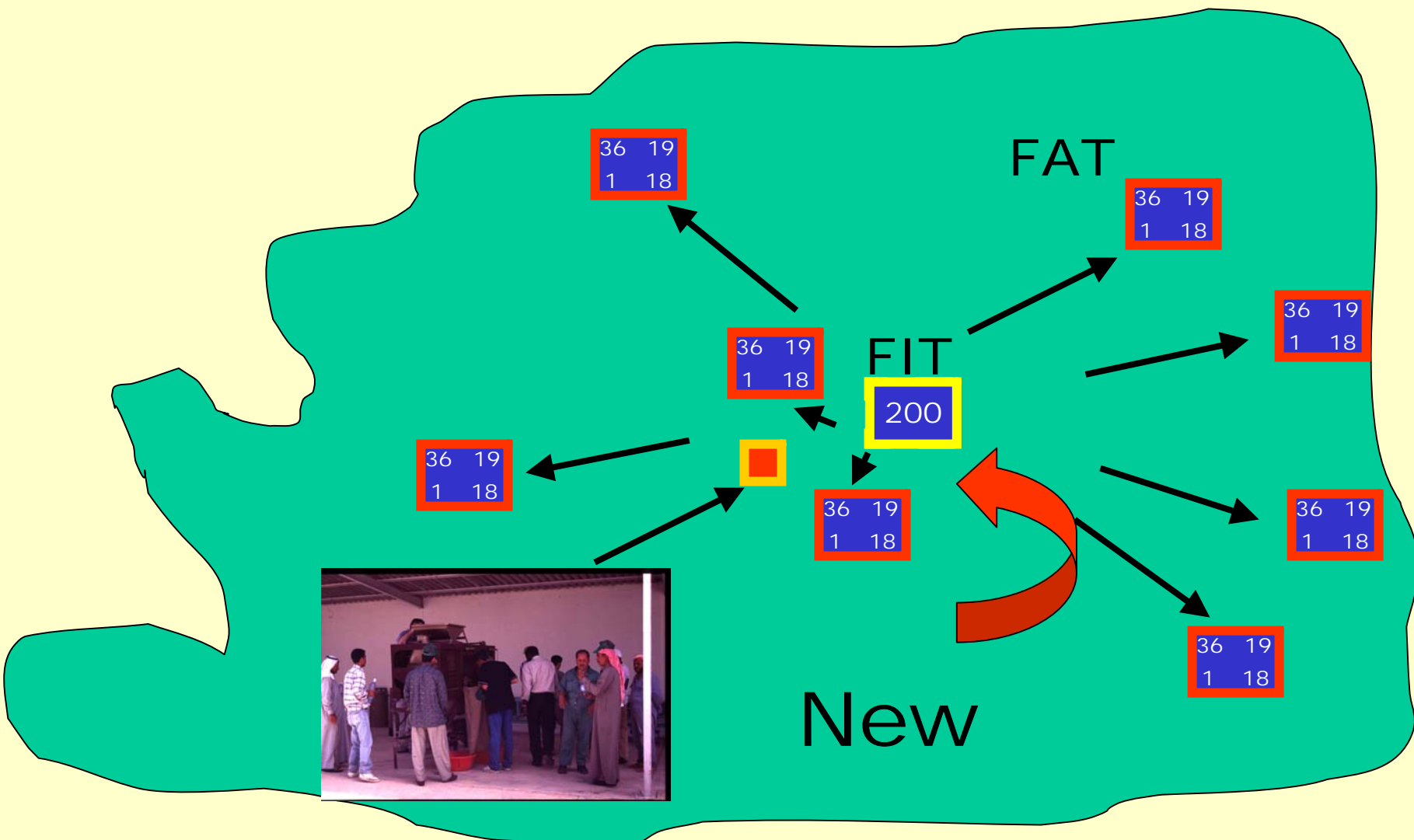
1st Meeting: Selection

2nd Meeting: Design of the trials for the following cropping season





Year 2



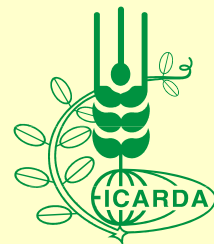
The FAT as Adaptation Trials

Each FAT within the same village is considered as a replication of the same trials (the entries are common). Therefore, the number of replications corresponds to the number of farmers

However, each farmer may plant his own FAT in a different rotation, or with a different seed rate, or on a different soil type, he may use fertilizer (or apply a different amount of fertilizer)

Farmers rely greatly on the information about the management of the trial during the selection process

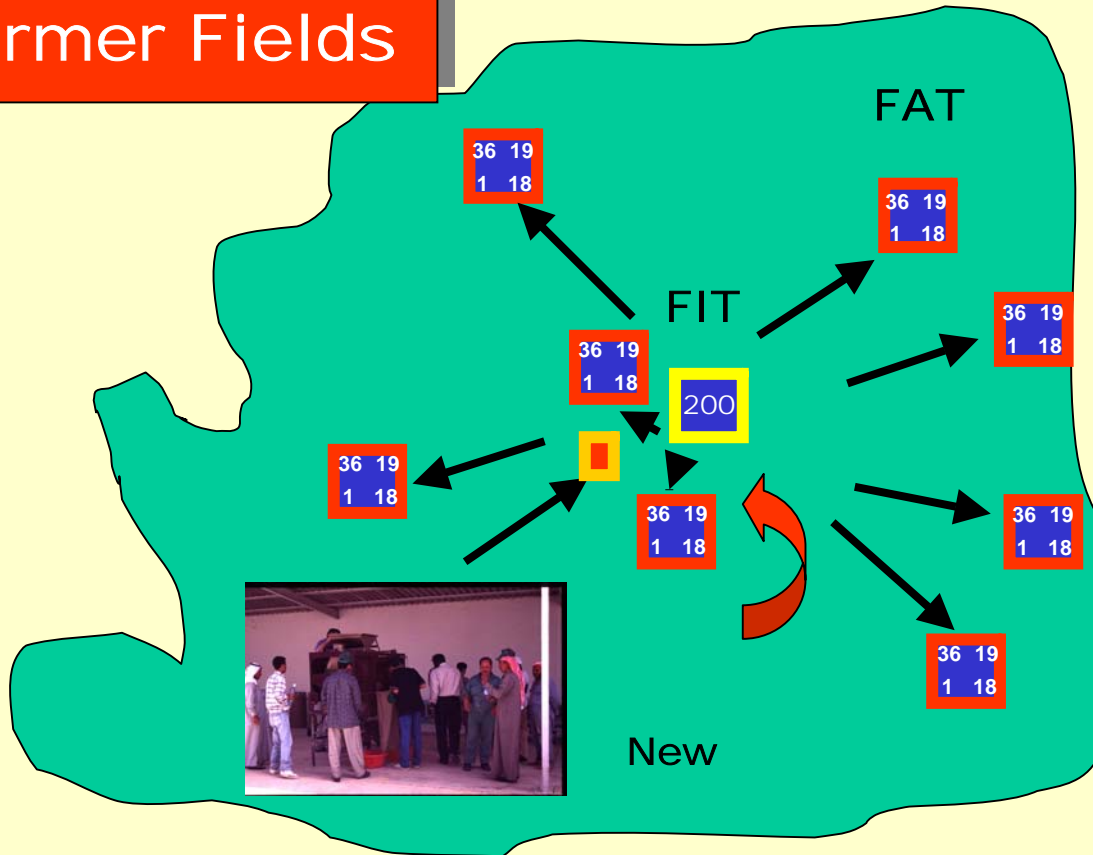
At an early stage of the selection process the lines are already characterized for their responses to environmental or agronomic factors



Year 2

Farmer Fields

On Station



Select rows of entries selected in the 2nd year testing

Seed multiplication
Head selection of best entries

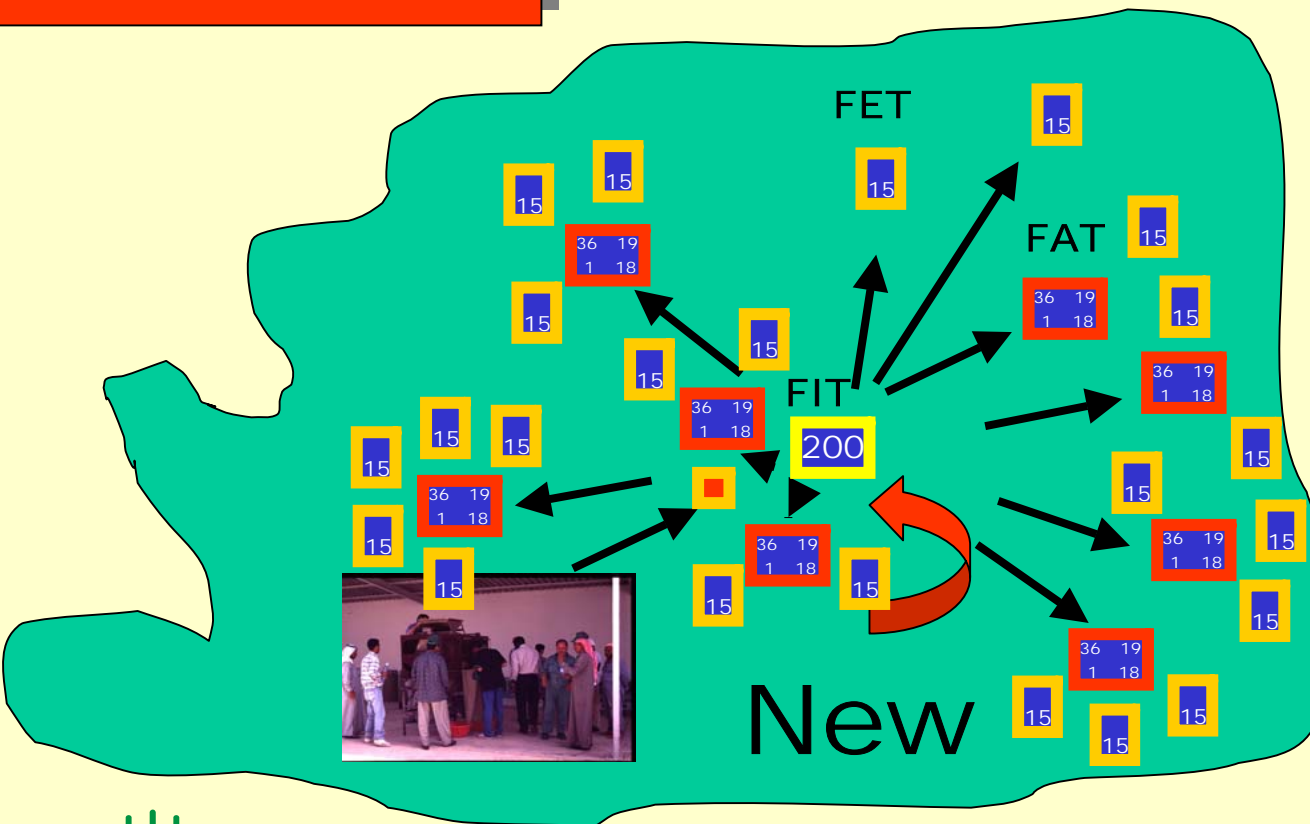
Marker Assisted Selection can start at this stage



Year 3

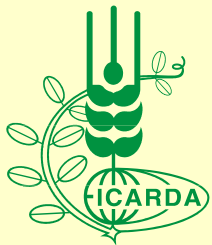
Farmer Fields

On Station

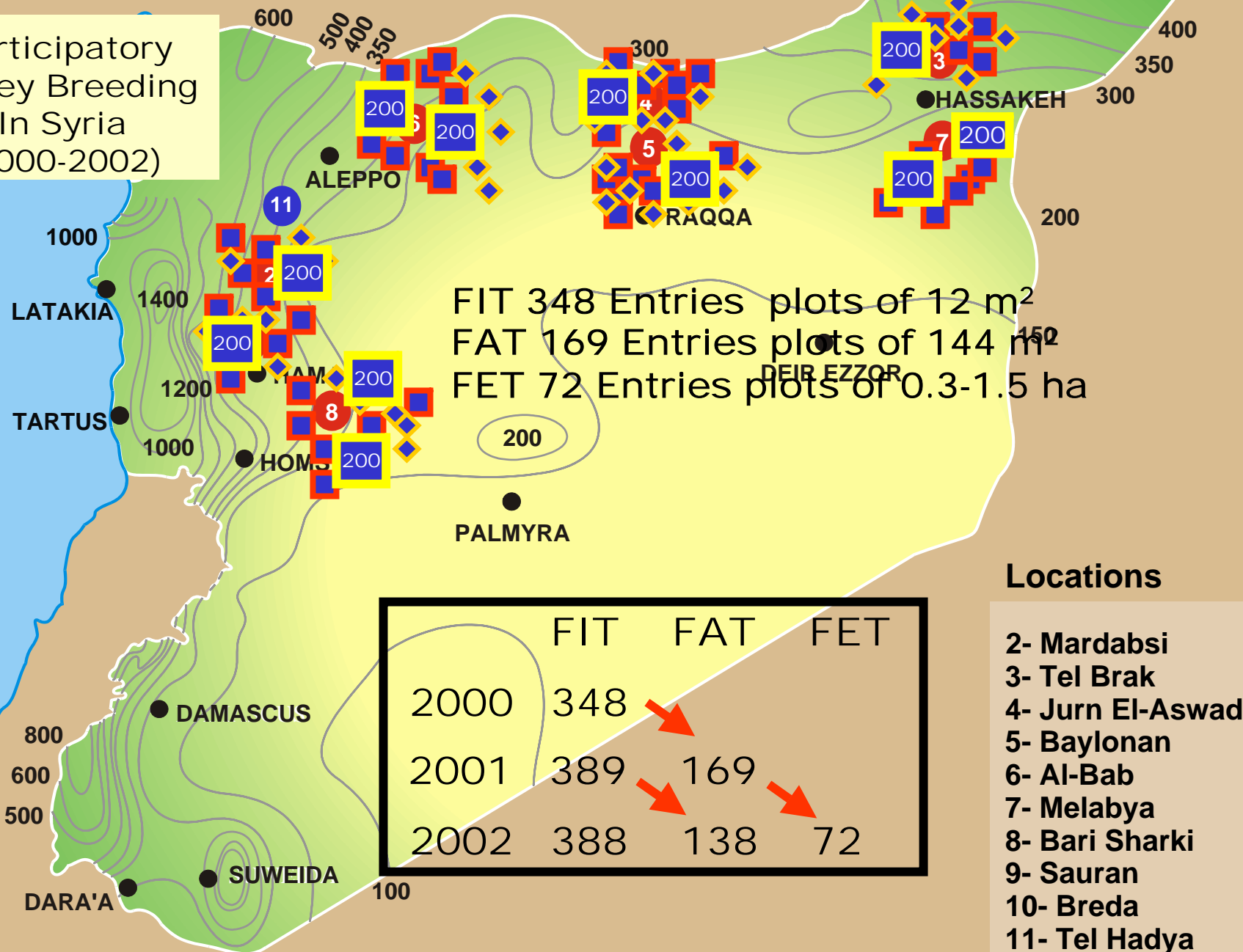


Select rows of populations selected in the 2nd year testing

Seed multiplication
Head selection of best populations



Participatory
Barley Breeding
In Syria
(2000-2002)



FIT 348 Entries plots of 12 m²
 FAT 169 Entries plots of 144 m²
 FET 72 Entries plots of 0.3-1.5 ha

Locations

- 2- Mardabsi
- 3- Tel Brak
- 4- Jurn El-Aswad
- 5- Baylonan
- 6- Al-Bab
- 7- Melabya
- 8- Bari Sharki
- 9- Sauran
- 10- Breda
- 11- Tel Hadya

From crosses to 0.5 ha in six years



14/4/2002

PPB and Biodiversity

Different entries selected in
different locations

Heterogeneous populations

Landraces and wild relatives



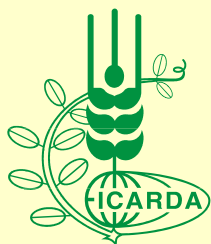
Entries selected with different strategies of selection

Type of selection	Barley (Syria)	Barley (Yemen)	Lentil (Yemen)
Decentralized-participatory	0.74	0.50	0.56
Decentralized-non participatory	0.79	0.52	0.46
Centralized-participatory	0.61	0.24	0.40
Centralized-non participatory	0.34	0.20	0.22



Participation plant breeding in Egypt:
entries selected from an initial population
of 53 entries

Entries selected		N	%
Total		15	0.3
Three	villages	1	0.1
Two	"	2	13.3
One	"	12	80.0





In 2001/2002

In Syria: 8 villages, 95 trials (11 first level, 45 second level and 39 third level)

Jordan: 6 villages, 12 Farmers, 19 trials (7 first level and 12 second level)

Egypt: 8 villages, third year selection, hulless barley included in the new trial (requested by farmers)

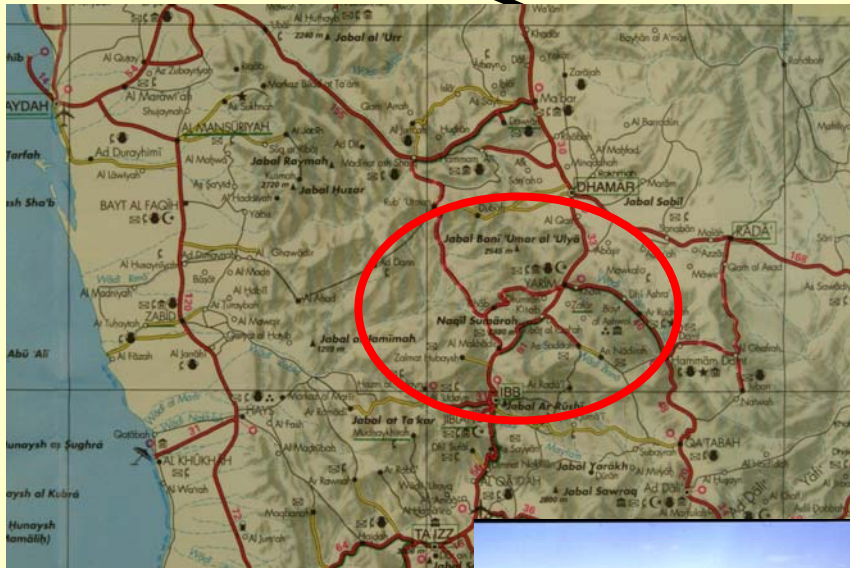
Eritrea: 3 villages, second year selection finished, start seed production of very promising lines selected from the landrace Atsa.

Yemen: 6 villages, third year selection, two varieties of barley and two of lentil being multiplied





Khulan Affar: 90% of agriculture is in the mountain terraces



Central Highlands:
large terraces



Khulan Affar: 90% of agriculture is in mountain terraces



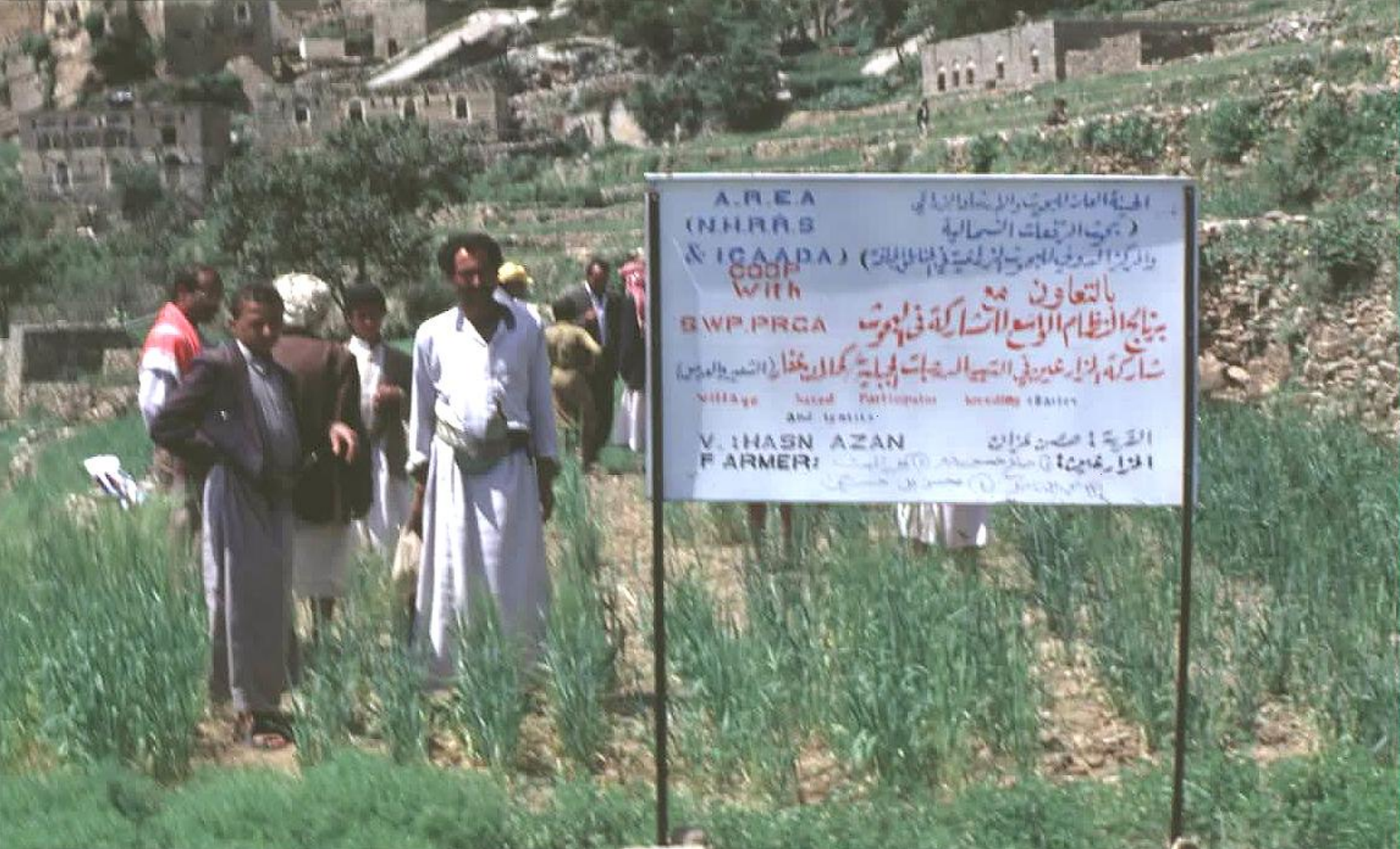
PPB and small farmers: incomplete blocks designs

One trial:
One Farmer

One trial:
Ten Farmers

200	181	→	200	181
161	180	→	161	180
160	141	→	160	141
121	140	→	121	140
120	101	→	120	101
81	100	→	81	100
80	61	→	80	61
41	60	→	41	60
40	21	→	40	21
1	20	→	1	20





Initial yield trials at Hasn Azan(Yemen,
2050 m asl)



Lentil and Barley Initial Trial on the same terrace at Bit Al Wali (Yemen, 2500 m asl): two incomplete blocks of the lentil and barley trials



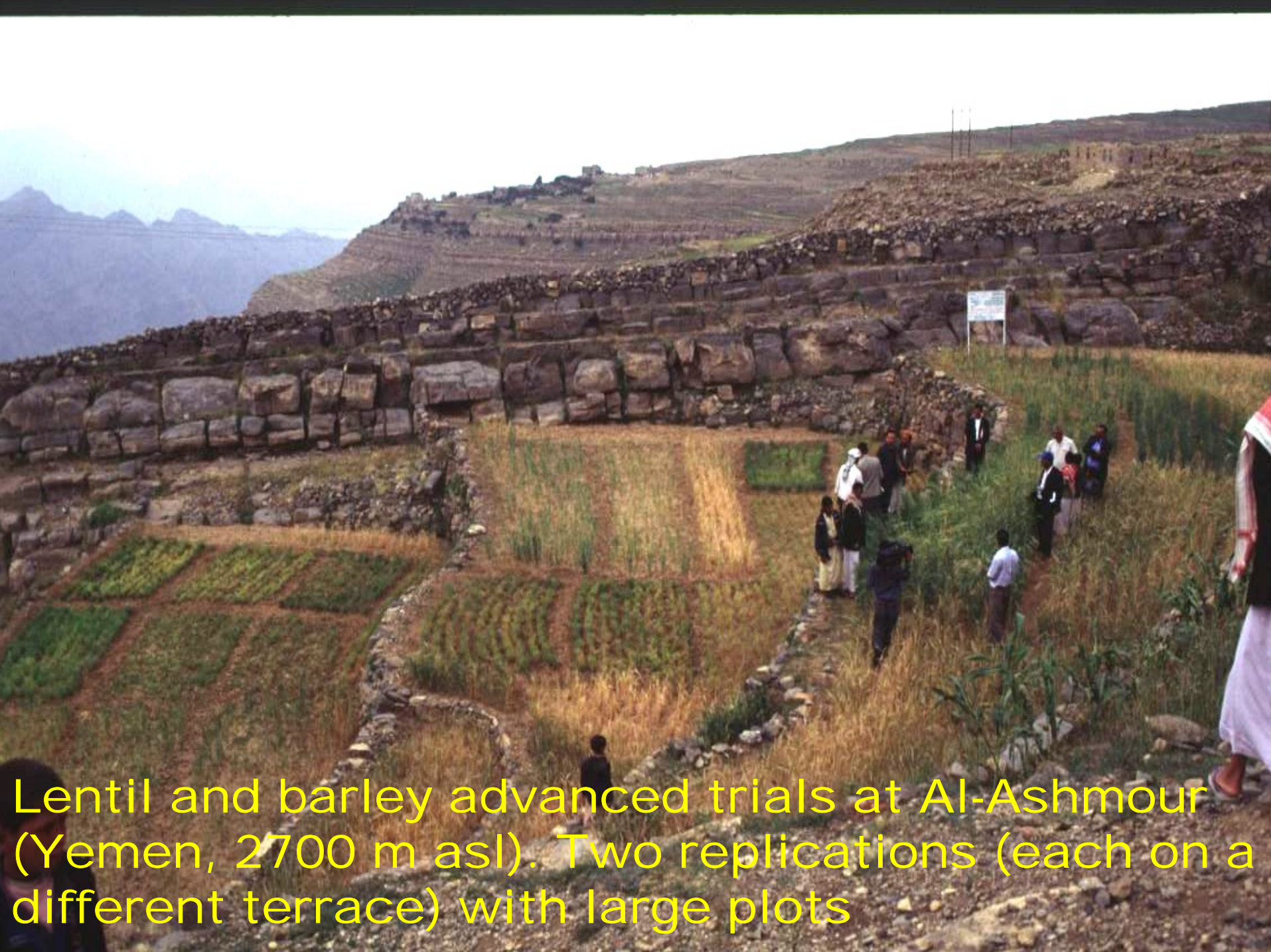
Lentil and Barley Initial Trials on different terraces at Hasn Azan (Yemen, 2050 m asl)

Incomplete blocks in Bit Al Wali (Yemen, 2500 m asl)





Too small ?



Lentil and barley advanced trials at Al-Ashmour (Yemen, 2700 m asl). Two replications (each on a different terrace) with large plots

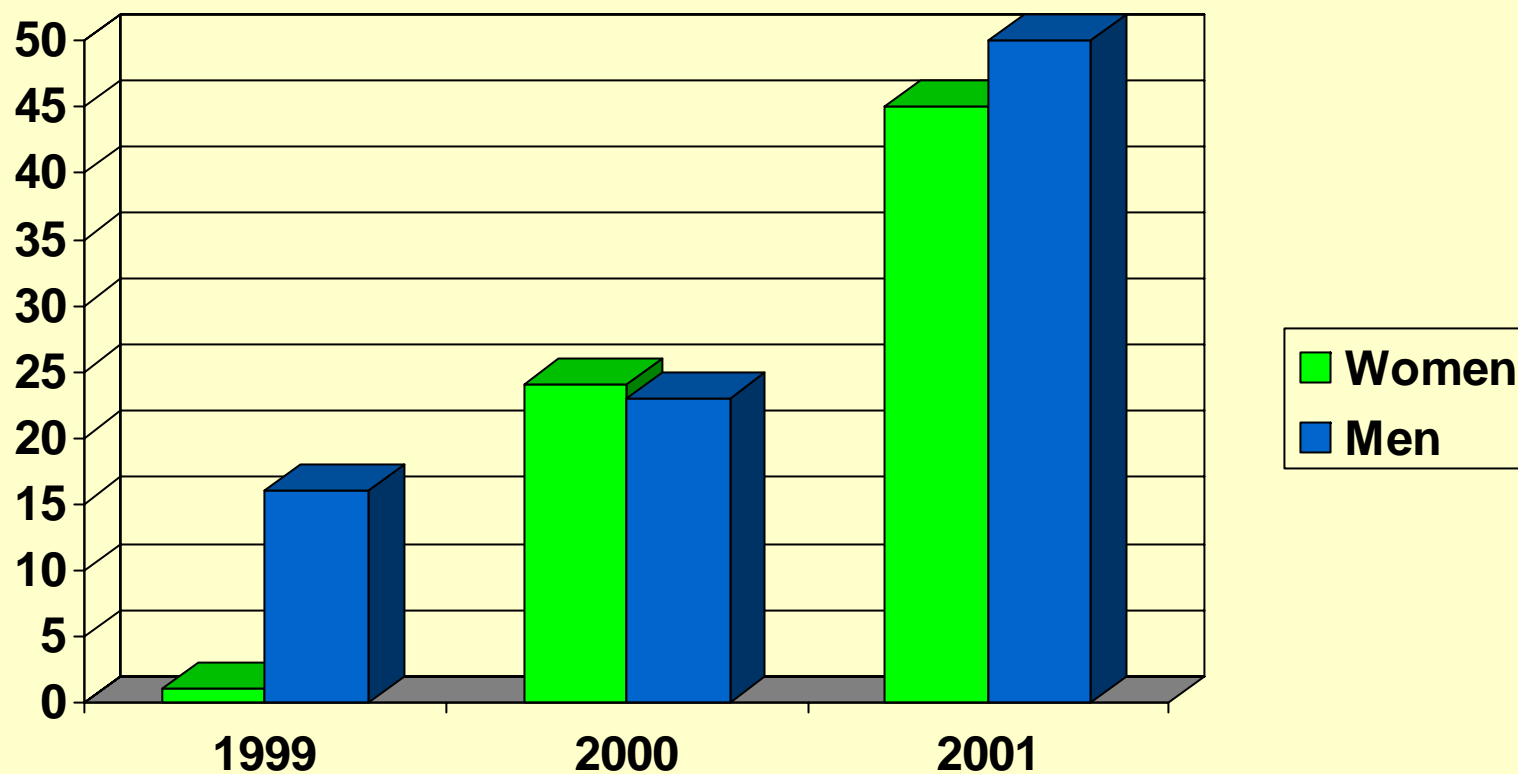




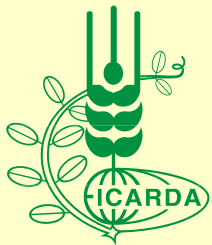
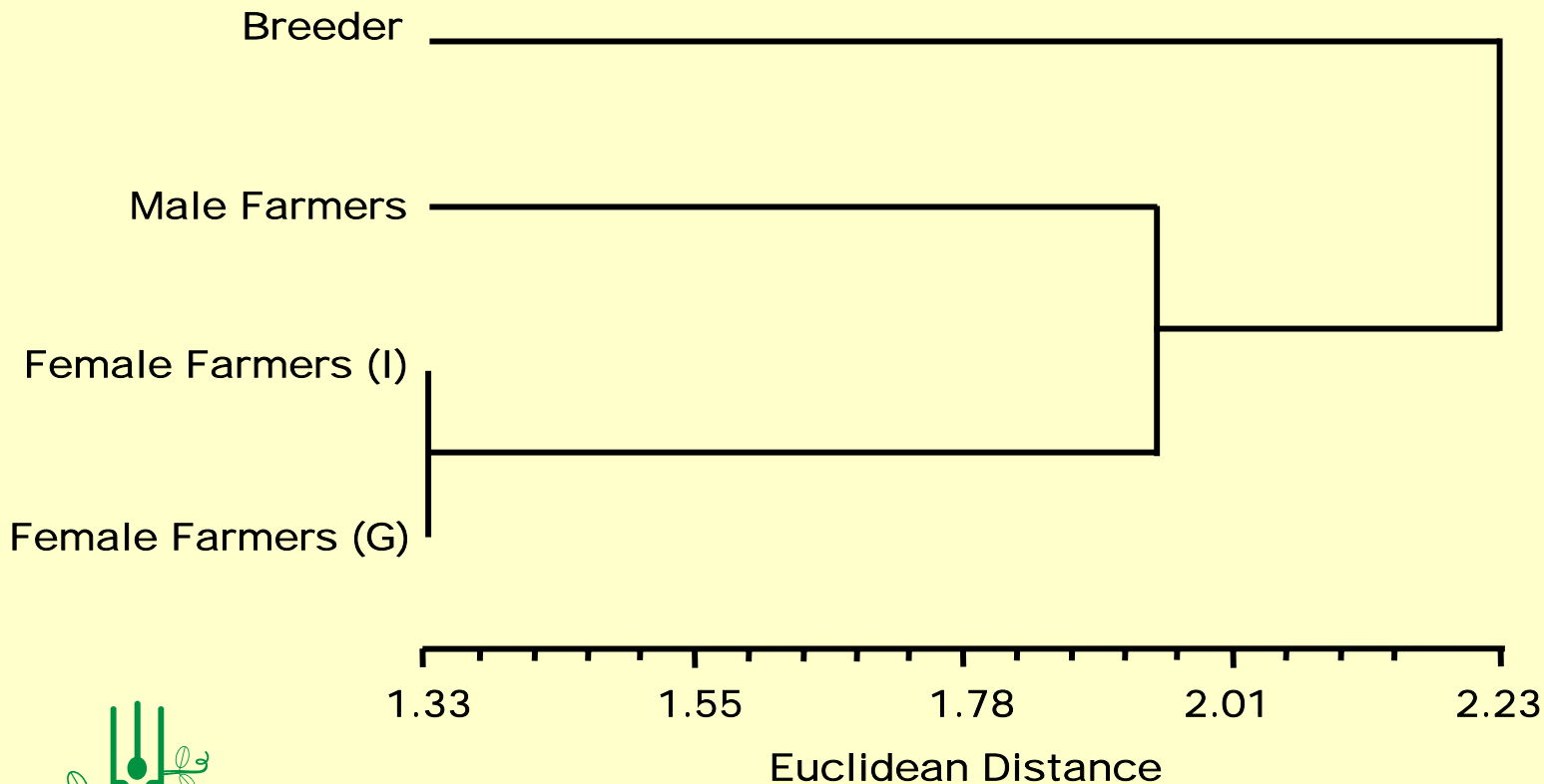
Women participation



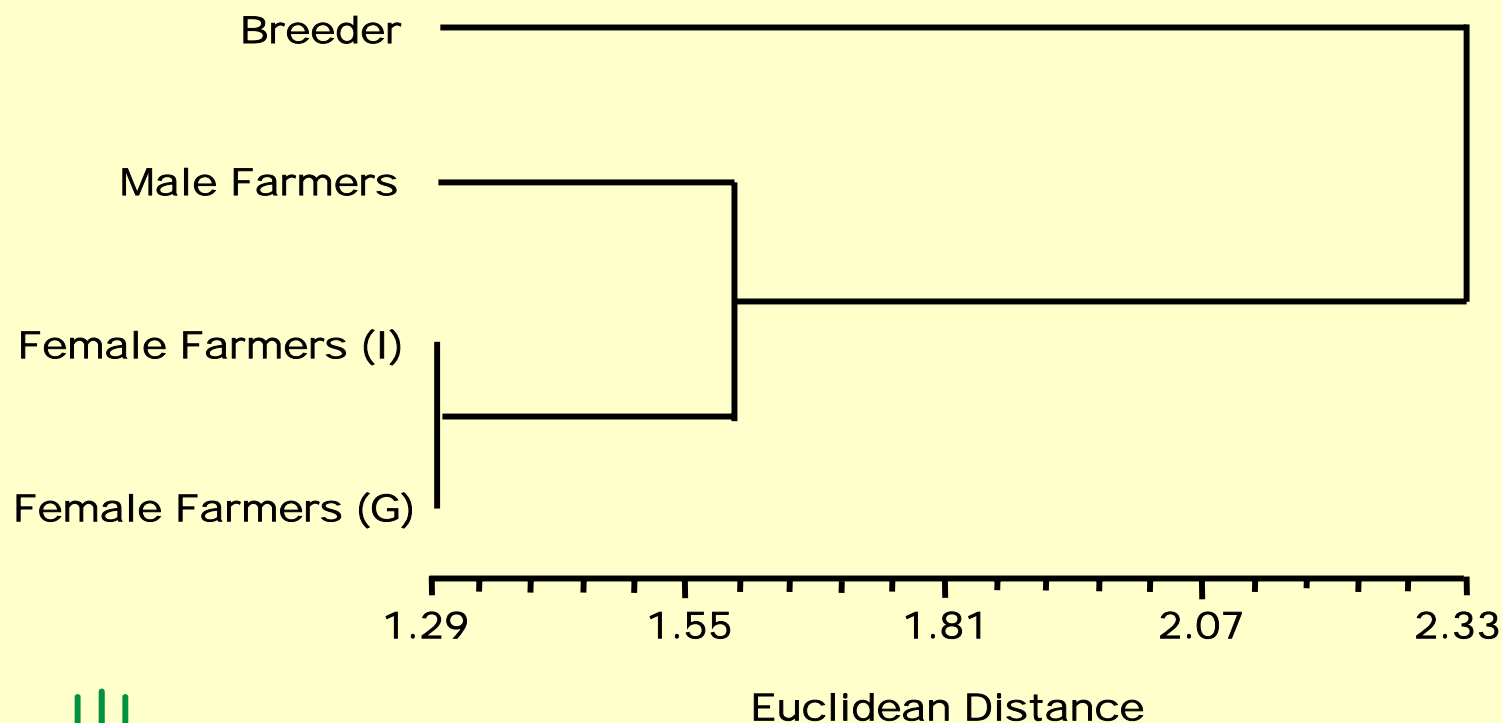
Number of women participating in selection in three villages in Yemen



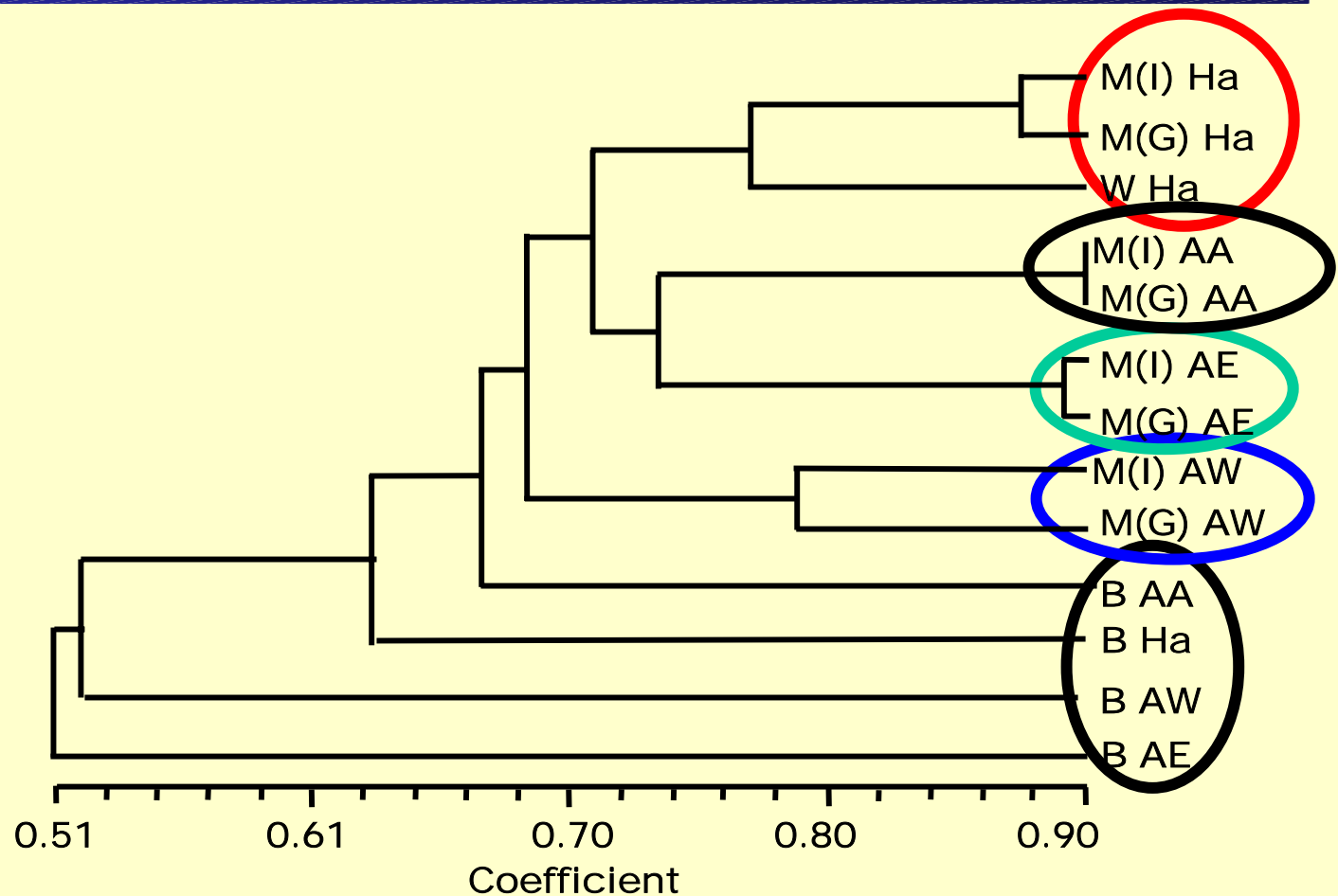
Dendrogram of Euclidean distances based on average scores given by the breeder, the individual male or female farmers, and by the group of female farmers in the lentil trial at Bit Al Wali (2000)



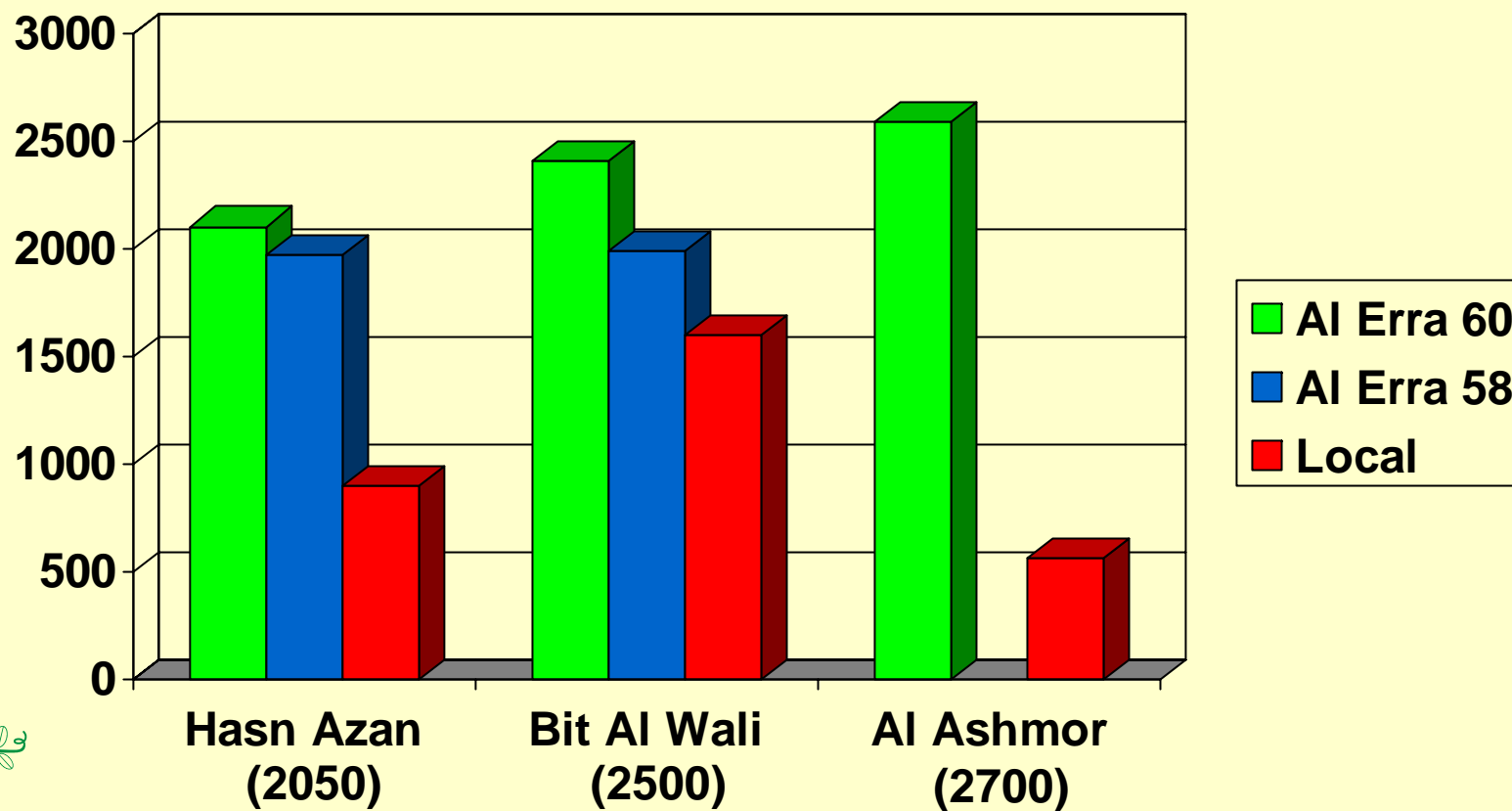
Dendrogram of Euclidean distances based on average scores given by the breeder, the individual male or female farmers, and by the group of female farmers in the barley trial at Al Ashmor (2000)



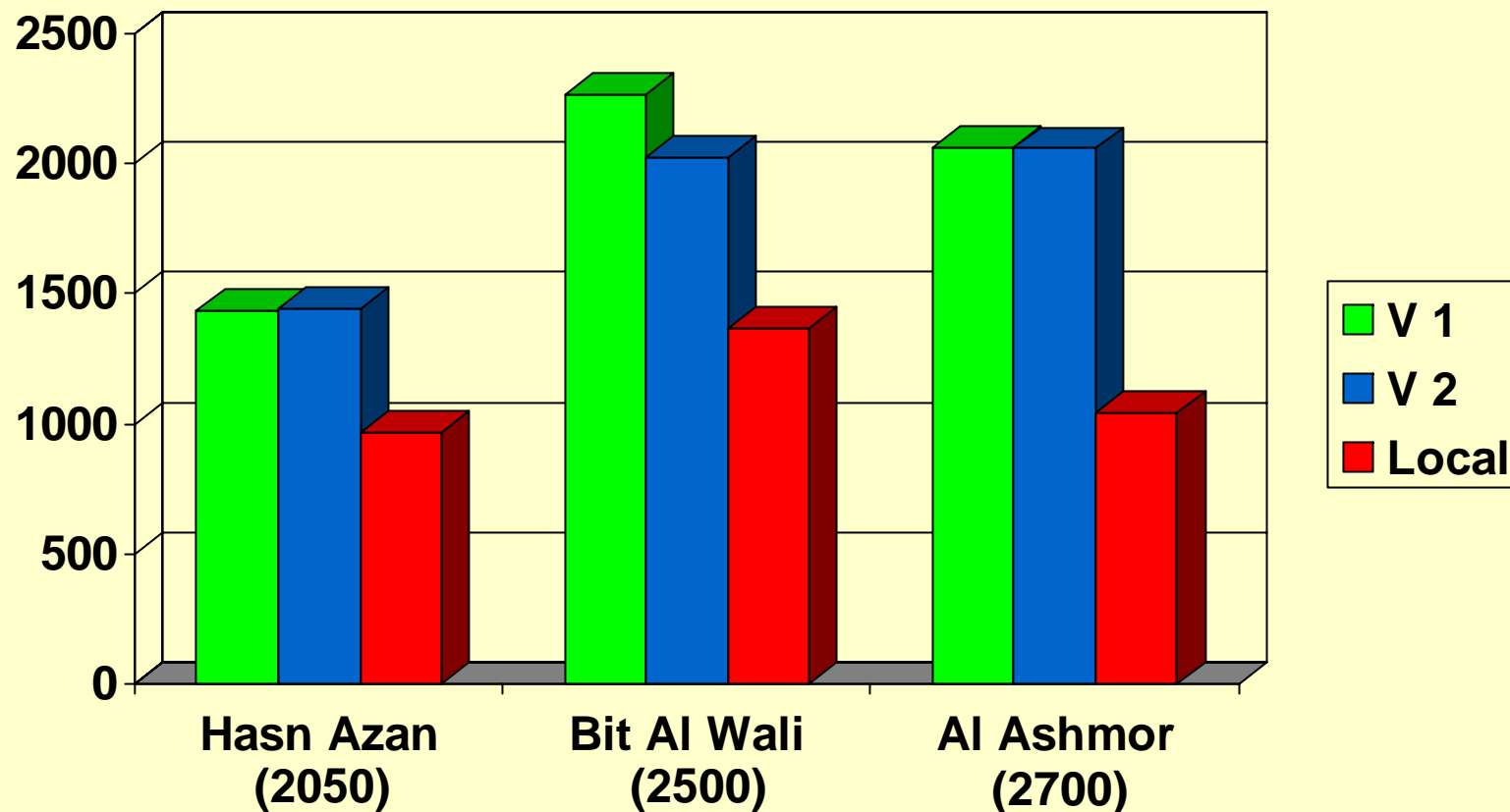
Dendrogram based on cluster analysis of farmers, women and breeder selections in lentil (Yemen)



Performance of the barley lines Al-Erra 60 and Al Erra 58, selected by farmers, in three mountain villages of Yemen (elevation in parenthesis) in 2001



Highest yielding lentil lines selected by farmers, in three mountain villages of Yemen (elevation in parenthesis) in 2001



Hasn Azan: V1= YG-NH, V2 = YG-35007

Bit Al Wali: V1= YG-35014, V2 = FLIP 95-6L

Al Ashmor: V1= Sehore 74-3, V2 = YG-NH





Mr. Salah, Seed Producer, Bit Al Wali, 2500 m asl
(Yemen)

Other intermediate impacts

New scientific tools available and disseminated through training



More formal scientists able to run PPB programs

Farmers request to control seed production



Village-based seed production facilities developed

Selection criteria differ among participants



Gender sensitive programs

New farmers' skills



Reports prepared by farmers; briefing of non participating neighbors by participating farmers; full management of trials; layout of trials (borders, randomization)

PPB is efficient and effective



Better breeding material identified

Institutionalization of PPB



Morocco, Yemen, Jordan, and Syria



Farmers' skills

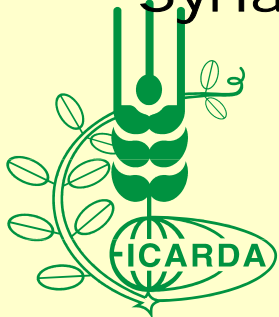
حلقة بحث

تقديم المزارع
أحمد الحاج صالح



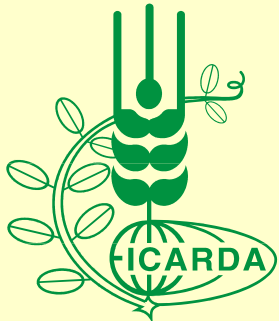
Institutionalization of Participatory Plant Breeding

- | | |
|---------|--|
| Yemen | Extension to other three villages
Used as a model in other projects |
| Morocco | The barley breeding program has been re-designed as decentralized and participatory |
| Jordan | Both the Minister of Agriculture and the Director General of NCARTT requested the establishment of a decentralized participatory barley breeding program |
| Syria | The transfer of the project to the Ministry of Agriculture depends only on resources |



Institutionalization of Participatory Plant Breeding

The key seems to be the participation of the Institution(s) that have the mandate for plant breeding in the country



The future

Study on cost of PPB to be completed soon

Scaling up the Syrian model: transferring the program to the Ministry of Agriculture

Expand PPB to cover more crops

Integrated Participatory Research



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Thank you