

# Use of Crop Diversity by Eritrean Farmers to Improve Agricultural Production



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# Eritrea

Total area: 121,320 sq km  
*agricultural land: 61%*  
*arable land: 4.78%*  
*permanent crops: 0.03%*

Population: 4.8 million  
*growth rate: 2.47%*  
*0-14 years: 44%*

80% of the population  
involved in farming and  
herding



# Poverty in Eritrea

- Among the 10 poorest countries
- 50% of the population below poverty line
- About 65% estimated to be undernourished
- 40% of children under 5 estimated to suffer from malnutrition
- Poverty and food insecurity widespread and on the increase





# Poverty in Eritrea

- Little access to essential social services such as health care
- Lack of safe drinking water





# Crop production

- Cereals provide 70% of the national per capita calorie intake
- Pulses provide a major portion of the protein requirements
- Barley and wheat are the major staples of the Highlands



# Production constraints

- Highly variable and erratic rainfall
- Recurrent droughts
- Insect pests and diseases
- Soil erosion and declining soil fertility
- Lack of post-harvest storage facilities
- Insufficient draft animals and cultivation equipments



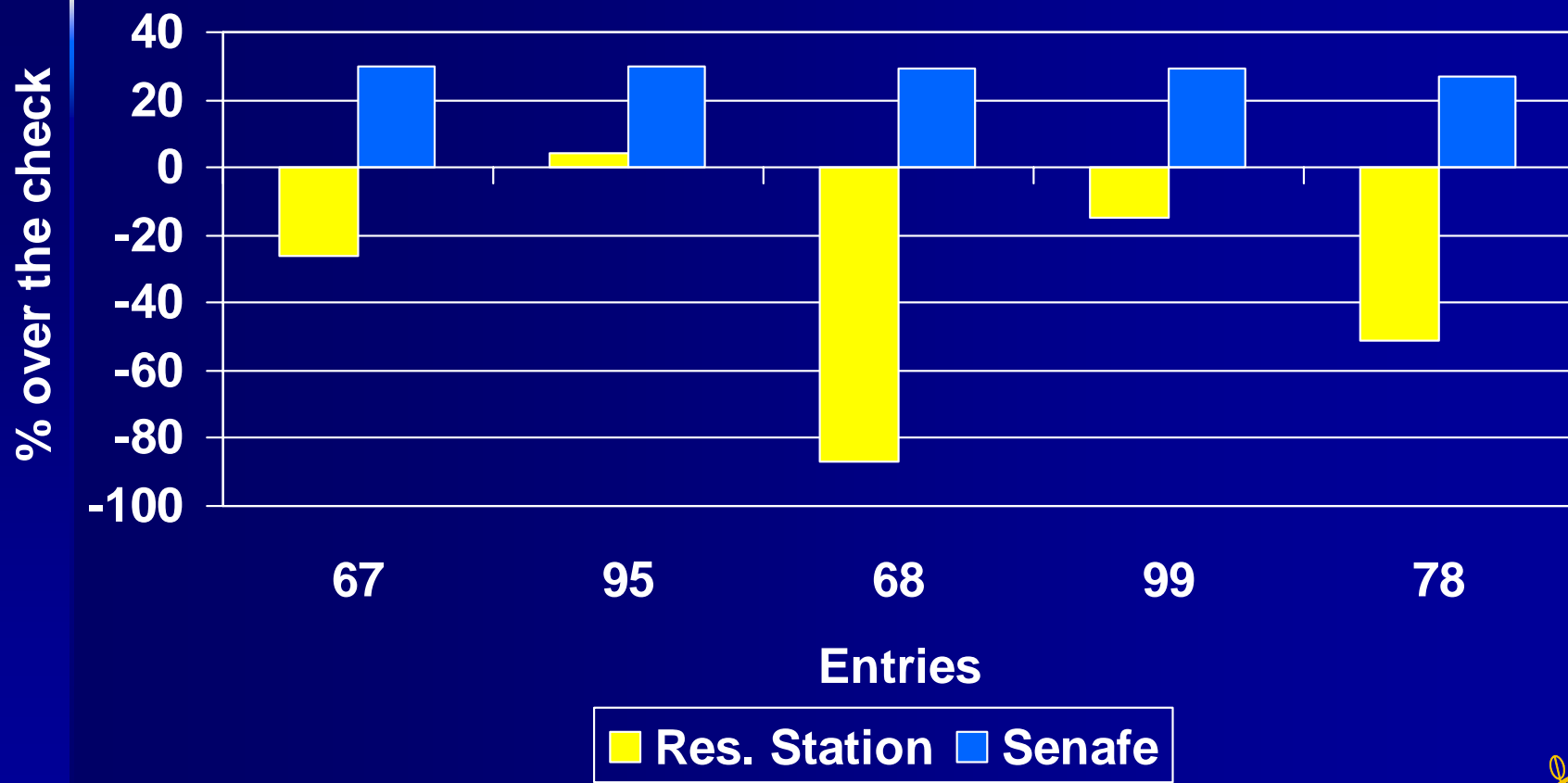


# ICARDA and Eritrea

- Shortly after Independence (1993) a program of training and technical assistance started
- In 1997 National Seed Development Program of the DANIDA Agricultural Sector Program Support (ASPS)
- In 1999 a participatory barley improvement program started



# Grain yield (% over the check) on station of the best five entries at Senafe





# Improving Water Productivity of Cereals and Food Legumes in the Atbara River Basin of Eritrea

Mereb-Gash and Tekeze-Setit Basins



# Participating Institutions

- National Agricultural Research Institute (NARI)
- Hamelmalo College of Agriculture
- System wide Program for Participatory Research and Gender Analysis (PRGA Program), International Center for Tropical Agriculture (CIAT)



- Farmers' Communities in the Atbara Basin
- Zobas and Sub-Zobas
- NGOs

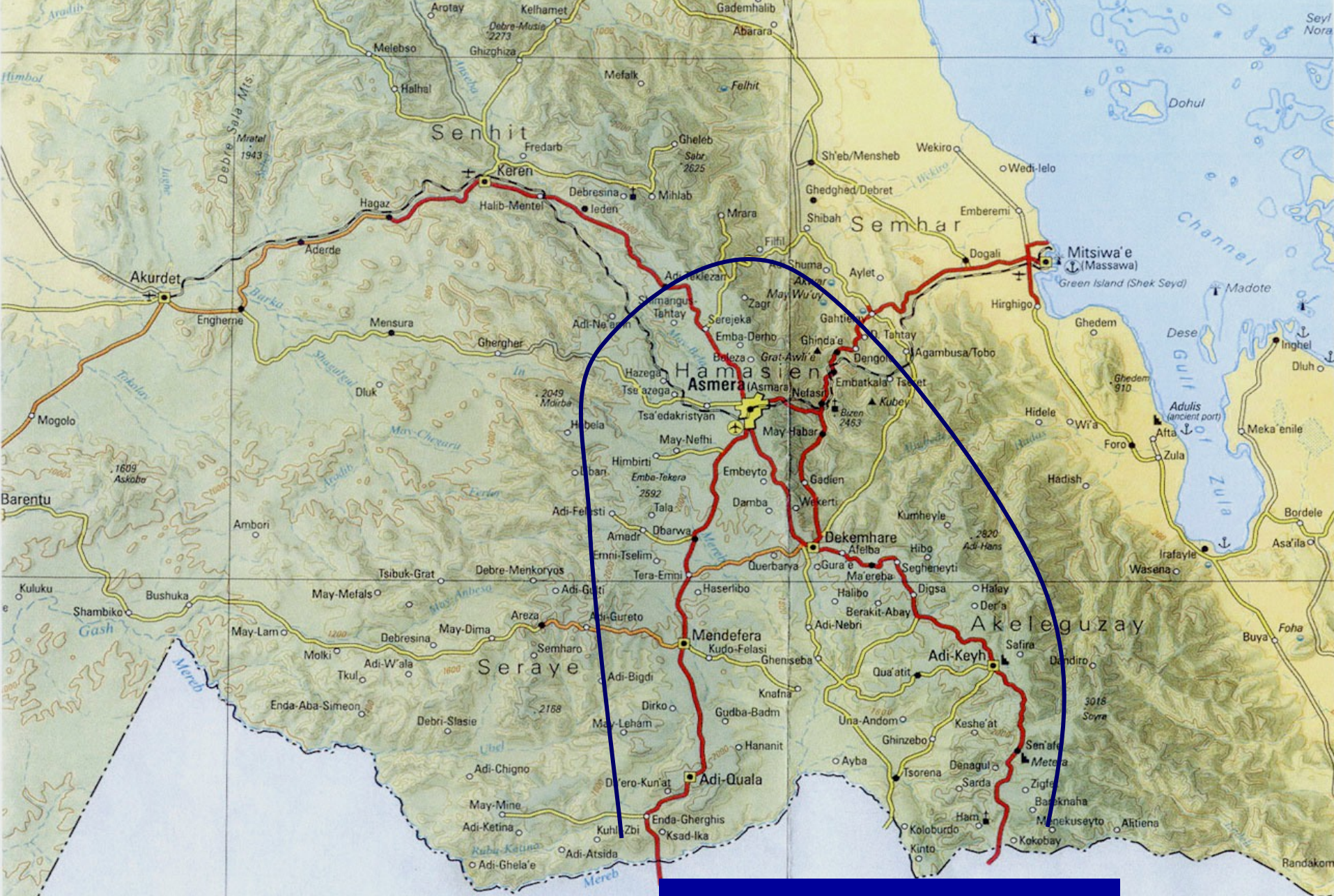


# The Goal

To enhance food security and alleviate poverty in the Gash and Setit basins by increasing crop water productivity, using low-cost inputs, while minimizing risk and ensuring sustainability of production







Project area



# Approach

- Participatory research and technology development
- Participatory on-farm technology testing
- Scaling out of the technology options to non-participating farmers



# Main Activities

- **Participatory breeding**
  - barley, wheat,
  - lentil, faba bean and chickpea
- *Hanfetse*
- Agronomy trials in barley and wheat
- Conservation Agriculture
- Seed production

# *Hanfetse*



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# Germplasm

- Local landraces
- Breeding lines from ICARDA (barley, lentil, chickpea, faba bean) and ICARDA/CIMMYT (wheat)





# Farmers' and breeders' visual selection





# Data collection and analysis



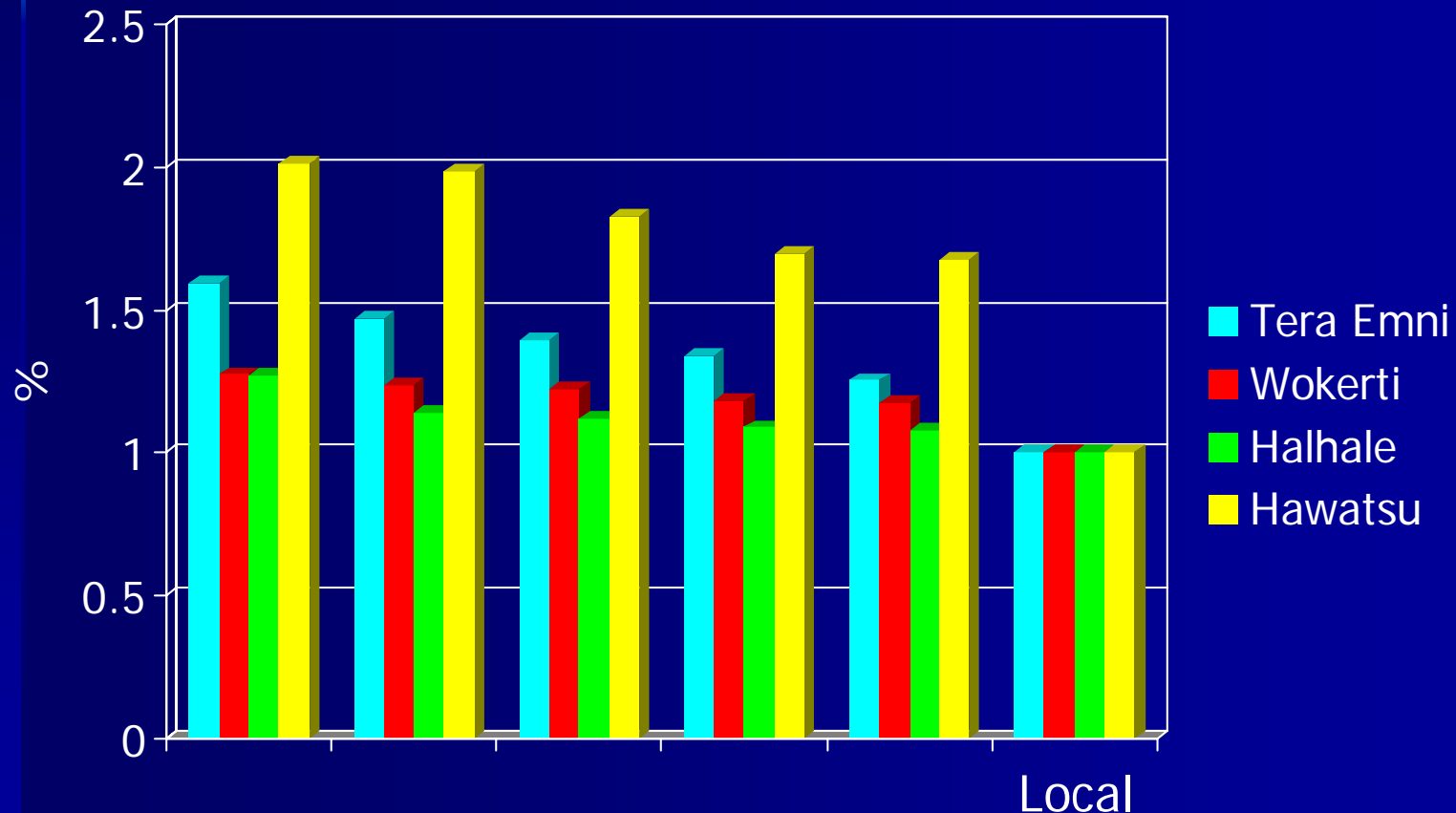
# Data analysis

- Spatial Analysis (specific GENSTAT programs written by the Biometrics Unit at ICARDA)
- G x E Interactions

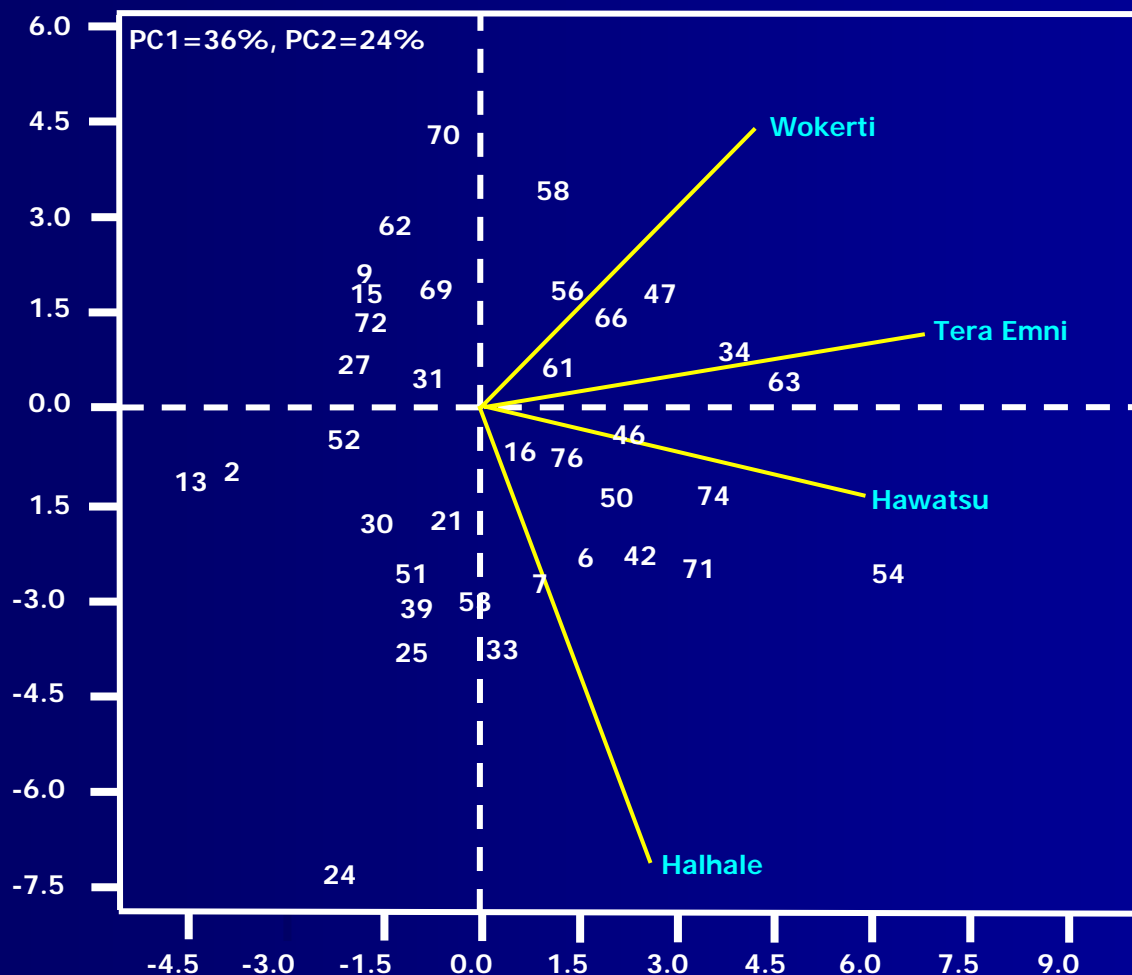


# Yield (% of the local check) of the top 5 yielding wheat lines in four locations

Yield advantages from 8 to nearly 100%



# Genotype x Locations Interaction for grain yield in wheat



## Yield of the top yielding wheat lines in the advanced yield trials across locations

Wokerti	Entry	Name	GY04	F1	F2	F3	Mean	rank	%
	6	-	3.46	1.71		1.20	2.13	1.00	1.14
	12	SHA4/3/22*CHUM18//JUP/BJY	3.33	1.66		1.27	2.09	2.00	1.12
	25	Ckeck	3.12	1.34		1.12	1.86	5.00	1.00
<b>Serejeka</b>	23	HAR1685	2.12	0.75	2.17	0.90	1.48	1.00	1.08
	25	Ckeck	2.17	0.59	1.69	1.07	1.38	2.00	1.00
<b>Tera Emni</b>									
	24	17thSAWSN	4.49	1.15	2.84	0.48	2.24	1.00	1.15
	20	TUI/PYN//RAYON	4.38	1.11	2.86	0.40	2.19	2.00	1.12
	7	SW89.3064/STAR	4.06	1.12	2.90	0.64	2.18	3.00	1.12
	25	Ckeck	3.54	1.10	2.88	0.29	1.95	10.00	1.00



# Barley





Shishai released for medium altitude areas  
Rhawa released in Embaderho  
Tekonda released in Adi Keyh





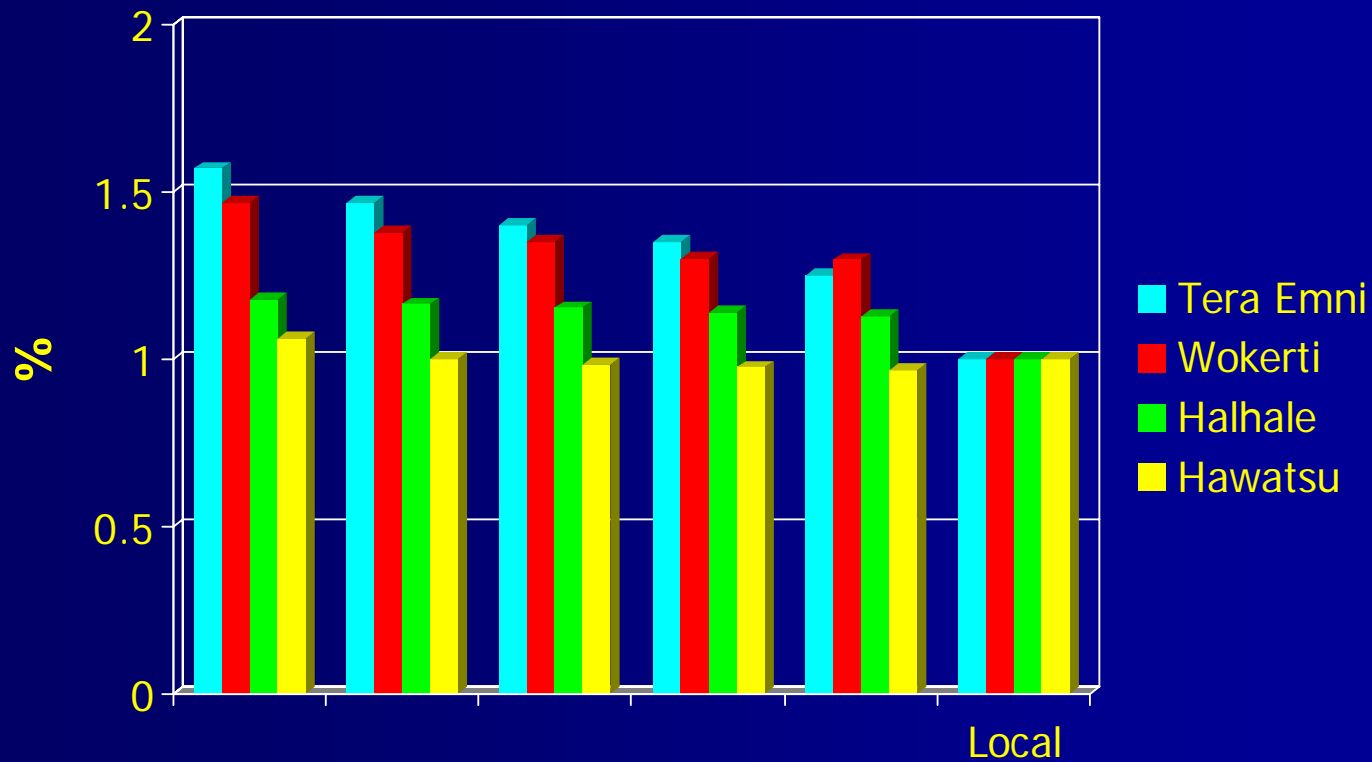


Ms Fida participated in the selection of Tekonda



# Yield (% of the local check) of the top 5 yielding barley lines in four locations

Yield advantages ranging from 6 to more than 57%





# Legumes



# Lentil







Variability for wilt and rust

# Highest yielding lentil

Entry	ILL	vg	fd	ph	md	dm	gy	sw	ms
14	7978	3.76	43.7	32.8	75.5	0.53	333.4	32.8	2.88
51	Local Chec	4.53	41.6	35.6	77.7	0.58	114.8	19.5	2.43
44	10013	3.58	41.2	32.0	74.1	0.43	109.0	20.8	2.56



# Chickpea



# Landraces and Improved entries in Chickpea

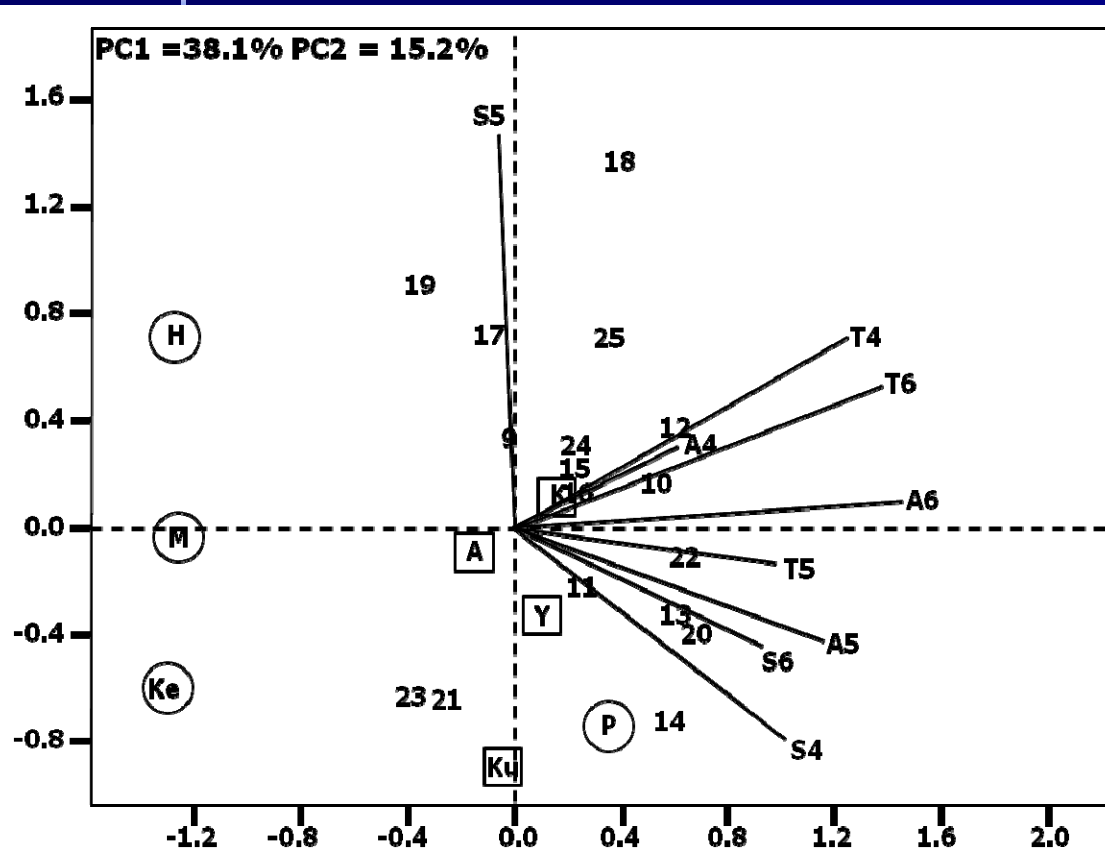
Germplasm	vg	fd	ph	pla	po	dm	gy	sw	ags	ms
Landraces	3.29	50.29	32.78	21.39	37.56	0.35	133.21	152.10	2.78	1.99
Improved	3.23	63.46	33.89	27.08	13.09	0.27	36.38	189.35	2.43	1.18



# Faba bean



# Hanfetse



The most stable entries were always hanfetse but that not all the hanfetse are necessarily stable



# Village base seed enterprise





# Conclusions

- Yield increases are possible by exploiting existing genetic variability
- Large yield increases observed in legumes
- Large variation between landraces
- Information is now available to allow selection of parents for a crossing block
- Farmers have an extraordinary ability to identify the highest yielding varieties
- Farmers are very happy with the participatory work

# Conclusions

Participatory plant breeding improves the interaction between farmers, researchers, extension agents, and other stakeholders



**The University professor**



**The lentil breeder**



**The bread wheat breeder**



**The NARS' DG**

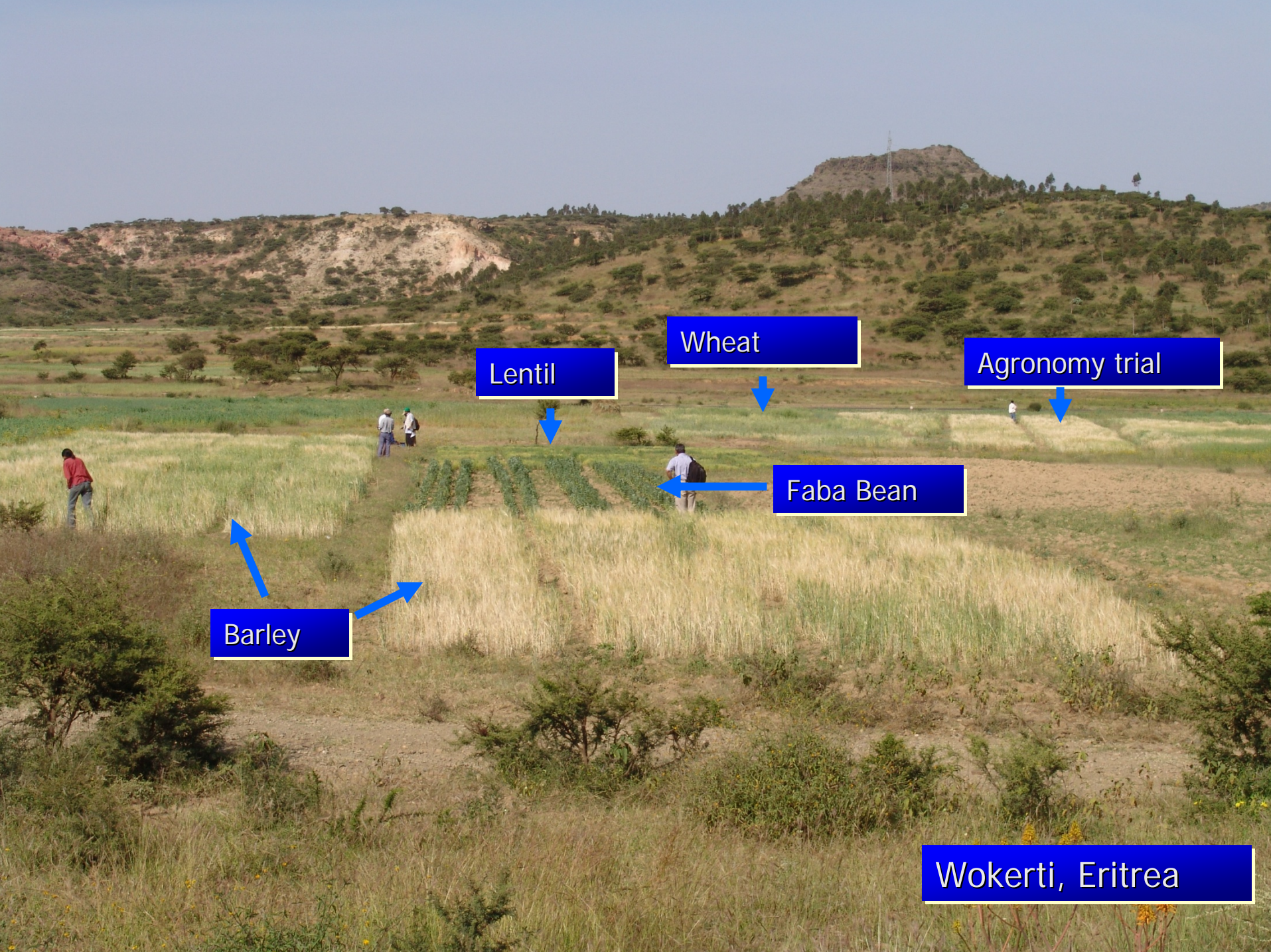




# Conclusions

Participatory plant breeding offers the possibility of improving more than one crop within the same program





Lentil

Wheat

Agronomy trial

Faba Bean

Barley

Wokerti, Eritrea



# Conclusions

Participatory plant breeding allows to respond quickly to both agronomic and/or climatic changes





New wheat germplasm resistant to yellow rust. Wokerti, September 2006





10 2 2005

Thank you

