Community-based sheep breeding in Ethiopia: Attractive approach to low input systems

EIAR/ATA/ICARDA Workshop on small ruminant breeding programs in Ethiopia
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Context

- In livestock breeding matching genotypes with appropriate environment is crucial

- If we can't change the environment, then we have to work with indigenous adapted breeds

- In developed countries and in high input animal production systems, systematic genetic improvement of livestock species is based on:

  - large scale recording and genetic evaluation schemes

  - specialized breeding farms and breeding companies which produce improved breeding stock readily available for use in commercial farms

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Context

- In developing countries and low input production systems such breeding schemes and structures are uncommon
  - livestock keepers have limited access to improved breeding stock
  - the cost involved to acquire improved stock
  - the availability of the appropriate animals
- Farmers with these limitations can develop own breeding program through Community-Based Breeding Programs (CBBP).

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Participatory and modern breeding

Feature	Participatory	Modern
Drivers of program	Demand (users)	Supply (breeders)
Structure	Usually open to upward gene-flow	Usually closed to upward gene-flow
Genotype	Local breeds	Internat. breeds
Breeding objective	Set by participants	Set by breeders/politicians
Traits	Adaptation, etc.	Production, etc.
Selection criteria	Visual, performance	Pedigree, performance

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- What do you want to improve?
- Where do you get the males from?

$I = b_1 X_1 + b_2 X_2 + ... + b_m X_m$ (Index)

X's = measurements / information

b's = index weights which maximize correlation with H

Formally calculated as **$b = P^{-1} Ga$**

Columns of **$P^{-1} G =$** index weights to calculate breeding values

With pedigree information we can use BLUP procedures to calculate breeding values more accurately

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Selection accuracy

Random
0%

Visual
30%

BLP analyses
Records
60%
Performance test

BLUP analyses
Records on relatives
90%
Progeny test

Genomic
100%

Sophistication of selection system

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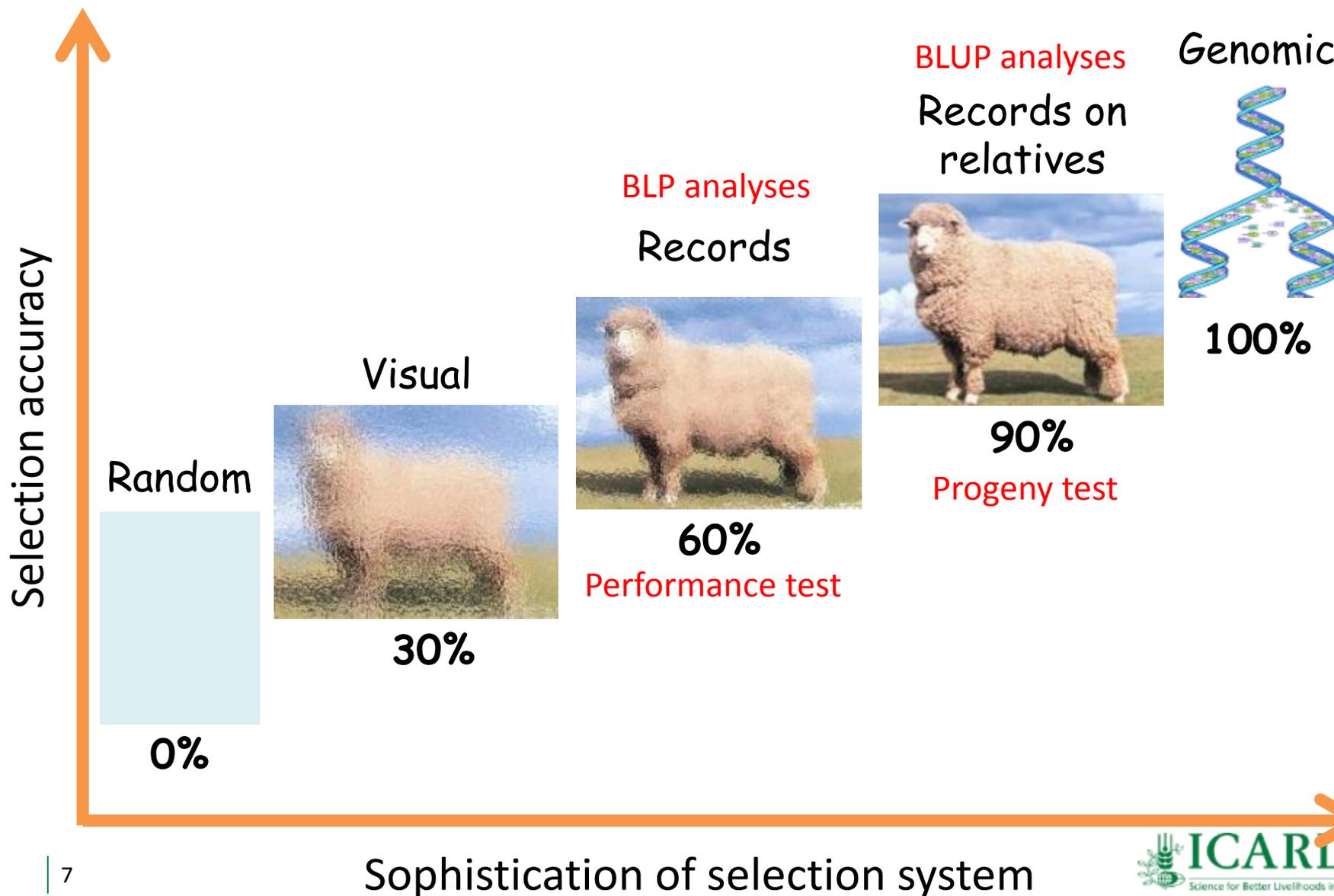
Community-based breeding

- Participatory breeding – decentralized breeding plans and programs

- Improvement programs carried out by communities of smallholder farmers often at subsistence level

- Community based breeding considers proper consideration of farmers breeding objectives, infrastructure, participation and ownership

Steps for setting up community-based breeding

Target Sites Identified and Breeds Characterized

| Selection of Community and Breeds | Analysis of Production System (Including Livelihood Strategies) | Phenotypic and Molecular Characterization | Markets and Institutional Analysis |

Breeding Objectives Defined

Ranking Experiments | Choice Experiment | Economics of Traits

Breeding Structures Developed

Performance recording:
• Animal Identification
• Recording System
• Database Management

Breeding plan:
• Simulation Studies
• Selection Scheme
• Nucleus/total community

Ram Management:
• Sharing and Exchange
• Selection Index
• Breeding Value Estimation

Enabling Environment Created

Institutional backup including cooperatives | Related Interventions (Feeding, health, market linkages...)

Functional Community Based Sheep Breeding Program

Evaluation of Breeding Program | Impact Assessment

Monitoring and Evaluation of Progress

Our approach

- One-tier community breeding scheme
- Selection is carried out in the whole community sheep population. The villagers select breeding rams from across all the flocks in the village taken as one big breeding flock and use the selected rams communally
- Animals screened from the community based on the selection criteria could be transferred to a central test station for comparative ranking in a common environment

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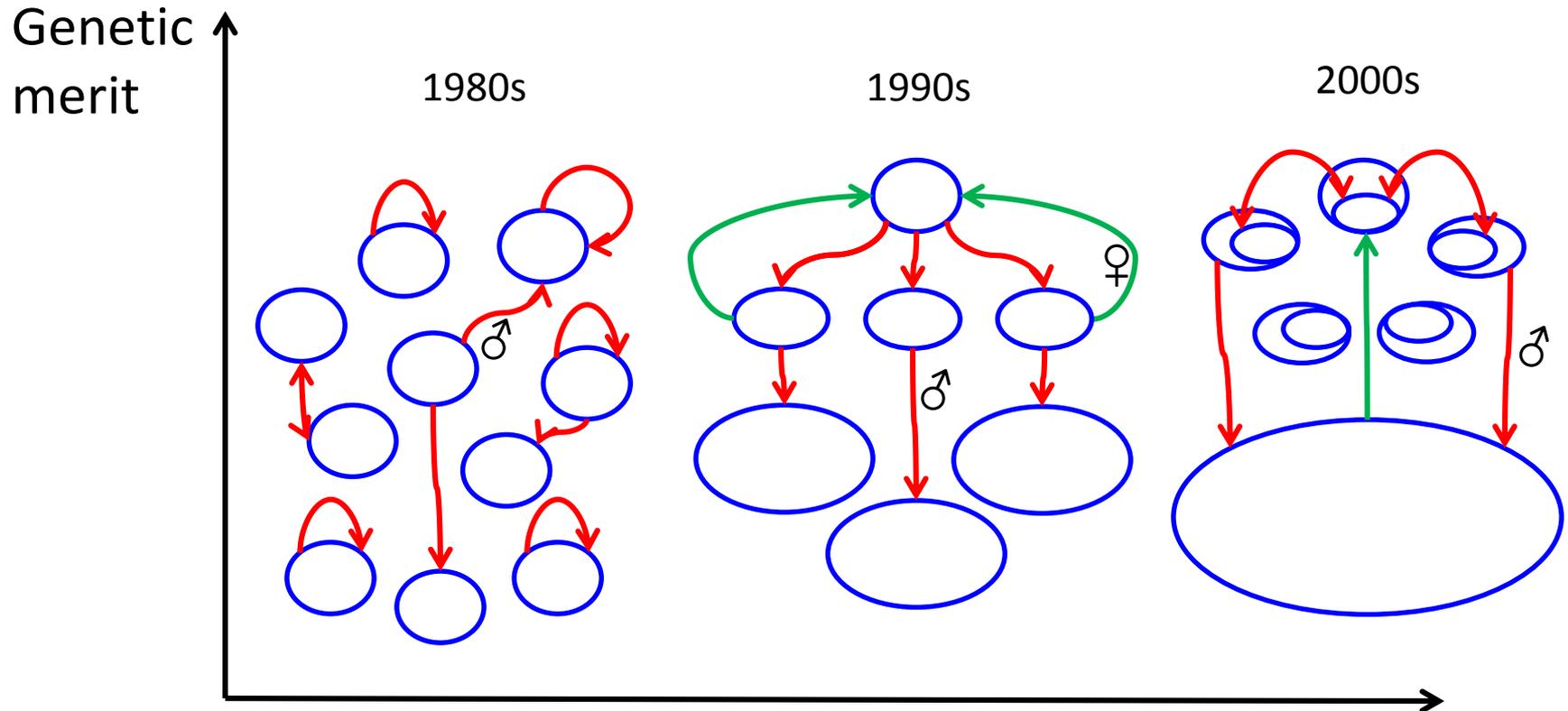
- 30 years from "no" structure to open dispersed nucleus
- Organization - extension - marketing – training – prefinance

Hypothetical choice experiment

Structured questionnaire

Ranking of groups of live animals

On-farm ranking based on farmer's choice
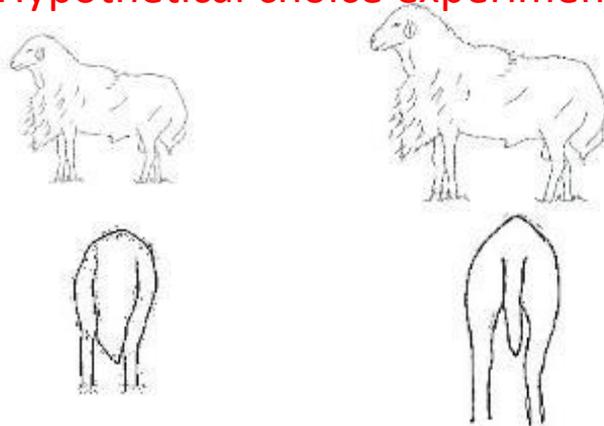
Modeling alternative breeding plans

Trait preferences

	Menz	Horro	Bonga	Afar
Option	10% intensity 2 years ram use	10% intensity 2 years RU	10% intensity 2 years RU	10% intensity 3 years RU
Traits	• Fleece weight • Growth performance • Lamb survival	• Growth • Twining rate • Lamb survival	• Growth • TR • LS	• Milk pdn • Growth • LS

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Young rams selection procedures

- Performance records:
  - weight (birth, weaning, 6 and 12 months) – all breeds
  - wool yield??? (Menz) by households and technicians
  - number weaned (all breeds); twinning (Bonga & Horro)
- Ram selection:
  - candidates are ranked based recorded information
  - physical soundness (tail type, coat color, horns, conformation and general appearance)
- A research team and a committee consisting of five community members jointly screen the candidates

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Results, Impacts/ changes-examples

- Reverting 'negative selection'
- More births, better growth, and reduced mortality in participating community flocks
- In Bonga breeding rams are sold for more than double the price of meat sheep of similar condition
- High demand for breeding rams from neighboring communities, other government programs and NGOs.
- Most of the participating households in Menz graduated from the government-run safety net program that meets short-term food needs through emergency relief.
- Bonga cooperative has capital of around 1.7 million Birr)

Mean flock size of CBBP participants and non participants

Participate in the programme	N	Mean	t-value	p-value
yes	120	16.3(12.6)	8.3	0.001
no	120	6(5.2)		

Average number of sheep slaughtered for consumption/year

Participate in the programme	N	Mean	t-value	p-value
yes	120	3.6(2.6)		
no	120	1.4(1.3)	8.5	0.001

Average number of sheep sold/year

Participate in the programme	N	Mean	t-value	p-value
yes	120	6(5.2)		
no	120	4.5(5.1)	2.13	0.035

Results

	Birth weight	Three months weight	six months weight	Lambing Interval
Menz	2.27	9.3	13.7	270
Menz L	2.15	8.5	11.3	303
Horro	3.12	11.7	17.3	270
Horro L	2.55	10.6	14.0	277
Bonga	3.65	14.4	20.0	275
Bonga L	3.6	12.6	18.0	265

EBV over selection rounds (6 MWT-Menz)

Round	EBV
1	0.3110
2	0.4387
3	0.4800
4	0.5145
5	0.5400
6	0.5621
7	0.6111

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Growth performance (kg)- Bonga

YEAR	BWT	3MWT	6MWT
2009	3.88	14.0	19.4
2010	3.63	14.6	19.1
2011	3.45	13.5	20.6
2012	3.37	14.4	20.9
2013	3.62	14.1	18.9
2014	4.00	15.4	21.3
P	**	**	**

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- Through CRP L&F ICARDA and ILRI have established CBBP at two news sheep sites and two goat sites

- CBBP is becoming a program of choice in Ethiopia: for example, the south regional state of Ethiopia allotted 2 million USD for outscaling of the approach in the region

- CBBP in Bonga is fully funded by the regional government; sites have been increased from 2 to 16 communities and CBBP has been started at new locations

- Menz/ Doyogena upscaling by the research and BoA???

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The thinking as we move forward

- Scale up genetic improvement from single village-based activities to regional breeding programs

- It involves establishing nuclei breeding villages where genetic improvement is generated, which then serve as sources of improved rams to the whole population

- The village nuclei would be located strategically across the sheep/goat breeding tract

- How many rams/bucks can we possibly produce; how many rams/buck do we need; how big is the target population; we don't have to set up CBBPs everywhere; we don't need recording in 'participating' communities; complementary services needed

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Requirements for CBBPs to succeed

- Commitment, close follow up

- Trust

- Support (Government NGOs others)

- You need champions

- Training

- Link with other interventions

- Market linkage

- Farmer organizations with committed leaders

- Flexibility

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Data Recording and Management System (DREMS) Term of Use

Administrator Area

User Area

Management System

Wireless

Satellite
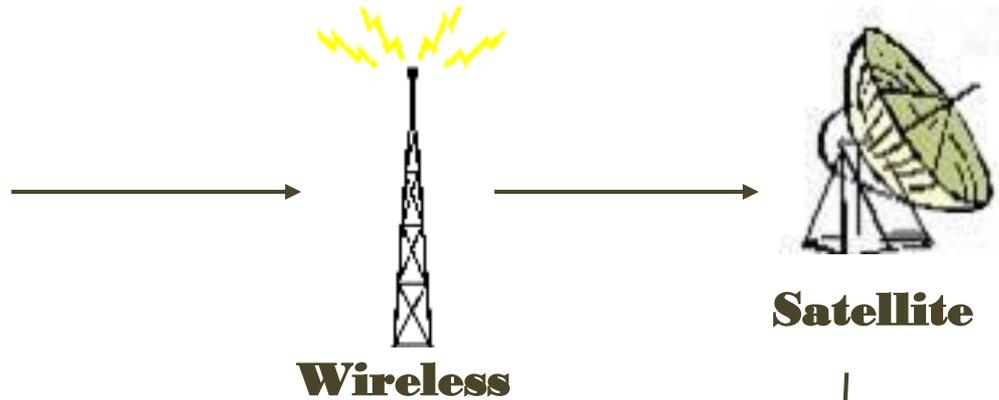
System installed on tablets

Field enumeration using tablets

ICARDA Server/DREMS
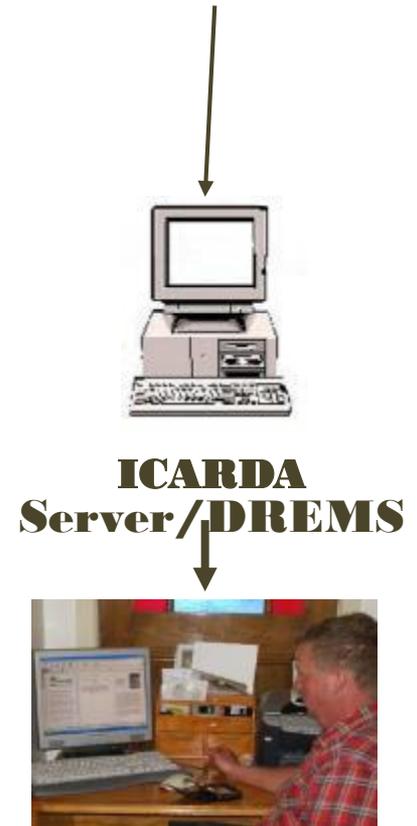
Remarks

- Farmers: work together, establish organizations

- Projects: involve stakeholders, in particular farmers, right from the start of the design of a breeding project

- Breeding programs: Discuss and agree on the design, objectives, activities and expected outcomes.

- Plan optimum intervention strategy but be prepared for changes

- Researchers

  - Act as catalysts and facilitators providing options to farmers to make decisions based on scientific evidence

  - Plan exit, training and adoption of responsibilities by farmers for sustained breeding program

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Thank you!!!