Opportunities for Enhanced Crossbred dairy based Milk Productivity through use of Genomic, Reproductive and IC Technologies


International Livestock Research Institute (ILRI)

Special Dairy Breeding Seminar
Getfam Hotel, Addis Ababa, Ethiopia: 13th April, 2018
Role of Agriculture and Livestock Sector to Africa’s economic growth

• Agriculture holds key for Africa’s economic growth, but is hugely under-resourced!

• Currently, one-third of all calories consumed in Africa are imported at a cost of US $35 billion/yr

• In eastern Africa- 40 billion litres milk supply deficit/yr
  • Ethiopia’s GTP II ambitious targets:
    • 10,51 million litres of milk by 2018/19
    • 705,207 annual increases in more productive dairy heifers and cows
    • 6 and 10% in increases in average milk production in crossbred cows in smallholder/specialized systems.

Source: Bouet et al, 2014
MoL&F- ET, 2016
African livestock (% world population):

- 324 million cattle (21%),
- 387 million goats (37%)
- 351 million sheep (29%)
- 36 million pigs (3%)
- 24 million camels (85%)
- 1.9 billion chicken (8%)
- 150 indigenous breeds
- Human population(2016)-1,225,080,000

Source: FAO, 2016

Source: harvestchoice.org
Huge gaps between demand and supply in dairy products in Africa

Africa produces 5.4% of the global milk from cattle (FAOSTAT, 2016)

Big productivity gaps persist: Gaps of up to 430% in milk

Steinfeld et al. 2006
Large differences in productivity depending on the production system

Light coloured bars = Minimum production
Dark coloured bars = Maximum production
$x_i$ = Differences in production due to “animal husbandry practices”
$y_i$ = Differences in production due to “genotype”
Low herd/cow productivity and the environmental consequences

Herero et al. 2016
Opportunities

- Demand for, and consumption of dairy products is growing
- Strong emerging market oriented investments in dairy
- Potential for dairy as a source of income for millions
- New technologies offer opportunities for increased productivity & profitability

2 Options for meeting the huge & livestock product demands:

1. Importing industrial production know-how
2. Transforming smallholder livestock systems

OECD and FAO Agricultural Outlook, 2016-2025*
Why the African Dairy Genetic Gains? (The Challenges that ADGG is addressing)

- little or no systematic and sustainable breeding programs
- limited access to the dairy genetics or breed type that best suit the different production systems
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- Inadequate access to input & market services
- access to information or farmer education and training services lacking so can’t improve herd productivity and system profitability
ADGG: Approach and Objectives

**Innovative application of existing & emerging technologies**

1. To establish National Dairy Performance Recording Centers (DPRCs) for herd and cow data collection, synthesis, genetic evaluation and timely farmer-feedbacks

2. To develop & pilot an ICT platform (FFIP) to capture herd, cow level & other related data & link it to DPRCs (feeds back key related herd/cow summaries, dairy extension & market info. etc.).

3. To develop low density genomic chip for breed composition determination & related bull certification systems for crossbred bulls
Effective phenotyping

Dairy cattle: Innovative application of Genomics & ICT thro PPPs

Optimize Realized Productivity for farmers

Smart application of Genomic tools

Engagement (PPP & Capacity development)
Cow Calendar

Increased efficiency and profitability

DAIRY FARMERS

iCow Platform

Genomic chip

AI Technician

Platform
Current ADGG phenotypes

- Milk yield \((\text{litres on test-day basis})\) & milking frequency
- Lactation length \((\text{derived})\)
- Calving interval \((\text{derived})\)
- Birth weight
- Calf/heifer growth \((\text{weight for age})\)
- Survival to different age \((\text{derived})\)
- AFC \((\text{derived})\)
- Lactation number
- Type and incidence of disease, interventions/treatment & costs
- Body condition score on the test –day
- Teat and udder type scores, including disorders
- Behavioral (movement/rumination) tracking in association estrus detection
- Milk composition \((\text{provided for but not being measured now})\)
  - Fat %
  - Protein %
  - Urea \((\text{mg/dl})\)
  - Lactose %
  - Somatic cell count \((\text{cells/ml})\)

The above are being used to develop breeding objectives
Achievements
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<tr>
<td>Number of registered /recorded herds</td>
<td>400</td>
<td>23,583</td>
</tr>
<tr>
<td>Number of animals being recorded</td>
<td>&lt; 8000</td>
<td>48,800</td>
</tr>
<tr>
<td>Number of records</td>
<td>≈ 60,000</td>
<td>174,000</td>
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<tr>
<td>Number genotyped to inform genomic selection</td>
<td>0</td>
<td>7000</td>
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<tr>
<td>Genomically evaluated x-bred breeding bulls</td>
<td>0</td>
<td>By July 2018</td>
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Other related results and outcomes

• Dairy Performance Recording Platform operational & is supporting >100 AI technicians who have done > 160, inseminations

• Farmers receiving & using hundreds of thousands digital farmer education messages to improve their herd/cow productivity

• Bull/cow certification genomic chips (being developed)

• More than 15 Ethiopian scientists quantitative genetics and genetic evaluation using the DPRC data

• Public Private Partnership/business models for AI delivery and DPRC sustainance being explored
Challenges

• Unstable internet connectivity
• Weak institutions
• Inadequate/not fully supportive policy to PPR-arrangements
• Inefficient supply chains that increase business risks
• Anticipated PPP business models for running DPRC not clearly emerging
Some conclusions

- Transformation of the dairy genetic improvement gain and delivery is technically feasible, but enabling policy environment is a critical factor.

- PPP-based business models are key to enabling effective & sustained participation of the private actors in transforming the dairy sector.

- Institutional and individual capacities need to be continuously co-created to support the transformation.

- For faster productivity gains, technical/regional partnerships in crossbred cattle genetic improvement/evaluation and exchange programs need to be embraced.
Acknowledgements

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ADGG
African Dairy Genetic Gains
More productive and profitable dairy cows

Bill & Melinda Gates Foundation

National/regional Institutions/govts.

Dairy Farmers & Farmer organizations
better lives through livestock

ilri.org

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