Animal breeding and genetics in the Tanzania livestock master plan

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Tanzania is endowed with an abundance of natural resources—land, water, forage and a large livestock resource base. Despite the large livestock population—the third largest in Africa—the contribution of the sector to gross domestic product is fairly poor at 7.4%. While indigenous livestock in Tanzania—comprising 98% of the total—are well adapted to the local environment, e.g. resistant to disease, productivity is low. The annual growth rate of the sector is low, with rates declining from 3.5 to 2.4% between 2010 and 2015, far below the 9% projected in the 2010 National Strategy for Growth and Reduction of Poverty; this is largely due to low growth, high mortality, low reproductive rates and poor product quality.

High population growth and rising living standards are putting pressure on Tanzania's livestock owners to increase the productivity of their animals. Quick-win genetic-based technologies—including artificial insemination with oestrous synchronization and community-based schemes to improve indigenous breeds—can significantly contribute to the transformation of the value chains for cattle, dairy, small ruminants, pork and poultry. Modest improvements in these production coefficients and value addition through processing, could significantly increase output and income from the livestock sector.

Analyses by experts who developed Tanzania's livestock master plan (LMP) argue that genetic improvements could help increase Tanzania's production of dairy milk, poultry meat and eggs, pork and red meat by 77%, 666% and 40%, 69% and 50%, respectively by 2022. National livestock genetic improvement programs could, thus, significantly

help reduce poverty by helping millions of family farmers upgrade their traditional subsistence livestock production systems to market-oriented, profit-making, enterprises that directly improve livelihoods and reduce food insecurity. Transformation of the livestock sector would also benefit Tanzania's growing urban consumers by offering them more, and more affordable, meat, milk and eggs.

Crossbreeding initiatives could increase the number of crossbred cattle and improved pork by 337% and 45% in family systems and by 163% and 180% in specialized systems respectively, with milk production by crossbreds increasing tenfold and parturition rates by 50% compared to local breeds. The number of improved and crossbred birds would increase by almost 75%, and crossbred chickens raised in specialized production systems would increase their egg and meat production three- and thirteen-fold respectively, with significant decreases in mortality rates.

However, global industrial livestock operations are growing twice as fast as traditional mixed farming systems and six times as fast as traditional grazing systems. In response to growing demand, there has been a strong move to depend on few specialized livestock species and breeds. Such an approach ignores the scope for improving the productivity of locally-adapted breeds which are often more resistant to disease and climate change. In Tanzania, some vulnerable indigenous breeds risk extinction. In this context, there is compelling need to determine the extent of differentiation among livestock breeds at phenotypic and molecular levels. The focus needs to be on the phenotypic characterization,

parameter estimates, and documentation of the local policies and interventions. This would lay the ground for the establishment of conservation priorities for indigenous livestock breeds in the country.

The critical issues facing genetic improvement of the national herd include the need to maintain/develop appropriate genotypes and streamline breeding efforts. The absence of coordinated breeding and selection programs hinders capacity to meet demand by communities for improved breeds. Resilience to diseases, community preferences and high twining rates in small ruminants, should be the characteristics considered in animal genetic resources (AnGR) programs focusing on breeding and conservation.

The coordination of AnGR in Tanzania should prioritize the establishment of reliable and sustainable germplasm delivery systems and encourage the private sector, including farmers, to actively engage in genetic improvement system. The important species and their respective breeds—as per the Tanzania livestock master plan—are cattle, sheep, goats, pigs and poultry.

Approaches to improving the genetic potential of the herd

The potential approaches to improving the genetic potential of the herd include: breed selection, crossbreeding with exotics, and the introduction of exotic breeds for production of meat and/or milk.

Cattle

Tanzania is endowed with local cattle breeds and is well placed to take advantage of crossbreeding indigenous with exotic breeds through the use of artificial insemination. Improvement within local breeds should be directed through the selection and interbreeding of breed-types taking advantage of additive gene action. Conversely, in taking advantage of non-additive gene action, the suitable breeds of cattle, depending on the goals of the production system, recommended for use in crossbreeding with indigenous cattle are: Friesian, Ayrshire, Jersey and Brown Swiss for dairy production; Angus, Hereford, Charolais, Brahman, Beefmaster and Bonsmara for beef production; and Simmentals, Brown Swiss and Red Poll for both dairy and beef production, as well as and the Sahiwal, Mpwapwa, Boran and Gir breeds to improve the local zebu population.

Table 1: Summary of inventory and parameters based of indigenous and exotic breeds

Species: breed	Total population	Parturition rate*	Prolificacy rates**	Mortality rates	Parameters Weight adult	Dressing %	Milk yield	Litres
Cattle	**25,799,980**							
Local	25,180,800	61%	1	2%–20%	260–380 kg	51–53%	270–1,200	250
Exotics	619,180 (incl. 411,500 crosses)	67%	1	2%–10%	350–400kg		1,550–2,200	305
Sheep	**8,700,000**							
Local	8,684,761	1.5%	1.2	2–7%	38–40 kg	45–47%	NA	NA
Exotics	15,239	1.6%	1.1	2–6%	47–50 kg	50%		
Goats	**16,700,000**							
Local	16,198,185	1.5%	1.3–1.5%	2–20%	38–65 kg	48–50%	90	180
Exotics	501,815 (incl. 492,521 crosses)	1.5%	1.5%	2–12%	49–70 kg	50–53%	500	187
Pigs	**1,900,000**							
Local	475,000	2%	6%	2–30%	55–60 kg	60%	NA	NA
Exotics	1,425,000 (incl. 1,140,000 crosses)	2%	8–10%	2–15%	72–90 kg	70%	NA	NA
Poultry	**76,500,000**							
Local	42,000,000	Not established	Not established	8–40%	1.2–1.5 kg	80%	NA	NA
Exotics	34,500,000	Not established	Not established	2–5%	1.2–1.6 kg	85.5%	NA	NA
Total	76,500,000							

*Parturition rate to calving rate means the number of calves born per cow which spend the whole year in the herd, expressed as a percentage.

**Prolificacy rate means producing offspring in great abundance or litter size at birth.

Sheep and goat breeding

The main focus of sheep and goat breeding is to improve growth rate thus mature weight, prolificacy, survival rate for meat animals and milk yield for dairy goats. Indigenous goats form the foundation stock to improve survival rates and some local strains are known for special traits like twinning. Exotic breeds that can be used for crossbreeding include: Boer, Kalahari and Jamnapari for meat goats; Saanen, Norwegian, Togenburg and Anglonubian for milk goats; and Dorper and Blackheaded Persian sheep. Breeding programs should involve the massive multiplication of the Malya (blended) goat so that more farmers keep locally developed goat breeds. They should involve the characterization of locally adapted goats, followed by productivity improvements and conservation.

Poultry

The main constraints facing poultry breeding are the lack of information on breeding programs used by commercial breeders, and a successfully tested on-farm local poultry breed. The proposed strategies to support the development of a poultry breeding program include the:

- establishment of a breeding committee to make decisions on the breeds and strains of chicken to be used for commercial poultry production;

- development of locally adapted poultry breeds/ strains either through breeding or testing, as well as the approval of breeds developed elsewhere; and

- undertaking of the characterization and selection within the indigenous chicken breeds and the establishment of desirable traits to be improved and conserved.

Pigs

The control of potential inbreeding within the current herd, the introduction of improved breeds, and the upgrading and introduction of modern technologies should be main areas of focus for pig breeding programs. Decisions on which pig breeds to be selected should be taken in accordance with the needs of pig associations and market demand. As such, the importation and multiplication of desired breeds should be undertaken by private sector organizations and coordinated by the government through the ministry responsible for livestock. Producers should obtain breeding stock from farms with a track record for good herd performance.

Local policies and intervention methods

There are many opportunities for genetic improvement in Tanzania. A lot of local strains of zebu cattle, poultry and sheep have already been identified and documented, and are available for improvement through selection and/or crossbreeding with suitable exotic breeds. The climate in the country favours livestock keeping with a minimal level of disease control, and the availability of extensive rangelands and water resources also supports animal breeding programs. Moreover, the existence of emerging local and regional markets, improved transport and communication infrastructure, and relative political stability are all factors encouraging investment in livestock production and growth in the sector.

While the livestock ministry drafted the National Livestock Policy in 2006, drawing upon the 1997 Agriculture and Livestock Policy, insufficient emphasis was given to animal breeding. Only one section of the 2006 policy document refers to the importance of good quality breeds to increased livestock productivity. There is need for a road map that will guide the establishment of a legal framework for regulation, coordination and improvement of AnGR in Tanzania. A specific policy document is needed to guide interventions and address challenges of animal genetic improvement.

Drawing upon the 2006 National Livestock Policy, the proposed animal breeding act should facilitate the establishment of institutions to coordinate AnGR activities in the country and enable implementation of the livestock sector development goals of Tanzania's Vision 2025. Success will depend on overcoming challenges in the:

- encouragement and facilitation of the engagement of farmers and the private sector in genetic improvement;

- maintenance/development of appropriate genotypes and the streamlining of breeding efforts for improved impact;

- establishment of reliable and sustainable germplasm delivery systems;

- capacity to sustain interventions and optimize productivity in a given environment; and

- establishment/strengthening of institutional arrangements and policies for livestock genetic improvement.

Policy recommendations

There is a need to ensure that the choice of breeds meet the requirements of the livestock production typologies and the preferences of communities. In order to make best use of the country's AnGRs, the authorities will need to:

- formulate and implement the animal breeding act, and associated regulations, to facilitate the establishment of institutions to coordinate the AnGR activities;

- undertake the characterization of the environment and animal genetic resources in the country to determine the phenotypic and genotypic diversity, and uniqueness in such breed-types, helping match breed types to appropriate production environments;

- develop and implement a sustainable system of animal genetic resource management to enhance breeding, selection and conservation programs. This will include the development of methods for open nucleus breeding schemes and renovation of public livestock farms and artificial insemination centres;

- establish data recording system for on-station and on-farm breed evaluation programs for both locally adapted and exotic breeds and their crosses;

- facilitate the delivery of capacity development support to stakeholders in terms of training and the strengthening of the animal breeding infrastructure, such as artificial insemination and multiple ovulation and embryo transfer laboratories; and

- facilitate the organization of breeding societies and breeders associations in all production system typologies to help them choose the appropriate type of breeding programs—crossbreeding or within-breed breeding, selection criteria, etc.—best suited to meet their needs.

Background to the LMP

The Tanzania livestock master plan was developed by a joint team from the Tanzanian Ministry of Agriculture, Livestock and Fisheries (MALF) and the International Livestock Research Institute (ILRI). Its development was overseen by a high-level technical advisory committee (TAC) convened under the auspices of the MALF Livestock Permanent Secretary, Maria Mashingo, and chaired by Catherine Dangat, the director for Policy and Planning. The TAC comprised the directors of key MALF livestock-related departments and other government agencies, and representatives from the private sector, civil society organizations and development partner agencies.

Data collection and quantitative diagnostics were supported by the ongoing involvement of key national livestock experts and consultation with a wide range of key stakeholders. The quantitative sector analysis was undertaken using the Livestock Sector Investment and Policy Toolkit developed by the World Bank, the Agricultural Research Centre for International Development (CIRAD) and the Food and Agriculture Organization of the United Nations working under the auspices of the African Union Interafrican Bureau for Animal Resources.

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