General introduction

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CHAPTER 1: General introduction

1.1 Background and research objectives

The livestock sector in Kenya accounts for approximately 42% of the agricultural Gross Domestic Product (GDP), which represents about 10% of the overall national GDP (MOLD, 2008). The sector is supported by various livestock species which include cattle, sheep, goats, poultry, camels, pigs, bees, rabbits and other emerging livestock species such as ostrich, quails, guinea fowls, guinea pigs, llamas and pigeons. Cattle are predominant and most important species in terms of biomass (73%) followed by sheep and goats (19%) and camels (6%) (MOLD, 2009). Cattle and small ruminants are reared under various production systems which vary in agro-ecological conditions, and production and husbandry objectives that range from extensive subsistence pastoral, to more developed productivity based intensive systems (Bebe et al., 2003; Mwacharo and Drucker, 2005; Kosgey et al., 2008). Over 60% of the cattle population are found in the arid and semi arid lands (ASALs) which are mainly characterised by pastoral production systems (MOLD, 2008). Local Zebu cattle breeds (mainly the East African Zebu and unimproved Boran) are predominant in this system where they fulfil socio-cultural, subsistence and economic needs of the pastoral communities (Mwacharo and Drucker, 2005; Ouma et al., 2007; Rewe et al., 2009). These breeds have evolved to adapt to the prevailing harsh environmental conditions and traditional husbandry systems. However their production potential is sometimes perceived to be relatively low and thus producers sometimes resorted to crossbreeding with both exotic *Bos taurus* and other introduced Zebu breeds in order to exploit the trade offs that exist in regard to production and adaption (Mwandatto et al., 1988; Muhuyi, 1997; Muhuyi et al., 2000; Mwacharo and Drucker, 2005; Roessler et al., 2010). The Sahiwal is one of the breed of choice in this regard because of its relatively high milk production and growth potential, as well as good

reproductive ability (Rege et al., 1992; Mwandatto, 1994; Ilatsia et al., 2007; Ilatsia et al., 2011). Its suitability for the rangelands is also based on the fact that it has evolved and been reared under almost similar harsh agro-climatic conditions in its native home in the Punjab region of India and Pakistan (Meyn and Wilkins, 1974; Kimenye, 1978; Trail and Gregory, 1981; Muhuyi, 1997). Specifically the Sahiwal breed is used in an up-grading programme of the relatively well adapted East African Zebu (EAZ) for improved milk production and growth performance under the challenging rangeland conditions (Meyn and Wilkins, 1974; Trail and Gregory, 1981; Muhuyi et al., 1999). The Kenya Sahiwal is thus a product of several generation of this up-grading programme. The breed has also been utilised in crossbreeding with European cattle breeds for both, large scale and smallholder dairy production, but only on a limited scale (Kahi et al., 2000; Bebe et al., 2003).

Sahiwal bulls were first introduced in Kenya from India and Pakistan in the early 1930s because of the generally low response capability of the local EAZ cattle for both milk and beef production under rangeland conditions (Meyn and Wilkins, 1974; Gregory and Trail, 1981; Muhuyi et al., 1999). The Sahiwal breed was identified then by British colonial government officials as an ideal breed that could guarantee both milk and beef production especially in the ASALs through crossbreeding with local Zebu (Meyn and Wilkins, 1974; Gregory and Trail, 1981). Bulls imported were kept in various government livestock improvement centres across the country. Due to growing demand for Sahiwal bulls and increased importation costs, the government decided to centralise all breeding activities by collecting the best cows and bulls from the livestock improvement centres to form the National Sahiwal Stud at Naivasha, and an initial breeding programme set up to serve as a starting point (Meyn and Wilkins, 1974; Kimenye, 1978). The aim of the breeding programme was to select for improved milk and growth performance under conditions that are

almost similar to the low-input production systems that characterise most of the pastoral areas. The NSS was stationed at Naivasha, which has semi arid climatic conditions that provide the ideal rangeland conditions similar to the target pastoral areas (KARI, 1994). The breeding programme at the NSS was supported by an elaborate performance and pedigree recording scheme and artificial insemination (AI) that allowed for a progeny testing scheme. The NSS remains one of the leading sources of Sahiwal bulls and semen as well as the main stakeholder in the Sahiwal cattle breeding and conservation programme. Several other private and government ranches were also established in the rangelands with similar objectives of producing a dual purpose breed suitable for low-input production systems.

Currently there are two types of producers who keep Sahiwal genetic resources: private and government ranches that collectively form the nucleus herds, and the Maasai pastoralists (Roessler et al., 2010; Ilatsia et al., 2011a). Sahiwal cattle producers have continued to interact through exchange of genetic material based on temporal breeding structures established over 45 years ago. These structures were envisaged to serve only on interim basis as more elaborate and systematic plans were contemplated to anchor a more inclusive and sustainable breeding programme. However, these structures remain in operation to date, notwithstanding lack of knowledge on their suitability as well as competitiveness when compared to other alternative breeding schemes. Before further considerations are made on whether to maintain the status quo, or explore other alternatives, it is imperative to have clear knowledge on the production conditions under which the programme will be implemented as well as factors that motivate continued interests of producers in the Sahiwal cattle genetic resources, a clear understanding of the existing stakeholder institutional arrangement and how the different breeding programmes technically compare with each other. Over the years most studies have only focused on on-farm and on-station performance and

genetic evaluation (e.g. Mwandotto et al., 1988; Mwandotto, 1994; Rege et al., 1992; Muhuyi et al., 2000; Karimi et al., 2005; Ilatsia et al., 2007; Ilatsia et al., 2011b). There have been no systematic endeavours undertaken to understand the production systems under which Sahiwal genetic resources are raised, including the different constraints in these systems, as well as production objectives and breeding goals of the two categories of Sahiwal cattle producers. Moreover, there is lack of knowledge on the suitability of the existing breeding programme, as well as on how competitive it is when compared to other alternative programmes with regard to economic and genetic success. Such knowledge will be of particular interest because it will assist in developing breeding strategies that are sustainable and able to bring about general improvement in productivity and profitability. This study aimed at developing breeding strategies for Sahiwal cattle genetic resources in Kenya by systematically following important prerequisite steps. To achieve this general objective, the following specific objectives were pursued:

1. To critically examine breeding and conservation programmes for Sahiwal cattle in the tropics, highlighting shortcomings and strengths in existing strategies, and opportunities for improvement and conservation.
2. To understand the production conditions under which Sahiwal cattle genetic resources are raised, determine producers' production aims and assess the relative importance of breeding goals and production challenges.
3. To identify and define the structure and roles of various stakeholder institutions that are crucial in the implementation of practical and sustainable Sahiwal cattle breeding and conservation programme in Kenya.
4. To identify, based on genetic and economic merits, the optimal breeding programme for Sahiwal cattle genetic resources by evaluating the current and alternative breeding programmes.

5. To discuss practical options for implementation of a sustainable Sahiwal cattle breeding and conversion programme in Kenya.

1.2 Structure of the thesis

Subsequent to chapter 1 that presents the general introduction, Chapter 2 of this thesis, accepted for publication in Animal Genetic Resources, is entitled 'Breeding and conservation programmes for Sahiwal cattle genetic resources in the tropics. A review'. This chapter presents a review of breeding and conservation programmes for Sahiwal cattle genetic resources in the tropic. It mainly focuses on Pakistan, India and Kenya as the core regions for development and highlights strengths and shortcomings in existing breeding and conservation programmes. Chapter 3 of the thesis, 'Production objectives and breeding goals of Sahiwal cattle keepers in Kenya and implications for a breeding programme' published in Tropical Animal Health and Production, reports on the results of a field survey undertaken to understand the production systems under which Sahiwal cattle are raised and the reasons why producers prefer to keep Sahiwal cattle genetic resources. This chapter describes the production conditions and objectives and identifies the breeding goals of Sahiwal cattle producers using participatory approaches. Production constraints are also highlighted in this chapter. Chapter 4 is entitled 'Evaluation of basic and alternative breeding programmes for Sahiwal cattle genetic resources in Kenya' is published in Animal Production Science. This chapter presents results of an examination of the current basic and alternative breeding programmes based on findings in Chapter 2 and Chapter 3 and recently published pertinent findings on the breed in Kenya. The chapter specifically examines the roles of various stakeholder institutions supporting the existing Sahiwal cattle breeding programme, as well as its genetic and economic success. Chapter 5 integrates all results from the previous chapters, and other relevant information into general discussions and considerations for breeding and

conservation of Sahiwal cattle genetic resources in Kenya. Chapter 5 also highlights the strength and shortcomings in the methodological approaches used in the previous chapters. The major findings in the thesis are summarised in Chapter 6.

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