Agricultural Systems 131 (2014) 11–22

Contents lists available at ScienceDirect

Agricultural Systems

journal homepage: www.elsevier.com/locate/agsy

# The 'One cow per poor family' programme: Current and potential fodder availability within smallholder farming systems in southwest Rwanda

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ARTICLE INFO

*Article history:*
Received 7 January 2013
Received in revised form 7 July 2014
Accepted 10 July 2014
Available online 24 August 2014

*Keywords:*
'One cow per poor family' programme
Ubudehe
Resource groups
Fodder availability
Scenarios
Rwanda

ABSTRACT

Livestock is an essential component of smallholder farming systems in the East African highlands. The 'One cow per poor family' programme was initiated in Rwanda as part of a poverty alleviation strategy, aiming to increase the livestock population. A four month-study was conducted in Umurera village (Simbi sector), southern Rwanda with the objectives to (1) quantify the on-farm fodder availability, (2) quantify the amount and quality of fodder on offer to livestock, (3) analyse potential fodder availability under five future scenarios and (4) evaluate the implications and feasibility of the programme. Farmers' surveys, measurements of field sizes, together with daily measurements of fodder on offer, milk production and fodder refusals were conducted. Feeds used were diverse, comprising grasses (53%), banana plant parts (25%), residues of several crops (9%) and other plants (10%). Herbs collected from valley-bottoms, uncultivated grasses and crop residues were predominant fodder types on poorer (Resource group 1 – RG1) farms while *Pennisetum* and *Calliandra* were predominant fodder types for moderate (RG2) and better resource endowed (RG3) farms. The amount of fodder on offer for cattle ranged from 20 to 179 kg fresh weight animal$^{-1}$ day$^{-1}$ (9–47 kg DM). The milk yield ranged between 1.3 and 4.6 L day$^{-1}$. The amount of *Pennisetum* and *Calliandra* fodder available decreased in the dry season with a concomitant increase in reliance on banana leaves and pseudo-stems. The poorest farmers (RG1) were not able to feed a local cow under all scenarios. RG2 farmers can sustain a local cow during both seasons when using all possible fodder resources, but can sustain a European cow under just two scenarios during the rainy season. RG3 farmers can feed a European cow during the rainy season under all scenarios and for four scenarios during the dry season. We conclude that the 'One cow per poor family' programme needs to be adjusted to increase its effectiveness. Our main recommendations are to shift to livestock that require less fodder, for example local cattle or small ruminants such as goats.



## 1. Introduction

Mixed crop-livestock farming is practiced on landholdings as small as 0.2–1 ha in the highlands of East Africa in which crop production and livestock play complementary roles (Tittonell et al., 2005a; MINAGRI, 2009). Livestock contributes to food security through provision of high value protein in the form of milk and meat, provision of additional income to the household and serves as a way to store capital and meet social obligations of the farmer (Powell and William, 1993). Cattle is a major livestock species in Rwanda with a population estimated at one million heads comprising 86% of local, 13% of crossbred and 1% of exotic breeds (MINAGRI, 2006, 2009). Crops together with cultivated grasses provide the bulk of feed for cattle, small ruminants (goats and sheep), pigs and to some extent rabbits, which return soil nutrients to the cycle through the supply of organic manure.

Cattle feeding is largely based on a zero-grazing system in which fodder is carried to the animal kept in confinement. Reasons for this practice are land-scarcity and limited forage resources, minimizing the risk of overgrazing and environmental degradation. Cattle grazing outside the farm is prohibited, though small

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http://dx.doi.org/10.1016/j.agsy.2014.07.005
0308-521X/

ruminants (e.g. goats) may be tethered outside the farms to browse on roadside vegetation. Animal feeds are diverse, including grasses and legumes (both indigenous and exotic), crop residues and other organic household wastes (Mutimula and Everson, 2011). Crop residues commonly fed to livestock include sweet potato vines, foliage and damaged tubers, bean residues, banana pseudo-stems and leaves. Some agroforestry species such as *Calliandra calothyrsus* and *Sesbania sesban* are used to provide fodder and have shown good potential for biomass production (Roose and Ndayizigiye, 1997; Niang et al., 1998).

Livestock production in Rwanda occurs in a diverse biophysical and socio-economic context. Variation in annual rainfall and its irregular distribution are key factors determining seasonal fluctuations in fodder availability. Feed shortage is most acutely felt during the dry season when the fodder quantity is often insufficient for the number of cattle, leading to starvation of grazing animals, as well as poor productive and reproductive performance (Mapiye et al., 2006; Hall et al., 2008). Farmers shift from dependence on certain types of fodder to others depending on their relative availability. In Kenya, for instance, in both of the rainy seasons, the bulk of the fodder consists of fodder crops and weeds, while in the dry season these are supplemented by crop residues and banana pseudo-stems (Abate et al., 1992; Paterson et al., 1999). Moreover, feed shortage is often compensated through the use of poor quality fodder, which is inadequate to sustain lactating and/or reproducing cattle (Shem and Otsyia, 1997; Lanyasunya et al., 2006).

Besides climate variability, local conditions may determine fodder production such as the strong heterogeneity in soil fertility within smallholder farming systems caused by natural factors (type of parental material and topography) and farmer management practices (Tittonell et al., 2005b; Giller et al., 2006; Zingore et al., 2007). For instance, Napier grass (*Pennisetum purpureum*) is mostly established on field edges close to annually cultivated food crops and therefore receives nutrients through application of manure or mineral fertilizer. Other fodder types such as weeds or uncultivated grasses grow in fallowed plots or degraded fields.

In 2006 the Government of Rwanda initiated the 'One cow per poor family' programme, which aims to make cattle available for the most vulnerable households (MINAGRI, 2006). Farmers need to construct a cowshed, establish improved forages and have to agree to pass the first offspring to another farmer. The programme seeks to reduce malnutrition through an increase in milk consumption by the rural poor, to provide farmers with manure for soil fertility improvement, to promote social cohesion through a system where the first born calf is passed on to others in need, and to create opportunities to earn additional income. Currently, milk consumption is estimated to be only 13 L person$^{-1}$ year$^{-1}$ in Rwanda, far less than the 220 L person$^{-1}$ year$^{-1}$ recommended by FAO. Child malnutrition in Rwanda is estimated to average 43% (MINAGRI, 2006).

The community selects beneficiaries of the programme based on strict criteria such as the families owning no cattle and less than 0.75 ha of land. Some 668,763 families are expected to benefit from the programme nationwide (MINAGRI, 2006). The 'One cow per poor family' programme focuses on providing Holstein Friesian crossbred cows, motivated by their potentially higher milk production compared with local breeds. The larger live weight of crossbred cattle and their higher milk yields automatically result in a higher feed demand.

Despite the envisaged benefits of the 'One cow per poor family' programme there is scanty information on the availability of fodder resources on smallholder farms in Rwanda. Existing information is based largely on estimates by the farmers collected through surveys (Mutimula and Everson, 2011). Knowledge of on-farm availability of fodder resources and their quality is key in exploring opportunities to increase fodder production. We conducted this study to: (1) quantify fodder availability on different farm types in south-west Rwanda, (2) quantify the amount and quality of fodder offered to livestock by farmers who currently own cattle, (3) analyse potential fodder availability across seasons under different future scenarios and (4) analyse the implications of our results for the 'One cow per poor family' programme.

## 2. Materials and methods

### 2.1. Study site

The study was conducted in Umurera village (164 households, 1324 people) located 17 km from Butare, Southwestern Rwanda (2°30′28″ and 028°42′09″) with a population density of 520 inhabitants km$^{-2}$. The area is located in Simbi sector and shares biophysical and socio-economic features with the Central Plateau agro-ecological zone (AEZ) (Table 1). The topography of the zone is dominated by hills and valleys lying at an altitude around 1634 m above sea level. The average temperature is 20 °C (daily range: 10–30 °C). Rainfall ranges from 1050 to 1200 mm annually and has a bimodal distribution pattern, allowing two major cropping seasons, the short rainy season from September until December and the long rainy season from mid-February until June (Hagedorn et al., 1997).

The majority of soils in the area are acidic (pH 4.3 to 5.7), sandy loam or sandy clay loams with high variation among fields. Soil organic carbon (SOC) ranges from 1.3 to 4.0% and total N from 0.1 to 0.4%. The cropping system is dominated by basic food crops including beans (*Phaseolus vulgaris* L.) and sweet potato (*Ipomoea batatas* L.). Other important food crops are maize (*Zea mays* L.), sorghum (*Sorghum bicolor* (L) Moench), banana (*Musa* spp.) and White potatoes (*Solanum tuberosum* L.). Coffee (*Coffea arabica* L.) is the main cash crop. Cattle are the main livestock species alongside small ruminants (sheep and goats) as well as pigs and chickens.

Agroforestry is widely practiced with a large diversity of tree species on individual farms. Trees and shrubs, including timber, fruit and legume species, are planted in different niches. Fruit trees (avocado, *Persea americana* Mill., being the most visible on farm) are established near the homestead, legume tree species for stakes and fodder are established on field edges (e.g. *C. calothyrsus* Meissner, *S. sesban* (L.) Merr., *Leucaena leucocephala* (Lam.) de Wit) and timber tree species (e.g. *Eucalyptus* spp.) are established away from crop fields (Bucagu et al., 2013).

### 2.2. Farm selection

All rural households in Rwanda have been categorised according to a governmental typology named 'Ubudehe'. The Ubudehe (translated: local collective action) programme aims at targeting poverty alleviation and it stratified households according to their resource status (Reckling, 2011). In Simbi, households were found from three of the total of six categories. For this study we renamed them as three resource groups (RG): poor resource group (RG 1: representing 86.6% of the households), moderate resource group (RG 2: 8.5%) and wealthier resource group (RG 3: 4.9%). Initially twelve farms were selected; within each of the resource groups four farms were randomly selected. During the data analysis, one household was found to have mistakenly been categorised in RG 1, and was reclassified as RG 2. Data collection was interrupted for one RG 3 farm when the farmer was unavailable. Therefore, data analysis was completed for 11 farms, comprising 3 farms from RG 1 and RG 3 and five farms from RG 2. Interviews were conducted during the short rainy season (September to December 2010). The first interview was conducted to collect general data such as the number of household members, livestock and number and area of fields. A