RUFORUM Working Document Series (ISSN 1607-9345), 2022, No. 20: 10-18.
Available from http://repository.ruforum.org

Research Application Summary

Understanding the dynamics of access to water for beef production and adoption of valley tanks in eight cattle corridor districts of Uganda

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Abstract

The basic resources for beef cattle are pastures and water. It is estimated that for every TLU reared 21 litres of water per day are required. Ninety-five per cent of the beef consumed in Uganda is produced in the cattle corridor. Cattle management systems in these areas were mainly pastoral and agro-pastoral systems. The cattle corridor is in an agro-ecological zone that is characterised by annual periods of moisture stress resulting in inadequate water for cattle. At such times, the cattle keepers in these areas, in the past; would move with their livestock to find pastures and water. This practice has greatly reduced and many have adopted more deliberate improved cattle production practices such as pasture improvement and excavation of valley dams and tanks for ensuring availability of water for their livestock. With the growth of local and external market for beef and the desire to grow capacity of beef value chain actors to tap into this growing market there is need for precise information on the sector to guide decision making and implementation of interventions. This study was done to assess the status of water access for beef production and identify entry points for improvement in eight cattle corridor districts in Uganda. The interventions were to be implemented as part of the "Rangelands, Agro-forestry, and Water Resources Management" (RAWM) component contributing to the EU funded "Market Oriented Beef Improvement Project" (MOBIP). The major findings of the study showed 66% of the cattle keepers accessed water from on-farm valley tanks and that roof top rain water harvesting was almost non-existent. Correlation was observed between land size ($p<0.05$), cattle herd size ($p<0.01$), years of farming experience ($p<0.05$) and membership in a farmer group ($p<0.01$) were correlated with presence of an on-farm valley tanks. Based on these findings, the MOBIP-RAWM project strengthened the components of underground rain water harvesting tanks, Farmer Field School (FFS) approach and business incubation in the project implementation processes.

Keywords: Beef, pasture, rangelands, Uganda

Résumé

Les ressources de base pour les bovins de boucherie sont les pâturages et l'eau. On estime que pour

chaque enfermement temporaire (ET) élevé, 21 litres d'eau par jour sont nécessaires. Quatre-vingt-quinze pourcent de la viande bovine consommée en Ouganda est produite dans le couloir du bétail. Les systèmes de gestion du bétail dans ces zones étaient principalement des systèmes pastoraux et agro-pastoraux. Le couloir du bétail se trouve dans une zone agro-écologique qui se caractérise par des périodes annuelles de stress hydrique entraînant une eau insuffisante pour le bétail. A ce moment-là, les éleveurs de bétail de ces régions, dans le passé; se déplaçaient avec leur bétail pour trouver des pâturages et de l'eau. Cette pratique a considérablement diminué et beaucoup ont adopté des pratiques de production bovine améliorées plus délibérées telles que l'amélioration des pâturages et l'excavation de barrages et de réservoirs de vallée pour assurer la disponibilité de l'eau pour leur bétail. Avec la croissance du marché local et externe de la viande bovine et le désir d'accroître la capacité des acteurs de la chaîne de valeur de la viande bovine à exploiter ce marché en pleine croissance, des informations précises sur le secteur sont nécessaires pour guider la prise de décision et la mise en œuvre des interventions. Cette étude a été réalisée pour évaluer l'état de l'accès à l'eau pour la production de viande bovine et identifier les points d'entrée pour l'amélioration dans huit districts de corridors de bétail en Ouganda. Les interventions devaient être mises en œuvre dans le cadre de la composante « Gestion des parcours, de l'agroforesterie et des ressources en eau » (GPAE) contribuant au « Projet d'amélioration de la viande bovine axé sur le marché» (MOBIP) financé par l'UE. Les principales conclusions de l'étude ont montré que 66 % des éleveurs de bétail avaient accès à l'eau à partir des réservoirs de vallée de l'exploitation et que la collecte de l'eau de pluie sur le toit était presque inexistante. Une corrélation a été observée entre la taille de la terre ($p<0,05$), la taille du troupeau de bovins ($p<0,01$), les années d'expérience agricole ($p<0,05$) et l'appartenance à un groupe d'agriculteurs ($p<0,01$) étaient corrélées avec la présence d'un réservoir de vallée. Sur la base de ces constatations, le projet MOBIP-RAWM a renforcé les composants des réservoirs souterrains de collecte des eaux de pluie, l'approche Farmer Field School (FFS) et l'incubation d'entreprises dans les processus de mise en œuvre du projet.

Mots-clés : Viande bovine, Pâturage, Parcours, Ouganda

Introduction

Water is a key resource required in livestock production and in the case of beef cattle it is estimated that for every TLU reared 21 litres of water per day are required (estimated from Pedan *et al.,* 2002). The cattle corridor in Uganda where the pastoral and agro-pastoral cattle production systems are located, is the major beef resource for the country providing about 95% of the beef consumed (King and Allan, 2002). The cattle corridor is in an agro-ecological zone that is characterised by annual periods of moisture stress. As a result during these periods there is inadequate water for cattle and infact the cattle keepers in these areas were traditionally pastoralists and at such times would move with their livestock to find pastures and water. This practice has greatly reduced and many have adopted more deliberate improved cattle production practices such as pasture improvement and excavation of valley dams and tanks for ensuring availability of water for their livestock. With the growth of local and external market for beef and the desire to grow capacity of beef value chain actors to tap into this growing market it is important to understand the dynamics of the water availability for cattle in the cattle corridor. As such, the implementers of the "Rangelands, Agro-forestry, and Water Resources Management" (RAWM) component of the EU funded "Market Oriented Beef Improvement Project" (MOBIP) deemed it prudent to carry out a study in eight cattle corridor districts in Uganda to:

i. Establish extent of access to different water sources for cattle
ii. Establish adequacy of water capacity of on-farm valley tanks for current cattle herds
iii. Identify water interventions and approaches that would be effective for adoption of technologies and practices that would increase access to water for beef production – specifically to integrate in the MOBIP-RAWM implementation process

Methodology

Multi-stage and purposive sampling techniques were used to identify respondents who were specifically beef cattle keepers. The study was conducted in eight districts of the cattle corridor; Kiboga, Kiruhura, Kyankwanzi, Masindi, Nakaseke, Nakasongola, Isingiro, and Sembabule (Fig. 1).

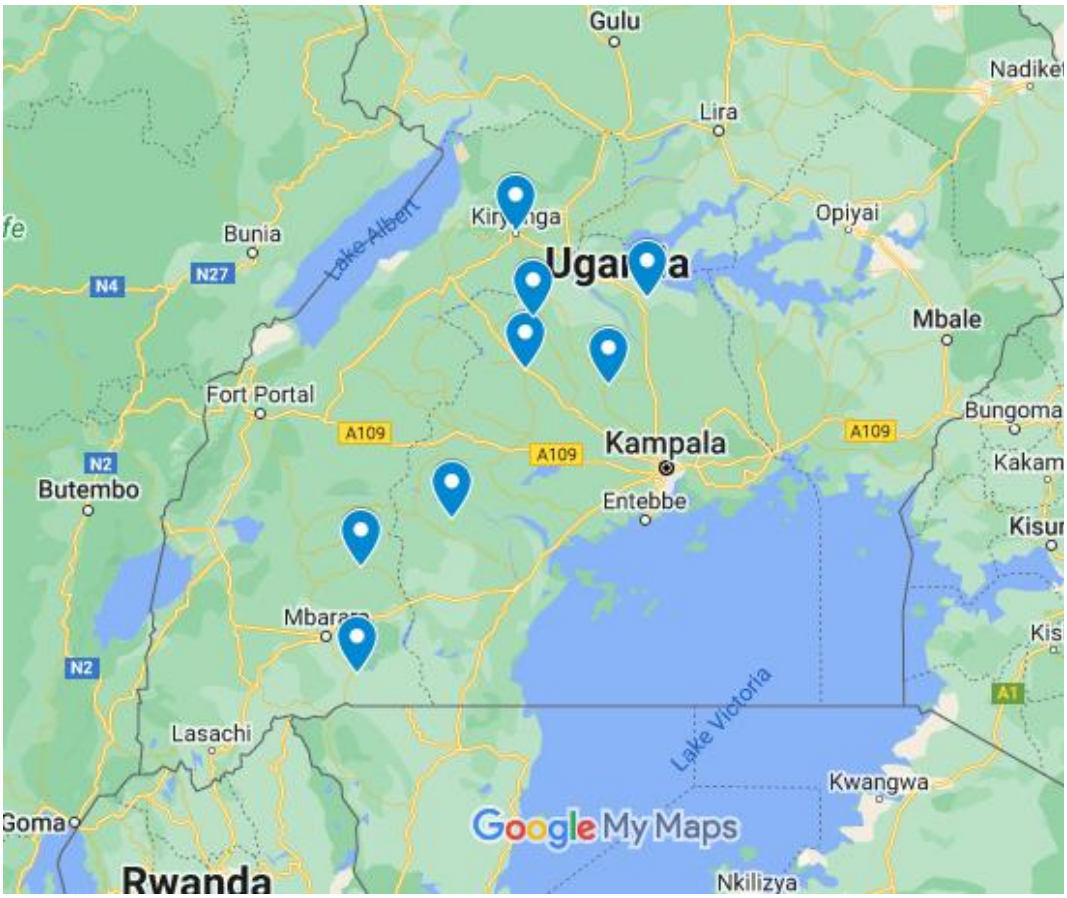

Figure 1. Map Showing the location of the eight study districts across the cattle corridor in Uganda

Quantitative data was gathered using a semi-structured questionnaire to capture information on number of cattle reared, herd composition, availability of valley tanks on the farms and their capacity. Data was entered in excel spread sheets and some summaries were generated in excel. Statistical analysis was done using IBM SPSS Statistics 20. Data summaries were used in establishment of exiting valley tank capacities on farms. Mean farm level water requirement by districts was generated basing on a number of assumptions as follows (i) average mass of an adult cattle head was 200 kg (ii) average mass of an immature cattle head was 100 kg (iii) daily water requirement for beef production was 21 Litres per TLU (Peden *et al*., 2002) (iv) valley tanks across the cattle corridor could be filled up at least 4 times every year; at the first half of each rainy season and at the second half of each rainy season. This would be twice in each of the two rainy seasons. Studies from BD Sande (2016) indicated that valley tanks in Uganda can provide water for livestock for 3 to 6 months. These assumptions were used in calculations for the adequacy of the farm level valley tanks for providing water for the current cattle herds and ultimately for the water capacity shortages. Bivariate correlation analyses were done to gain a deeper understanding into factors related with presence or absence of valley tanks on farms.

Results and Discussion

Overall livestock watering was largely by use of non-dam lined of earth bottom and wall, oo-farm valley tanks (66 per cent) – Fig. 2, which, unfortunately, are prone to water loss through seepage. To a limited extent oo-farm shallow wells were also used (18 per cent).

Between 30 to 40 per cent of households in Nakaseke and Masindi relied on communal dams. This water source is, however, increasingly becoming inaccessible and reducing in holding capacity due to fencing of livestock tracks, heavy siltation due to erosion and collapse of mud troughs in the water as well as weed infestation. Use of open surface roof rainwater harvesting tanks was scanty yet they can be cheaply adapted in the farming systems. Valley tanks ranged from small (36 to 50, Medium 50 to 100 and large above 100 M^3). Although the mean household cattle herd size was varying, the size of valley tanks in Kiruhura, Nakaseke and Kiboga districts ranged from small to medium. The rest of households in other districts had large valley tanks (Table 1).

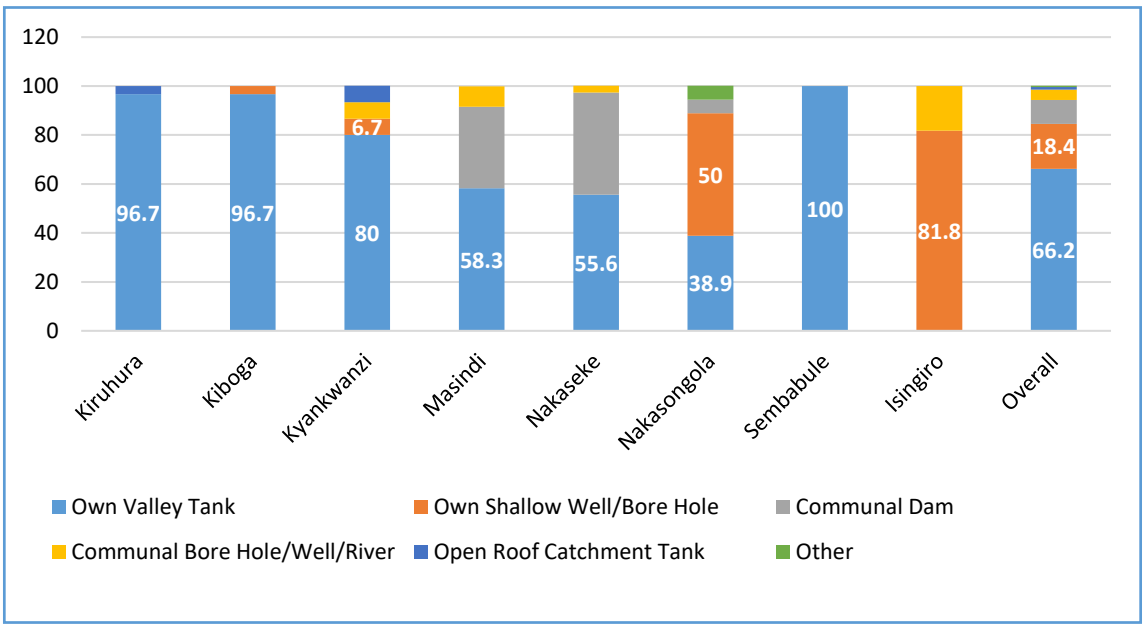

Figure 2. Distribution of Livestock Watering Methods in nine cattle corridor districts of Uganda

Table 1. Capacity of farm valley tanks across eight districts of the cattle corridor in Uganda

District	Valley Dam Capacity M^3	Standard Deviation
Kiruhura	36.00	3.351
Kiboga	98.25	27.876
Kyankwanzi	219.0	27.233
Masindi	120.0	113.137
Nakaseke	53.10	5.187
Nakasongola	170.0	20.206
Sembabule	148.35	17.461
Isingiro	134.07	19.812
Overall	127.45	18.273

According to farmers' assessment, valley tanks privately excavated and individually utilised by households were in good condition ie not being silted by more than 50 per cent of households in districts other than Kiboga and Nakaseke (Fig. 3).

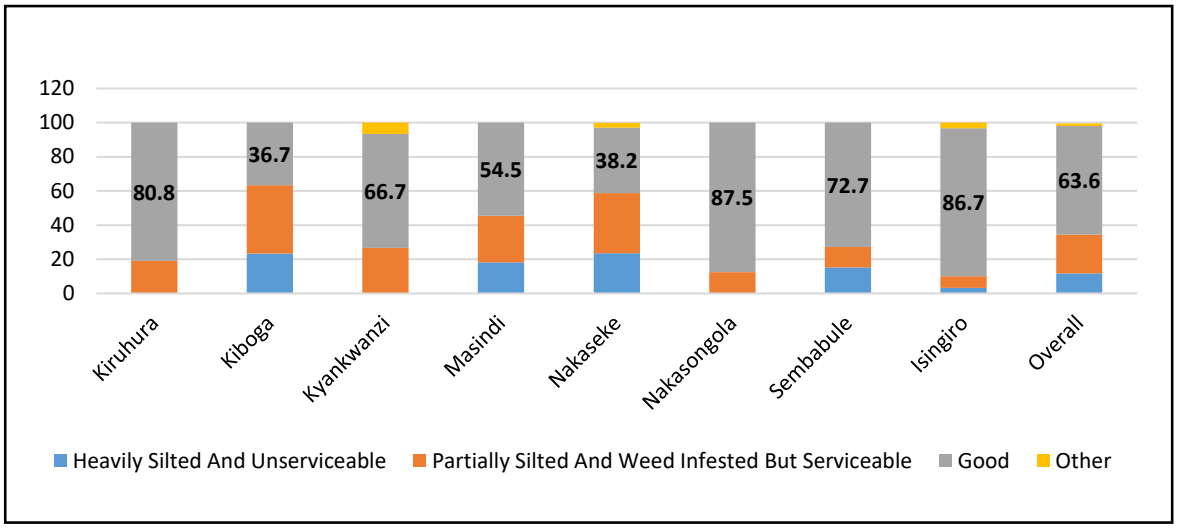

Figure 3. Current Status of on-farm valley tanks (per cent) in eight districts of the cattle corridor in Uganda

Reliability of watering points was based on the ability to retain and supply water throughout the dry season and findings of the study indicate that more than 60 per cent of households in Kiruhura, Kiboga and Sembabule indicated that they are able to water the animals throughout the dry season using the existing valley tanks (Fig. 4). Water scarcity was reported to be most acute in Kyankwanzi, Nakaseke and Nakasongola where on-farm valley tanks were reported to dry up mid-way during the dry season in 40 per cent of the households. Data analysis on adequacy of water tanks for providing water for the current herds at farm level showed annual water deficits in all the

districts with an overall deficit mean of 70% with highest being in Kiruhura and Kyankwanzi (Fig. 5) in the latter case confirming the direct responses from the farmers. I should be noted that this analysis included those households where on-farm valley tanks were absent. During the acute dry seasons, the cattle keepers mentioned copping strategies which included buying water bowsers at shillings 100,000/= (USD 26) for a 10,000 litre tank that lasts about a week or hire pasture with water at shillings 10,000/= (USD 2.6) per animal throughout the dry season or shillings 100,000/= (USD 26) per acre per annum.

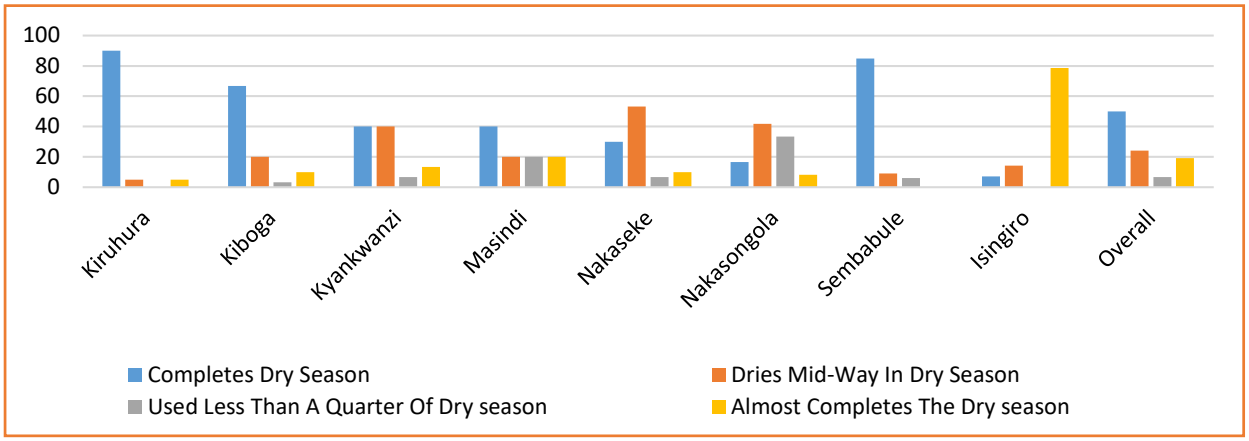

Figure 4. On-farm valley tank reliability (Per cent) on beef farms across eight cattle corridor districts in Uganda

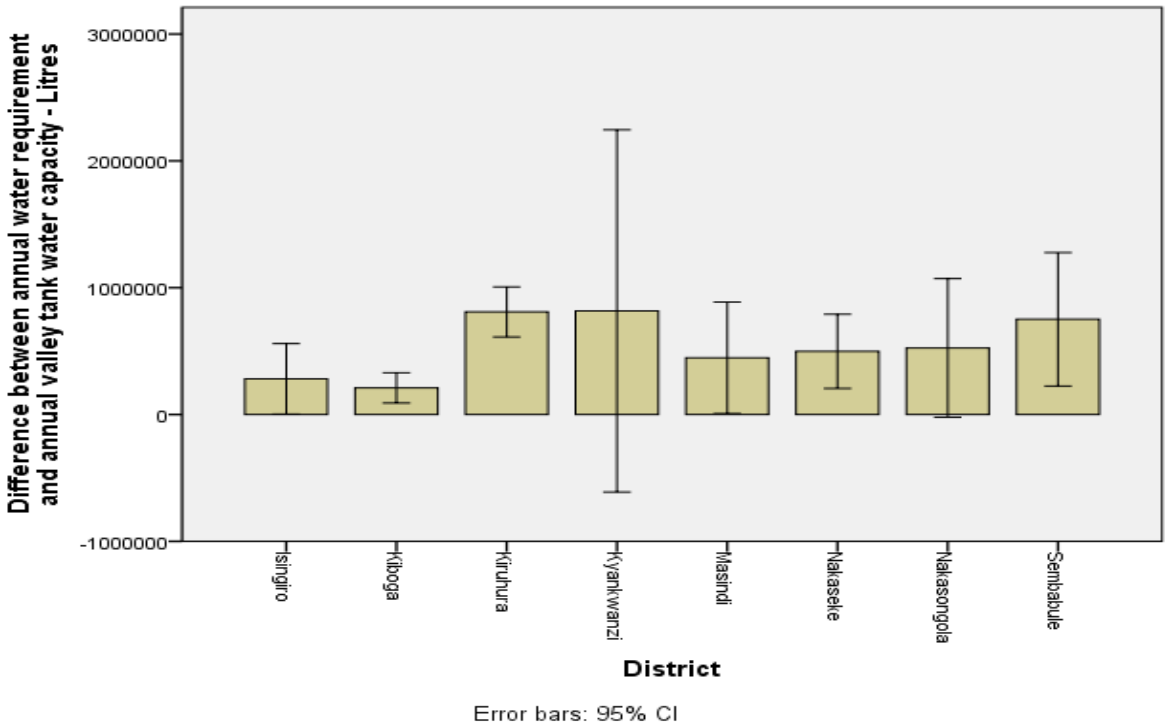

Fig. 5. Difference between annual water requirement (based on existing cattle TLUs per farm) and water potentially available in own valley tanks annually in eight districts of the cattle corridor in Uganda

Correlation analyses, showed that (i) total farm land size, (ii) membership in farmers group, (iii) herd size and (iv) years of experience in cattle keeping, were found to have linear relationship ($p<0.05$) with presence of valley tanks on farms. The strongest relationship was with cattle heads which had a positive relationship and the weakest was with experience in cattle keeping which had a negative relationship (Table 2).

A positive relationship between cattle heads and presence of valley tanks on farms could be attributed to the capacity to plan at the onset of the establishment of the farm. In this case, considering that the valley tank was not excavated during the period when the farm had the number of cattle heads captured in the data but rather earlier. This infers that the cattle keeper knew they would grow the cattle numbers to this and more and knew they would need a valley tank. Business planning is a critical approach to ensuring success in agricultural and livestock production and it is important to engage those starting out in beef production in business planning to integrate the aspect of water for the cattle. As a result, the strengthening of the business incubation component of the MOBIP-RAWM project was deemed critical in addressing this need.

A positive relationship between presence of valley tanks on farms and farmer group membership can have two interpretations. This is because the cattle keeper could have had the valley tank excavated before or after joining a group/s. (i) If the valley tank was obtained before joining a group, the interpretation would dwell on a growing enthusiasm of the cattle keeper in beef production which attracted them to join a group in a quest for accessing more knowledge, skills, capacity, market and other benefits and services that come through group membership. (ii) If the valley tank was obtained after joining a group, the interpretation would dwell on the benefits of exposure. In this case the cattle keeper belonging to a group where some of the members had valley tanks would have access to information from others about how one could be able to excavate a valley tank, visiting those who had done it and realising that they could also do it. In some cases, they could even have had the opportunity to pool resources with other members to have valley tanks excavated. As such, it is important to encourage beef producers to join groups to enhance growth. Farmer Field School (FFS) and other similar approaches have been found to be highly effective in transferring knowledge, skills and technologies as well as adoption (Henk van den Berg *et al*., 2020). The MOBIP-RAWM team, hence, saw the benefit in strengthening the FFS approach in the project implementation processes.

The negative relationship between presence of on-farm valley tanks and land size can be attributed to the probability of free access to a natural water source. Large expanses of land are normally distant from crowded settlements and are likely to have some natural water resources within the property or in the neighbourhood. In addition, in such locations it is common to find cooperation among communities including free access to water resources. In such cases, therefore, the need for excavation of valley tanks becomes unnecessary. Water interventions on these kinds of farms require a pre-assessment of the land and its surroundings to avoid introduction of water interventions where they are least required. However, with the current population growth and growing conflicts on land such opportunities are greatly dwindling.

The negative relationship between presence of on-farm valley tanks and years of experience in cattle keeping is possibly related with the pastoral approach to cattle keeping that was dominant in the cattle corridor in the past. This is a clear indication that on-farm water interventions for this category of cattle keepers should outline and demonstrate the long-term benefits that would accrue from adoption.

Table 2. Relationship of farm size, membership in farmers group, herd size and years of experience in cattle keeping with presence of valley tanks on farms

Variable	Standardised regression co-efficient	Significance
Cattle heads	0.400	0,000
Total land size (acres)	-0.249	0.027
Farmer Group Membership	0.235	0.000
Experience in cattle keeping (years)	-0.158	0.018

Adjusted R squared = 0.126

Conclusions and Recommendations

The study conclusions were critical in enhancing the design of the MOBIP-RAWM project and as such, to address the capacity for water acquisition on the farms which had serious water deficits with on-farm valley tank capacity deficits amounting to 70% of the estimated annual requirement; the project team integrated an aspect of introducing and demonstrating on farm underground rain water harvesting tanks. The correlation between land size, cattle herd size, and years of farming experience with presence of on-farm valley tanks was critical in enhancing the project business incubation component with emphasis on business planning and incubation approach for different age categories. The correlation between membership in a farmer group and presence of on-farm valley tanks was critical in refining the FFS approach in the project implementation process for enhanced adoption. Further research is required to address the aspect of maintenance of the valley tanks for sustainability as water sources for beef cattle as well as developing precise estimates of water requirements for beef cattle in Uganda.

Acknowledgement

We acknowledge European Union (EU) that funded the Market oriented Beef improvement project under which this study was undertaken. We highly appreciate the Project Management Unit of the MOBIP project under the Ministry of Agriculture Animal Industry and Fisheries (MAAIF) for the policy and technical guidance. We also like to thank the NARO/NaLIRRI management for financial and technical guidance offered throughout the design and implementation phase of the project. We thank all project staff and field-based staff, the partners including Food and Agriculture Organization (FAO), Consortium for enhancing University Responsiveness to Agribusiness Development (CURAD) and Agriculture Environment and Ecosystems (AGREENES) for their relentless efforts during project design and implementation. Lastly the local government authorities where the project was implemented and the participating farmers are applauded for ensuring a conducive operational environment.

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