NATIONAL AGRICULTURAL RESEARCH ORGANISATION

STUDY IN SUPPORT OF TRANSFER, ADOPTION AND DISSEMINATION OF LABOUR SAVING TECHNOLOGIES IN MASAKA & WAKISO DISTRICTS OF UGANDA

Food and Agriculture Organization (FAO) of the United Nations
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EXECUTIVE SUMMARY

This study was conducted under the framework for FAO's Integrated Support to Sustainable Development and Food Security Programme (IP). Improved forage chopping, farm/household water lifting and smallscale irrigation technologies have been adapted and promoted for use under Uganda's conditions. Their uptake, dissemination and adoption is, however, not well understood. In addition, knowledge on the appropriateness, relevance and effectiveness of such technologies has hitherto been lacking. A study was undertaken to assess the factors affecting adoption, dissemination and transfer of these technologies. A technology transfer and uptake action planning stakeholders workshop was then held bringing together researchers, extension agencies and NGOs to discuss and facilitate packaging of the findings of the study and draw up recommendations for the next phase of action.

Masaka and Wakiso districts were the areas selected for the study. These districts lie in the peri-urban intensive dairy production zones where the technologies have been demonstrated to the farmers and potential technology uptake pathways. Socio-economic and gender analysis (SEAGA) qualitative, semi-formal and formal data collection tools were used to elicit data from individual farm families, farmer groups and key informant sources. The bulk of the data was obtained from primary sources and an SPSS computer package was used to analyse primary data based largely on descriptive statistics and non-parametric tests.

Findings of the study confirm that the improved forage chopper attributes have the potential to address the constraints encountered by farmers in forage chopping. The chopper technology is relevant to the felt needs of the farmers and the intervention was timely considering that a hand machete has hitherto been nearly the only technology used in forage chopping. Improved choppers are required to reduce the risks posed by machetes to the users, fodder spoilage, low labour productivity and feed-use efficiency. Data on available chopping methods indicated that 88% of male headed and 79% of female headed households used machetes, 10% of male headed households and 18% of female headed farm families utilised fixed knife choppers and only 3% of both male and female headed households had adopted manual crank wheel choppers.

Farm water conveyance and pumping constraints lead to intensive labour use practices and poor livestock productivity. Head portage at 43% (bicycle at 34% and a combination of head portage and bicycles at 13%) was the major method of collecting water from sources located about a mile away. Children (50%) played the biggest role in water collection but all the same, all household members were involved in the activity. The intervention of the treadle pump with the capacity to draw water and/or raise it to sufficient levels and convey it for household use was also relevant and timely.

Information from focused farmer groups on the shortcomings of machetes showed that besides its low output capacity and lack of uniformity in length of cut, chopping with machetes was found to be tedious, time consuming and quite dangerous to the operator. Improved fixed knife forage choppers on the other hand were found to be ergonomically safe, less cumbersome with reduced forage chopping and controlled length of chop. There are, however, two shortcomings that farmers have noted on the improved fixed knife forage chopper: it is quite expensive and the aperture through which the machete moves as it cuts often gets blocked with bits of the cut forage. Despite the various advantages realised by some farmers on the use of the improved fixed knife forage choppers, many farmers (87%) had not yet adopted them due to financial limitations, lack of awareness on the possible sources and advantages of the technology as well as the false beliefs and opinions about difficulties encountered in maintenance and repairability of the choppers.

Information on treadle pumps shows that farmers had not largely adopted this technology because its applicability was not consistent with the existing and terrain, especially in Masaka. However, critical need for water acquisition technologies was evidenced. Water collection is a major constraint in most households, drawing household labour from boys, girls, men and women. Roof rain water harvesting is rarely invested in by most farmers although it was evident from households with roof water collection capacity that the water constraint is grossly reduced.

Generally, there was slow pace in dissemination and adoption of the two technologies that were studied. Besides, information about the attributes of these technologies and serviceability was

greatly distorted by the non-adopters. There is need to explore a range of methods to deliver agricultural engineering extension messages to the farmers. Use of extension leaflets, bulletins, stakeholder meetings, video or film shows, radios agricultural shows, on farm result or methods demonstrations in conjunction with the essential stakeholders in the agricultural sector could be explored.

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This study was undertaken as part of the FAO agenda for Integrated Support to Sustainable Development and Food Security Programme (IP) framework. The technical inputs and clarifications made by national IP facilitators and the host NARO institute of AEATRI made study design, outline and implementation consistent with expected outputs. The contributions of Mrs. Forough Olinga and Mrs. Catherine Barasa deserve special mention. The study team was composed of men and women professionals and enumerators who quickly internalised the requirements of a new and to some an adhoc task that enabled data collection fairly accurate and timely. Contacts persons at DPC and DVO's offices in Wakiso and Masaka districts made reaching key-informants and farmers sampled expeditiously efficient.

Government, development workers and local leaders assisted a lot in generating sampling frames, identifying and mobilising the required respondents and other information sources. The patience and hospitality exhibited by individual farmers and farmer focused groups from whom data was collected is commended.

Semi-formal data collection administered on private fabricators, Government and civil society organisations personnel tremendously improved the depth in understanding the relevance, effectiveness and appropriateness of the technologies. Supplementary information and support from the gender and poverty advisor - ASPS, LSRP – NARO –DANIDA, HASP – Masaka, local councillors and CAO's offices are appreciated.

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ACRONYMS AND ABBREVIATIONS

ADC	Agricultural development centre
AE	Agricultural Engineering
AEATRI	Agricultural Engineering and appropriate technology research Institute
AEZ	Agro-ecological Zone
AHO	Animal husbandry officer
ARDC	Adaptive research and development centre
ASPS	Agricultural sector Programme support
CAO	Chief administrative officer
DAs	Development agents
DAO	District agricultural Officer
DANIDA	Danish International Development Assistance
DPC	District Production Co-ordinator
DVO	District veterinary officer
FAO	Food and agricultural Organisation of the United Nations
HASP	Household agricultural support programme - DANIDA
HPI	Heifer project international
IP	Integrated Support to Sustainable Development and Food Security Programme
LSD	Least significant difference
LSRP	Livestock systems research programme
MADDO	Masaka diocesean development organisation
MADFA	Masaka district farmers association
MAAIF	Ministry of agriculture animal industry and fisheries
MGLSD	Ministry of gender, labour and social development
NAADS	National agricultural advisory services
NARO	National agricultural research organisation
NC	National consultant
NGO	Non-government organisation
OSR	On station research
PAF	Poverty action fund
PAO	Principle Agricultural officer
PMA	Plan for modernisation of agriculture
PTD	Participatory technology development
Protocol	Concept note on IP priority problem focus
R & D	Research and Development
SAC	Send - A - cow
SEAGA	Socio-economic and gender analysis
SHD	Smallholder dairy

SPSS	Statistical package for social scientists
SWOT	Strengths weakness opportunities and threats
TDT	Technology development and transfer
TOR	Terms of reference
VI	VI agro-forestry Dutch based NGO
VO	Veterinary officer

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1. INTRODUCTION

1.1. Background Information

It is widely believed that agricultural production, post-harvest and household operations in Uganda are dominated by women using simple rudimentary tools, equipment, structures and often traditional methods. Besides the serious limitations associated with these farm practices, other disabling and inhibiting factors such as poor nutrition, ill-health, HIV epidemic and the high rate of rural - urban migration, especially by the young and economically active sections of society, have compounded the already constrained opportunities available for disseminating agricultural technologies. Technology adoption rates are hence still low for most farm technologies. Considering the multiple demands of women who actively participate in both reproductive and productive household tasks, it is vital that strong gender considerations be given to the development and promotion of labour saving technologies with a view to effectively reduce the disproportionate workload on women. This approach is in line with the current policy of NARO of mainstreaming gender in all its activities. Gender appropriate technologies are therefore required to positively address the farming activities.

1.2. Justification

Reducing drudgery presented by high farm labour demands and increasing farm productivity particularly in the intensive stall feeding dairy production were identified as priority needs of smallholder dairy farmers (LSRP 1999). In order to respond to these needs, NARO through its Agricultural Engineering and Appropriate Technology Research Institute (AEATRI) is currently undertaking development and promotion, among others, of a variety of appropriate animal feed processing and rural energy-based technologies aimed at alleviating the constraints in feed processing and water acquisition. Gender responsive and appropriate technologies would most likely positively address the farming activities which are currently a women concern. Unfortunately, the uptake, dissemination and adoption of most of these technologies is not well understood. In addition, knowledge on the appropriateness, relevance and effectiveness of such technologies has hitherto been lacking.

1.3. Objectives

The main object of the project was to promote engendered dissemination of animal feed processing and water harnessing technologies for disadvantaged farming groups: female-headed households, youth, and resource poor peasants. The specific objectives were:

- To assess appropriateness of the animal feed processing, and water harnessing technologies on the needs of women, men and youth farmers;
- To develop recommendations for sustained forage chopper and treadle pump technology transfer and adoption to the gender relevant clients;

1.4. Scope of study

Dairy farmers are faced with a range of land, labour, feeding, management and marketing constraints. Farmers also have to address the multiple subsistence and income needs from the various enterprises raised on the farm. This project was restricted to the disadvantaged farming groups: female-headed households, youth, and resource poor peasants whose needs and priorities have been largely ignored in research and technology dissemination. The project, therefore, selected technologies likely to impact directly in the areas of women concerns to assess their impact in the transfer, adoption and dissemination processes. The assessment aimed at providing information on the appropriateness of the fixed knife forage chopper and treadle pump water conveyance technologies developed and currently being promoted by AEATRI. The forage chopper is peculiar and particularly designed for dairy cattle keepers to facilitate in chopping the huge volumes of fodder delivered to the farm to feed the zero grazed animals. The treadle pump on the other hand is used for lifting water for household needs and small-scale irrigation.

It is recognised that competing farm and household productive and reproductive gender roles often coincide and this compromises labour productivity. Farm labour is largely provided by farm family members because of high labour prices and low profit margins and revenues from the surplus sold or realised from most farming enterprises. The dynamics of relevant gender relations in farm family activities have therefore been observed and discussed.

2. LITERATURE REVIEW

2.1. Agricultural Development Policies and Planning

a) Decentralization Policy and Modernisation of Agriculture

The decentralization policy was officially launched in 1992 and enshrined in the 1995 constitution. Its legal provisions are based on the local Government Act of 1997. Decentralization is a process that deals with substantial transfers of political, financial and planning responsibilities from the Central Government. It provides for districts, sub-counties and urban authorities to take responsibilities for delivery of community services and promotion of popular participation and empowerment of local people in decision-making. In the decentralisation framework districts and sub-counties operate as governments. County, parish, and village echelons are administrative units.

Decentralized is based on the argument that local authorities are better placed to respond to the needs of the community and accountability for use of public resources. This will lead to equitable and rational allocation of resources among districts and within sub-counties. Decentralisation involves de-concentration of workloads from the centre, delegation of powers and responsibilities from the centre and devolution of powers by establishing financial and legal structures. With this mode of administration, it is, therefore, important to involve the district people in the development and transfer of technology packages to ensure their successful dissemination and sustainability.

The Plan for Modernisation of Agriculture (PMA) vision is poverty eradication through a profitable, competitive, sustainable and dynamic agricultural and agro-industrial sector. The broad objectives of PMA are to; increase incomes and quality of life of poor subsistence farmers, household food security and provide gainful employment, and promote sustainable use and management of natural resources. The mission of PMA is eradicating poverty by transforming subsistence to commercial agriculture. To ensure the success of the PMA, all research and development efforts therefore should feed directly into its objective. The main strategies of PMA include:

- Reducing district involvement of Government in commercial aspects of agriculture thereby promoting private sector participation.
- Promote bottom up and top down planning and budgeting by empowering local Government to influence public policy and allocation of resources.
- Ensure gender focused intervention agriculture programmes.
- Support the dissemination and adoption of productivity enhancing technologies.

b) Liberalisation and Privatisation of markets and support services

Privatisation of service delivery is considered as an independent decentralisation process. The major policy objective in liberalising trade in farm products and inputs is to ensure promoting production and enhancing competition in the agricultural sector. Importation and internal distribution of agricultural chemicals, tools, machinery, equipment and drugs has since the late 1980s, been divested to the private sector. Privatisation of extension/advisory services has been rather slow possibly due to the near subsistence level of most Ugandan farmers and slow establishment of government structures to register and regulate delivery services. The veterinary extension services are among those that have been affected by this. In addition, experience with privatisation farmer advisory services shows that it is normally a gradual process. This directly affects the transfer and dissemination of research technologies, as the avenues for transfer are limited.

2.2. The role of MAAIF and NARO in Uganda's agriculture

a) The objectives and major functions of MAAIF

The Ministry addresses the agricultural sector development objectives namely supply of adequate food and raw materials for agro-industries; improving rural incomes and welfare; stimulating production for export and natural resource sustainability. After implementation of the decentralisation policy that made extension services a responsibility of the districts, the major functions of MAAIF are giving policy guidelines; making supervisory and regulatory roles on services divested by government to the private sector, doing surveillance on disease and pest levels, and conducting, monitoring and evaluation of support services of Government programmes delegated to the districts.

b) The objectives and functions of NARO

In the context of changed internal and external environments, NARO sees its vision as "transforming into a more dynamic and better equipped institution with capacity to effectively respond to the changing needs and demands for agricultural technology, knowledge and information, and contributing to meeting the emerging agricultural development challenges of ensuring food security, alleviating hunger and eradicating poverty". NARO's mission is to increase the flow of agricultural technology, knowledge and information, and improving the delivery mechanism to disseminate its outputs for sustained rate of agricultural growth. The common goal of NARO is to enhance the institutional capacity to provide improved research services through sustained delivery of quality research outputs in a given time by improving governance and management of NARO, and management of the research processes and resources.

The main objectives of NARO are to streamline, coordinate, conduct and promote mainly adaptive and applied research in livestock, fisheries, forestry, crops, mechanisation and appropriate technology and food science; and to ensure dissemination and application of research results. The Agricultural Engineering and Appropriate Technology Research (AEATRI) is one of NARO's research institutes with a mandate to carry out applied and adaptive research to develop agricultural engineering technologies that will increase productivity and produce quality leading to improved socio-economic life in general. The main aim of AEATRI is ensuring food security and contributing to the modernization of small scale agriculture in Uganda through increased agricultural production and incomes for socio-economic development of the farm family and enhancing general improvement in the quality of life in the country by the use of efficient, affordable, economically sustainable, socially acceptable and environmentally sound agricultural engineering technologies.

2.3. The Integrated Programme (IP) initiative

The FAO's Integrated Support to Sustainable Development and Food Security Programme (IP) was initiated in March 1998, with funding from the governments of Norway and Finland. It is a normative programme implemented in collaboration with partners in Namibia, Uganda, Zambia and Zimbabwe. The aim of the IP is to promote synergy through interdisciplinary collaboration, information-sharing and support of ongoing rural development programmes. Gender is mainstreamed throughout the programme, and several of the activities involve capacity-building in relation to gender.

In Uganda, the IP's focus has been establishing networks and collaboration between diverse sectors that are working towards food security. Much of the work has been centered on gender mainstreaming and participatory approaches. In addition, activities focusing on appropriate farm technologies for the economically active women and men involved in agriculture and food security have been supported. The development objective of IP is to develop and implement an integrated strategy for sustainable development and food security that takes into account the main social, environmental and technical aspects of development. The priority areas of IP are:

- Policies and strategies for research, technology development assessment and transfer;
- Transformation of agricultural extension systems to enhance poverty reduction and integration of gender in sustainable development;
- Establishment of environmental and natural resource databases, information and communication;
- Socio-economic and gender analysis;
- Farm and household resource management;
- Management of farm animal genetic resources.

The focus of IP is to offer an integrated approach to sustainable rural development with a theme "A partnership to alleviate poverty". The programme is structured in a holistic way that addresses the four main elements of economic development – natural, human, institutional and social. A series of projects have been initiated to respond to the different IP priorities. This project is one such initiative to specifically address technology transfer aspects in IP.

2.4. Rationale and motivation for the study

Until very recently, agricultural research and technology development has largely ignored the needs and priorities of women, yet their contributions are substantial and essential to agricultural development. Achieving agricultural development goals of efficiency, sustainability and equity can be successfully attained by targeting both men and women needs in technology development. Moreover, technological innovations can be turned into opportunities to boost women's production potential and improve their quality of life and that of their families.

The positive attributes, technical efficiency and superiority of the Agricultural Engineering (AE) technologies notwithstanding a range of social, cultural, economic and institutional shortcomings could hamper the anticipated sustained dissemination and adoption of the technologies. This project therefore set out to understand the means by which deterrents to technology uptake inhibit the dissemination and adoption processes. Effective communication between researchers and policy makers often lacks. This communication could, however, be improved by a well-conceived adoption study (CIMMYT, 1993).

2.5. Selected technologies

a) Forage processing by zero-grazing dairy producers

In Uganda, livestock production contributes about 9% of the GDP and 30% of the total agricultural GDP. There are estimated 5.2 million cattle, approximately 96% of which are indigenous breeds, the rest are imported breeds and their crosses (Kabirizi et al, 1998). Over 60% of the country's livestock are kept by smallholder farmers to provide milk, meat, income, manure and draught power. Women play key roles in raising animals and in harvesting and processing livestock feeds and products both for home consumption and for sale. Although men are often the owners of large livestock, it is the women who perform most of the household labour devoted to animals. The processing of animal feed has dominantly become a women's role and very often assisted by the children. Since women's roles are increasing within the livestock sector, it is imperative to enhance their access to appropriate technologies and any information regarding livestock husbandry.

Feed materials for zero grazing animals require chopping for ease of consumption and increased palatability of the feed. Hand tools and head portage are common human powered activities that characterise forage chopping and haulage from fields often located far from the cattle stalls. These high labour demanding farm activities are followed by forage chopping tasks prior to feeding the cattle. Hand chopping is the common practice by most farmers. Besides its low output capacity and lack of uniformity in length of cut, the method is tedious, time consuming and quite dangerous to the operator. In order to improve on labour use efficiency, a number of improved forage chopper designs ranging from electric and diesel powered types, manual crank wheel and fixed knife have been developed. Results of on-farm trials conducted on various designs of forage choppers suggest that the fixed knife design is most promising for the small-scale farmers owning 1 to 5 animals. This technology is the least costing among the improved types in use. It is designed for reducing the current heavy workload and time spent by the majority of zero grazers who manually chop fodder for livestock using machetes as non mounted hand tools.

The improved forage chopper is able to cut grass and legume biomass as well as other feed supplements like banana peelings into small pieces more conveniently and quickly. This makes the process of mixing forage with high energy and nitrogen ingredients like calliandra leaf and maize bran easier and increases feed intake of the animals as well. By so doing the nutritive value of feeds and consequently milk yields are increased. The fixed knife forage chopper has been extensively field tested by AEATRI in the smallholder dairy (SHD) producing areas of Masaka, Mpigi, Wakiso and Kampala districts.

b) Water acquisition technologies

Women play an important role in water management in the home. They are most often the collectors, users and managers of water in the household as well as farmers of irrigated and rain-fed crops. Because of these roles, women have considerable knowledge about water resources, including quality and reliability, restrictions and acceptable storage methods. Over the years, women have developed practices for the effective and sustainable use of the water resources available to them. It is still important to build upon and enhance their skills in water management strategies that will alleviate them of the workload they are faced with.

Water acquisition for dairy animals is a main production constraint for farmers. Information on common water sources for dairy animals indicated the major water sources as spring wells, rivers, taps and bore holes that may be located a distance away from the farm. The major causes of lack of sufficient water are absence of roof catchment harvesting equipment and improved water delivery technologies from existing natural water sources (LSRP, 1999 and 2001). Most of the water required for household domestic and livestock needs is collected by head portage method by women, female and male children using small containers ranging from 5 litres to 20 litres. Much as this would serve the purpose for domestic use but, the method is quite tedious when large quantities of water are required as is the case for livestock. Interventions in the past have largely targeted water acquisition for irrigation, without much effort to address the issue of water acquisition for livestock and domestic use in rural areas. Recent research has now tried to address this time consuming and labour intensive exercise facing the women and children in particular.

The treadle pump is designed to handle lifting and conveyance of water for household use and livestock. It contributes to enhanced farm productivity and food security. The AEATRI developed treadle pump has an output capacity of 80 to 90 litres per minute and a sustainable water head of 4.5 to 5 meters. The pump can conveniently be operated by; women and men, boys and girls. If properly packaged and adopted together with roof rainwater harvesting and appropriate water storage technologies, also developed by AEATRI (either above ground or under ground low cost ferrocement tanks), the pump can lead to significant savings on energy and time on water acquisition hence reducing water portage related drudgery especially on women and children thereby releasing labour for other farm and domestic activities. The treadle pump has been demonstrated during the last three years on a small scale in the districts of Jinja, Mpigi, Wakiso and Masaka in the peri-urban smallholder milksheds.

2.6. Factors affecting technology dissemination and adoption

Cross-cutting aspects

Technology dissemination and adoption are affected by farmer and farm factors, community institutions, and local, national and international development plans and policies. The socio-economic and gender analysis tool (SEAGA) offers an understanding of cross cutting, specific gender and community development problems, livelihood sources, and benefits. The SEAGA approach also empowers communities to define their development priorities based on their experiences, felt needs, socio-cultural values and resource endowments.

Socio-cultural factors

Suspicion and lack of confidence in new innovations often leads to resentment of the technologies by the clients targeted. Farmers feel confident to stick to traditional practices; knowledge and skills even if improved technology may appear to offer better returns than the traditional method they are using. This risk aversion, which is sometimes interpreted as conservatism by the technocrats, is a result of fear of the uncertainty surrounding adverse outcomes that could potentially be associated to the new technology. Rabin, 1999 noted that people dislike vast uncertainty because a dollar that helps us to avoid poverty is more valuable than a dollar that helps us to become rich. In addition, people within communities or households often have social norms, values and attitudes that sometimes result into ‘peer pressure’ that controls behaviour of households.

Economic factors

Human capital leads farmers to gain techniques and knowledge thus influencing production decisions and practices. Besides, demand for agricultural technology is derived demand. Adoption of agricultural technology is hence determined by market opportunities available for farm products. Cost – benefit considerations are therefore intuitively undertaken by farmers prior to adoption of a technology. In addition, communication infrastructure; input and product acceptability and distribution channels; services and maintenance possibilities affect the affordability and accessibility of technology.

Institutional arrangements and policy issues

The priorities and activities of local community groups and associations, government and civil society organisations affect the trend of development patterns observed in an area. Regarding governance, economic development and agricultural policy and planning, it is worthy noting that decentralisation, market liberalisation, and services privatisation policies have shaped the role of political, administrative and private players in management of society. Farmers are now more active in determining their priorities due to participatory governance with development planning opportunities availed to them. The private sector has become more important in distributing farm inputs and products. Market forces determine the cost and selling prices.

3. METHODOLOGY

3.1. Project Approach

The project was undertaken into two phases. The first phase involved conducting a study to assess the constraints on adoption as well as strengths and opportunities of the technologies for reducing the farm workload and raising household livelihoods with particular focus on women and youth. In the second phase, the findings of the study were presented in an action planning workshop for stakeholders to jointly develop technology transfer and uptake implementation mechanism for technology dissemination by the relevant researchers, extension institutions, civil society organisations, key private sector players, policy, administrative and advocacy institutions.

3.2. The study

Study area

The study was conducted in the smallholder dairy (SHD) production zones of Masaka and Wakiso districts [see Figure (i)]. These areas are characterised by intensive paddock fenced, semi-zero and zero grazing (stall -feeding) management systems with a large proportion of farmers keeping grade dairy cattle. Communal herding and tethered grazing management are also practised by a few farmers who mainly raise local breeds (LSRP, 2001).

Wakiso district was part of old Mpigi that comprised of the counties of Kyadondo, Busiro, Mawokota, Butambala and Gomba. In the 2001 district restructuring process in Uganda, Kyadondo and Busiro counties were cut off to form the present day Wakiso district. This district is surrounded by Kampala and Mukono districts in the East, Kiboga and Mubende districts in the West, Luwero district in the North and Mpigi district in Southwest. Much of the South and Southeast are covered by Lake Victoria. The district is located in the banana-coffee farming system and in the southern and western tall grassland agro-ecological area.

Masaka district on the other hand borders Sembabule and Mbarara districts in the West, Rakai district in the South, Lake Victoria, Kalangala district in the East and Southeast and Mpigi district in the North and Northeast. The district is located in the banana-coffee farming system and southern and western tall grassland agro-ecological area".

Preliminary briefing and protocol validation

Following formal acceptance of the consultants' proposal and approaches for the implementation of the study, preliminary briefing meetings between the consultant, national facilitators and host institute were arranged in order to achieve the following:

- To consider the scope, focus of IP and priorities;
- To establish the coherence of the study with IP objectives;
- To understand the motivation, objectives and focus of the technology transfer protocol;
- To examine the functioning of interdisciplinary teams composed of FAO, national facilitators, AEATRI, the consultant and other stakeholders' responsibilities obligations and activities;
- To discuss the terms of reference, and;
- To draw up work plans, rationalise resource utilisation and obtain more information and materials on IP in order to enable the consultant prepare a detailed study design.

Preparatory meetings and team building

Initial preparatory meetings were held between the consultant, team leader and national facilitators to discuss the study design, qualitative and quantitative data collection tools and approaches presented by the consultant. Then the enumerators were also brought on board with the following objectives:

- To consolidate the study team by explaining the objectives of the project to the enumerators;

- To undertake enumerator training to internalise the particular SEAGA tools selected for the study and standard questionnaire data capture variables; agree on roles during qualitative and quantitative data collection and examine the appropriate techniques for eliciting qualitative and quantitative data from the respondents;
- To discuss the sampling procedure and the study areas;
- To examine the expected roles of AEATRI, enumerators, and the consultant and;
- To explain logistical arrangements and motivation to the team members for participating in the study.

Reconnaissance surveys and validation of survey tools

Reconnaissance surveys lasting two days each for Wakiso and Masaka districts by the national facilitator, study team leader and the consultant were conducted to undertake the following activities:

- To collect and collate available relevant secondary data for the study;
- To make preliminary arrangements and explain the thrust and objectives of the study to the district co-ordinators, field liaison contacts and identify local guides, interpreters and mass mobilisers;
- To identify major Government and civil society institutions, existing technology designs, and private fabricators/welder/service centers for developing a sampling frame for key informants and;
- To generate the sampling frame for quantitative data collection and identify areas for focussed group discussions in conjunction with district production departments.

Information obtained from the reconnaissance survey of the two districts revealed that the treadle pump was not being used for addressing any water needs on the farms. However, the need to have improved water harnessing technologies was expressed by the stakeholders contacted. The study approach on treadle pumps was, therefore, changed from a positive procedure where information is generated based on observed experiences to a normative approach that would yield information on the relevance of the technology given the water acquisition needs of the respondents. The focus on data collection for the treadle pump would hence be shifted from formal farmer respondents to key informants. The staff of the district production office in Masaka and a former user of a treadle pump in Wakiso were selected as main key informants for the detailed assessment of the treadle pump and irrigation technology issues.

After the reconnaissance surveys the team leader, consultant and one enumerator pre –tested the questionnaire each on two mock respondents located in some parts of Wakiso district falling outside the sampling areas. Following the field validation of the tools, it was agreed upon to have the following modifications on the questionnaire:

- The household structure to be made more detailed so as to cover the sex, age, main occupation and relationships of all household members;
- To include variables for capturing data on source and cost price or replacement costs of forage choppers;
- To expand the variable on awareness and skills to include actual management skills gained and their effects on farm productivity;
- To include a variable on source of stock of cattle the farmer has been keeping on the farm since they started the enterprise;
- To change the order of questions on water so as to get a logical flow and avoid disconcerting circumstances to the respondent and also make administering the questionnaire easier to the enumerators.

Sampling Area, Procedure and Techniques

The study was conducted in the sub-counties of Bukulula, Buwunga and Mukungwe of Masaka district and, Kira, Katabi and Wakiso sub-counties of Wakiso district. Multistage, purposive and random sampling techniques were used to select the respondents interviewed. Sampling areas in terms of sub-counties were purposively selected on the basis that they represented areas where intensive dairy production with 'cut and carry' grazing systems or heavy supplementation of chopped fodder in semi-intensive farms are practised. Selection of sub-counties was done at the district level by the team in conjunction with the district extension personnel. A similar procedure was followed in the selection of parishes with a bigger team involving the district staff, sub-county and NGO field workers operating in the sub-counties selected. Two villages were then randomly selected from each parish.

A sampling frame comprising of all farmers meeting the criteria used to select the sub-counties was developed to provide details on management – zero-grazing, fenced, tethering and communal; household type defined by gender characteristics – female headed, female managed and male headed; and type of forage chopper mainly used on the farm. Households that are female headed/managed and those with improved choppers were purposively selected because they were very few and could easily miss out in the random selection. The rest of the respondents were randomly selected using a 'fish bowl method' random selection procedure. The total sample size realised was 71 respondents for both Wakiso and Masaka districts.

Village groups from which focussed groups of men only, women only and adopters of improved choppers comprised of all men, women and children belonging to dairy keeping households. The groups contained all households in the locality including those where the individual household surveys had not been done. The key informants selected comprised of District production co-ordinators, Government veterinary field officers, NGO livestock development workers, community development workers, private veterinary personnel, elite farmers and private fabricators (welders). Secondary data was mainly collected from HASP - Masaka, LSRP-NARO-DANIDA diagnostic and baseline studies.

Data collection methods

The bulk of data for the study was collected from individual dairy keeping farm households using formal data collection techniques. Direct interviews on responsible members of selected households with the household as a sampling unit. Data collected using this method can broadly be categorised as:

- Household type, structure and composition by gender and wealth proxies;
- Farm sizes, enterprise types and mix;
- Livestock enterprise composition, forage and water resources;
- Water and forage sources, chopping and collection methods;
- Gender allocation of feed and water provision roles to the households;
- Cattle management knowledge and skills.

Secondary data and key informant comprised of local community mobilisers, NGO development workers, Government extension officers, local welders involved in forage chopper fabrication and experienced farmers. Data from these sources ranged as follows:

- Advantages and shortcomings of existing forage chopper designs and areas for improvement in order to foster adoption and better convenience of use by the different household members who use them;
- Advantages of the treadle pump as a water lifting device for underground tanks and natural water sources;
- Trajectory in weather and its effects on farming practices and farm technologies and;
- Contribution of R & D in promotion of forage chopping water lifting technologies.

Data on community wide issues that were collected from farmers' groups was as follows:

- ♦ Relative importance of institutions involved in agricultural development;
- ♦ Seasonal household crop and livestock activity profiles;
- ♦ Constraints, strengths, weaknesses, threats and opportunities related to the forage technologies and, priorities for improving dissemination;
- ♦ Explanation for the apparent low adoption for forage choppers.

3.3. The Stakeholders workshop

Scope of the Workshop

A one-day stakeholders' action planning workshop was organised that brought together Research, Policy and Administrative Institutions, Ministry of Agriculture, Animal Industry and Fisheries, Farmers organisations/groups and relevant NGOs. The aim of the workshop was to bring together these different stakeholders to jointly develop technology transfer and uptake implementation mechanism for technology dissemination.

Workshop procedure

The study report formed the basis for discussion during the workshop. A brief account of IP initiative, goal objectives and activities was given by the IP National facilitators to acquaint all participants to the operations of the programme. Before moving into the technical session, a brief account of the project rationale, objectives and activities was given to help participants fully appreciate the findings of the study. A technical session by the project National Consultant then followed that lead the group through the methodology, results/findings, conclusions and drawn recommendations of the study.

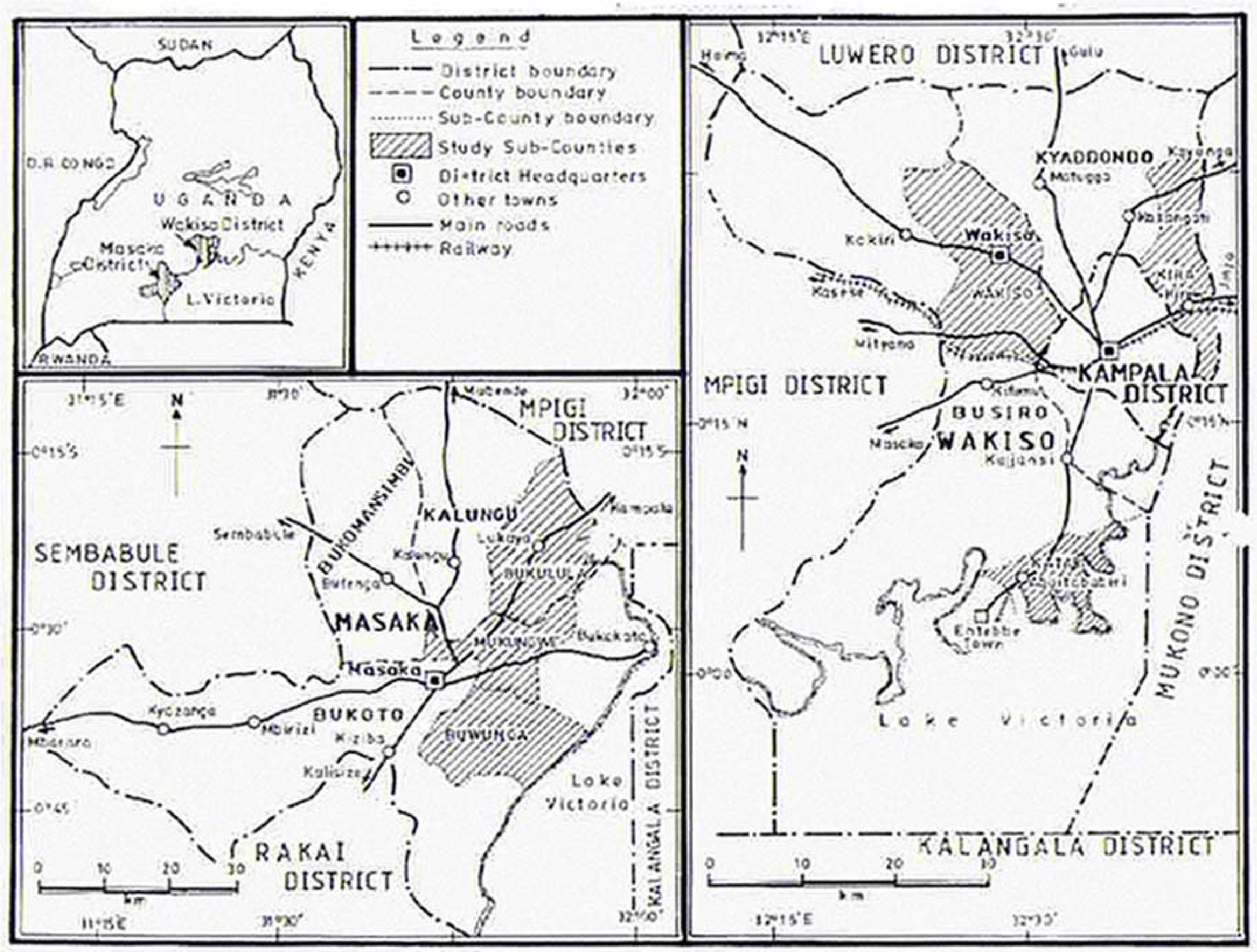

Figure (i): A map of Uganda Showing the Study Areas

4. RESULTS, ANALYSIS AND DISCUSSION

4.1. Qualitative aspects

Focus Group Discussions (FGD)

Seasonal rainfall data and crop calendars for Masaka district were summarised in figure (ii) and figure (iii). Both Masaka and Wakiso districts are located in the same farming systems and agro-ecological zone (AEZ). Information from these figures shows that there are two dry seasons – January to February and July to September; and two wet seasons March to June and October to December in a year. During the dry seasons farmers rely solely on wells as a source of water although this is the time when water intake by animals is highest because of high temperatures. During the wet seasons both rain water and wells are used. It was noted that the water constraint affects all household members. The men or husbands; women and wives; male and female children all participate in water collection activities from the wells and that, sometimes male labourers are hired.

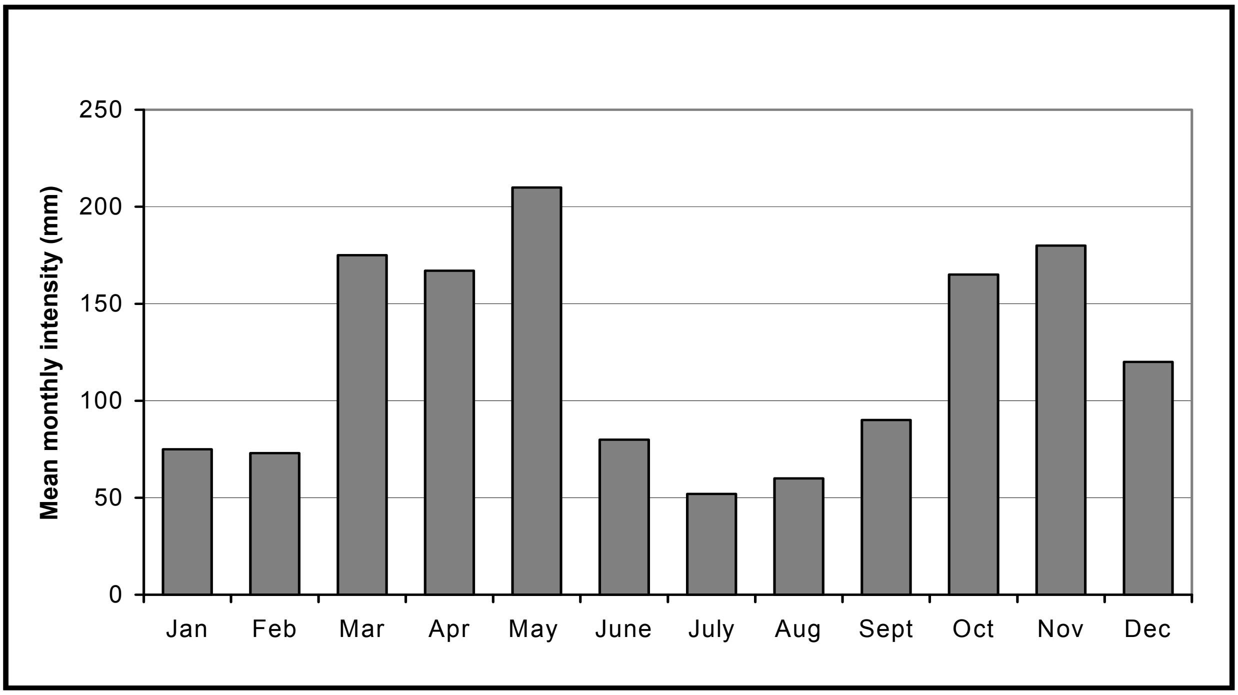

Figure (ii): Rainfall, household income, expenditure patterns and crop activity calender

1st Dry spell 1st Wet season 2nd Dry spell 2nd wet season

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Land preparation Planting Weeding Harvesting/Land preparation Harvesting

Ploughing maize Annual crops Planting annual crops/procure inputs

Weeding annual & perennial crops Weeding all crops

Compost making Compost making

Milk, coffee, annual crops major income Low income levels Farm income (harvests) Low farm incomes

High cash needs for School fees and food Initiate new farm enterprises

, Buy assets like bicycles

Maintain farm structures high labour and farm inputs Maintain farm structures High farm input needs

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The common method of collection involves use of plastic containers ranging from 5 to 20 litres. Whereas adult male members of the households and hired male labourers may use bicycles the women, male and female children ordinarily collect water on their heads. The male youth are preferred for hire because they take shorter time to obtain water on bicycles. In the neighbouring villages there are bore holes but dairy cattle producers do not draw water from there because according to their observation the animals reduce water intake whenever it is collected from bore holes. According to the farmers, cattle do not like the taste of water from boreholes. Some farmers depend entirely on the few water vendors who collect and sell water as a way of living. This option is becoming increasingly important because school going children who used to provide family labour for water collection were enrolled in school after the implementation of universal primary education (UPE) programmes. It was, however, noted that children both boys and girls still contribute to water collection activities. They go to wells in the morning before school and in the evening after school.

During the dry season there is scarcity of feeds. The situation worsens as the dry season progresses. When home grown fodder resources are depleted the farmers resort to communal sources of feeds like forests, road side tracks and natural range lands. Farmers who tether animals and those with intensively managed paddock fenced cattle are affected most by the droughts as the pastures and grasslands degenerate. The rate of regeneration of fodder planted by the farmers also becomes very low. Farmers have, therefore, gradually started picking up the use the alternatives of preserved feeds like silage and hay. In addition, use of crop residues, tree twigs and agro-industrial by-products like maize bran becomes an important fall back position to cope up with feed shortages especially for zero grazing dairy.

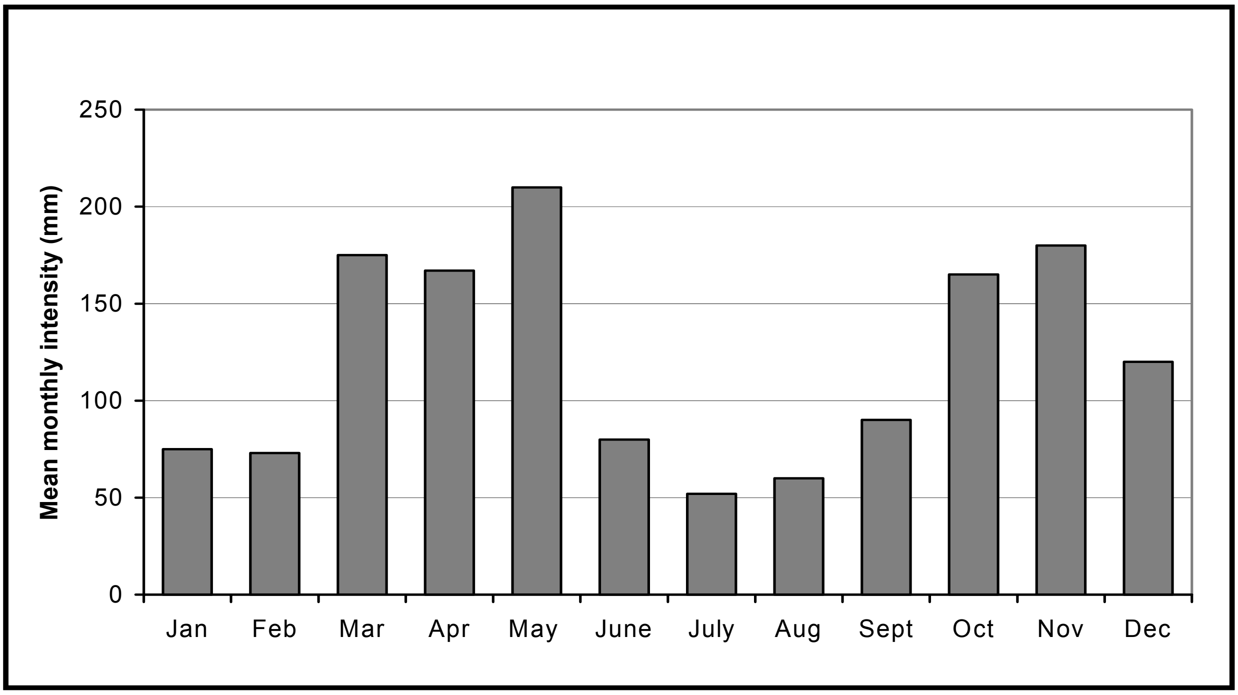

Figure (iii): Rainfall and livestock feed, water and constraints patterns

1st Dry spell	1st Wet season	2nd Dry spell	2nd wet season
Plant fodder/rely on crop residue	Farm/communal feeds available	Plant fodder/use crop residues	Farm/communal feed available
Use non-conventional/wild feeds	Make hay/Silage	Use non-conventional/wild feeds	Make hay/silage
Purchased/communal fodder		Purchased/communal fodder	
Low milk yield	Tick borne diseases	Low milk yields	Flies common
Feed scarcity	Flies common	Feed scarcity	Tick borne diseases
Water scarcity	Water scarcity		
Water from wells	Wells & rainwater	Water from wells mainly	Wells and rainwater
Hired labour (water)	Family labour water collection	Hired labour to collect	Family labour water collection

Institutional Profiles and Stakeholders

Some projects in the districts that have attempted to assist farmers in some aspects of agricultural production. During the FGD with the farmers, the following were identified the active development agencies in the area.

1. Send a cow (SAC)
2. VI agroforestry
3. Heifer project international (HPI)
4. Masaka district farmers association (MADIFA)
5. Adventist development relief agency (ADRA) adult education programmes
6. NARO (dairy feed improvement)
7. HASP
8. Community enterprises development organisation (IFCD)
9. MADDO
10. Water Environment and Sanitation
11. SAMD
12. World vision
13. Kitovu mobile case unit

Farmers were sub-divided into six groups and using the preference ranking procedure farmers were asked to identify three most important stakeholders from a list of six dominant development agencies. A scoring range of 1 to 3 was used with (3 = most important and 1 = least important). The institutions considered were involved in the following community development activities:

1. Integrated community development
2. Agriculture (crop and livestock improvement)
3. Veterinary (livestock production and disease management)
4. Fisheries (lake fisheries and pond culture)
5. Forestry (plantation and agro-forestry)

Table 1: Stakeholder analysis matrix for major development agencies

Stakeholders	Farmers' group scores						Total score	Rank
	1	2	3	4	5	6		
SAC	3	3	3	3	3	3	18	1
VI	2	2	2	2	2	2	12	2
MADDO	1	-	-	1	1	1	04	3
MADIFA	-	1		-	-	-	01	5
NARO	-	-	1	-	-	-	01	4

Reasons for the preference rankings assigned to the development agencies were as follows:

SAC

- Trained farmers in intensive dairy cattle management;
- Has provided farmers with cattle since 1998;

- Has introduced a revolving fund which farmers can use to pool financial resources for investment in farm development;
- SAC together with visitors taken to the farmers by SAC give technical input to farmers for continuous improvement.

VI agro forestry

- Trained farmers in soil management using organic household residues – farmers belong to the organic movement;
- Introduced different varieties of boundary, shed, fuel wood and fodder trees. Farmers are now realising the benefits of these trees;
- Trained farmers in integrating household crop, livestock, and human resources to better soil productivity; increase farm yields and improve household human and animal welfare though better housing, feeding and hygiene.

MADDO

- Trained farmers in dairy management water harvesting, animal production, health, reproduction (heat detection and management of in- calf cows), and in, various uses and methods of managing manure and urine;
- Encouraged farmers to grow elephant grass and legumes for fodder and erect shelters for zero grazed animals;
- Provided farmers with dairy cattle. In order for the farmers to contribute in the investment a farmers would provide shillings 350, 000/= for each cow received;
- When the scores were summarised NARO and MADIFA had equal ranks. The recombined group was asked to identify which of the two was more important. The group selected NARO mainly because of LSRP interventions on dairy feed improvement especially on fodder growing, silage and hay making as dry season feed reserves.

Fodder chopping technologies

Harvesting of forages from both farmers gardens and communal sources was being done by all household members men and women; boys and girls alike. There were two fodder common chopping methods – use of forage choppers and machetes. Information from key informants on locally fabricated choppers shows that these choppers are fabricated on order and most orders are commonly received from farmers in a radius of about 16 kilometers from the fabricators normally after seeing similar designs from fellow farmers. One welder, who is also a zero grazer in the SHD zone of Masaka district, stated that he had made up 15 forage chopper in a period dating back about five months prior to the survey. The greater majority of the farmers used machetes with very few owning improved forage choppers. It was observed that for farmers who had few animals, machetes would be preferred because of the following advantages:

- Chopping is quicker compared to other choppers;
- A machete is also cheaper, portable and multipurpose;
- It is easier to remove poisonous weeds from the feeds if a machete is used because the method allows the farmer to observe the feeds more as they are chopped.

Apart from ease of chopping, there are many shortcomings and dangers associated with machetes as outlined below. In Katabi group discussion it was revealed that machetes and crank wheel choppers were being used but still with a very large proportion of the farmers using machetes. Farmers in this area were not aware of the fixed knife AEATRI chopper design that would be an intermediate technology between the machete and the crank wheel choppers. Farmers considered those with crank wheel choppers to be wealthier. Fear of attracting thieves targeting the chopper and possibly ending up taking other household assets on the assumption that crank wheel owners belong to a well – to – do class of farmers was hence cited as another reason for low adoption of these crank wheel choppers in particular.

Information from focussed farmer groups in both Masaka and Mpigi districts on the shortcomings of machetes as forage choppers point out the following:

- There is a high risk of cutting ones finger;
- Use of a lot of energy causing chest muscle pains. Chopping is a cumbersome task that is normally done in the mornings at around 0700hrs and large volumes are chopped enough to feed the animals up to early hours of the afternoon around 1400hrs. This gives the farmers sufficient time to do other crop cultivation and water reticulation activities before they chop fodder again;
- Splashing of feed and inability to cut the recommended one inch size;
- Need to cut when there is sufficient light to avoid damage to fingers and ensure that relatively short pieces are cut;
- Regular replacement of the wood on which cutting is done, and need to lay some relatively wide polyethene square to avoid the scattered chopped material mixing with chuff or getting soiled.

Adopters of improved choppers realised the following benefits and advantages:

- Less cumbersome to the person chopping as less energy is used;
- It is less noisy and can even be done in the house late in the evening or even at night when there is little light hence reducing competition with other activities for labour,
- Less risk of finger bruising or cutting;
- Chops the recommended sizes of forage and does not scatter the chopped pieces;
- There is less feed wastage in that there are less feed refusals - the smaller the sizes of materials put in a feed trough the more is consumed by the animals. Besides, selective feeding in favour of legumes is avoided.

As a general assessment farmers observed that improved choppers are easy to operate and convenient – makes chopping enjoyable. There are two shortcomings, however, that farmers have noted on the AEATRI improved fixed knife forage chopper: the aperture through which the machete moves as it cuts often gets blocked and the cost of 120,000/= is unaffordable for some farmers. Table 2 further gives the SWOT analysis of the fixed knife forage chopper. For the crank wheel chopper the high cost was cited as its biggest undoing, ranging from 450, 000/= - 700,000/= for the manually operated one and goes up to 2,000,000/= when motorised.

Table 2: A SWOT Analysis and Dissemination Dimensions for Choppers and Water technologies

Problem	Causes	Strengths and Opportunities	Threats	Weaknesses	Activities to discontinue	Activities to initiate and/or carry on with
Lack of awareness on source of choppers.	Farm power, tools not a focus of intervention by traditional DAs.	AEATRI, relevant DAs, fabricators, are now all focussing on the same farmer. Some farmers have adopted choppers using different pathways.	Milk market is sometimes not good.	Some farmers who are not beneficiaries of donor projects are persistently left out in the dairy development related training.	Discrimination in selecting farmers for training although their constraints are the same.	Make farm power tools an integral part of livestock technology intervention package.
Incorrect information about designs and costs. It is widely believed that only one design exists	Inadequate demos, and information dissemination.	NARO outreach, Masaka ADC, PMA, PAF, LSRP options. Farmer groups, active community mobilisers, farmer responsive to training.	Informal information flow strong and often believed to be correct.	Less focus on dissemination AE technologies by most intervention channels to the farmers.	Putting overdue emphasis on OSR during technology generation. Putting dismal focus chopping technologies.	Participatory TDT, consider gender responsive designs, assign an officer in the district to be responsible for AE technologies.
Wrong attitude about chopper advantages service and repair by farmers.	Authentic information sources inefficient.	Current choppers have been working for more than a year without any service. Early adopters know the few adjustments required, local welders can fabricate & repair.	Low farmer demand for choppers hence slow initiative on local fabrication.	Weak farmer to farmer skills. Mutual learning is insufficient.	Leaving artisans and private fabricators at the peripheral of TDT.	Non adopters learn from early adopters through farm visits; On-farm demonstration relevant chopper technologies.
Inadequate rainwater harvesting	Partial roof harnessing, small container, capital costs	Two distinct rain seasons, iron roofs, availability of local materials, NGOs (VI) and artisans, users of underground/above ground tanks	Low savings from farm returns, multiple demands on farm revenue	Partial harvesting, reliance on natural sources	Use of small containers, partial harvesting	Attitude change, farm visits to adopters, demo. Low cost options
Head portage water collection method	Lack of pumping/conveyance equipment, limited animal/bicycle use	Bicycles & hire services locally accessible. Animal power on very few farms, consistent with cultural norms	Low savings from farm returns, multiple demands on farm revenues and labour	Family labour considered cheap (competing needs not computed)	Over reliance on human power	Explore farm animal power alternatives
Reliance on rain fed farming practices	Tradition, lack of awareness about irrigation technologies	Permanent water sources, small-scale and seasonal water extraction	Water extraction, wetland consideration	Belief of ample rain & good soils, poor focus by TDT	Rain fed tradition, change belief of ample rain/good soils	Priority setting for small-scale irrigation, development focus on irrigation.

Water acquisition technologies

Information generated from the pre-study reconnaissance survey had indicated that the treadle pump had not been sufficiently demonstrated in both districts. Awareness programmes, stakeholder sensitisation campaigns and other promotional efforts within the farmers close proximity or targeting key players involved in technology transfer to the dairy farmers had not been undertaken. The idea of promoting use of treadle pumps was dropped because after reviewing the farmer circumstances this technology would not be appropriate to meet the farmers' needs. The fact that a treadle pump can only overcome a head of only six metres and supply water covering only about 20 metres if the land is flat limited its potential applicability under Uganda's conditions. Most water sources are located in valleys yet most farms and households are located uphill according to the common terrain existing in Uganda. The cost price of a treadle pump – shillings 200,000 – is considered high given its limitations in lifting and conveying water. Farmers would most likely continue using head portage and bicycle loads even if it meant supplementing household water collection efforts with paying for water collection.

In Wakiso district the treadle pump had been in use for drawing water from an underground tank on one dairy farm. The farm manager interviewed stated that this pump was more convenient and efficient in drawing water compared to the traditional method of lowering a bucket suspended by a rope and manually lifting out. They had used the treadle pump to draw water amounting to about 1,000 litres per day (five drums each 200 litres) operated by one man. This pump was, however, withdrawn from the farm on the suspicion that it was linked to the eye diseases the cattle were suffering from at the time. This could have been a mere coincidence because when the pump was taken, and not returned, and the cattle treated the eye disease did not recur. Nevertheless, the drudgery and higher labour demand on water collection were prevailing after the removal of the pump from the farm.

Further information on the treadle pump in Masaka, however, revealed that treadle pumps had once been demonstrated at the MADIFA agricultural shows. Some farmers had shown interest in pursuing the idea of taking them on but the source of the pumps - which seemed not to have been clear to the farmers and technical staff in the district could not easily be identified by the farmers after the show. The group that demonstrated made a single shot display and there was no easy contact left for the farmers to get in touch with them.

Key informant sources in Masaka district concurred that there was a need to shift from over reliance on the traditional practice of rain based agricultural production by introduction of irrigation technologies on the farms due to the following observations:

- That during a normal year there are normally four seasons one long wet and dry season and one short wet and dry [see figure (ii)]; but sometimes rains are erratic with poor distribution and intensity even during the ordinary rain seasons. The poor rainfall reliability makes distortions in farmers' plans. Sometimes it comes much earlier or intensifies later than expected before farmers are ready to plant or when crops have already even suffered irreversible moisture stress. Sometimes rains coming unexpectedly stop before farmers have had time to adjust and synchronise their cropping patterns with that of the rains;
- A new trend is being persistently experienced where rains may come unexpectedly during traditional dry seasons and fail to come at the time it is expected to rain during a normal wet season - signifying a change in seasons;
- Some farmers especially the horticultural producers are in constant need for water to supply their produce to the market. Fruit and vegetable growers tremendously increase their returns in the dry season when their products fetch high prices due to the fall in supply when most farmers cannot produce;
- Some farmers of perennial crops like coffee have realised the need water especially to reduce fruit abortions common in the dry seasons and thereby increasing their yields and returns.

Efforts of R & D efforts on demystifying and promoting treadle pump technologies

There have been efforts by MAAIF and AEATRI to promote the use of treadle pumps in Masaka district. The actual exercise of demonstration of the technology to the farmers was done by the irrigation section of the Land Planning section of MAAIF. There was apparently poor linkage in conducting this demonstration between MAAIF and the production department of Masaka district since the latter had neither record nor idea when and where this demonstration was done. The demonstration was not continued because the engineers who had planned the demonstration on the treadle pump technology realised that that technology was obsolete considering the farmers needs and what the market can currently offer. The fact that the district and source of technology were not properly coordinated signals serious potential flows or threat to the sustainability of the technology uptake. Technocrats in MAAIF or AEATRI would only introduce a technology in the field but the local institutions and stakeholders would be the ones to play a key role in technology dissemination and uptake. The same stakeholders are critical in defining recommendation domains for wider adoption and in packaging the technologies in such a way that it is tailored for the existing farmer categories. Equally important is the fact that farmers immediate source advice for service and repairs are the district production offices. Moreover, as part of the decentralisation policy funding and planning of farm interventions heavily relies on the available information, funds and will of sub-county and district local government councils. If local funds are to be used to put up more demonstrations in the same areas or expand to other demonstration sites it will be the production committees at the local level of governance to approve the plans and disburse the funds. Local stakeholders are also better placed with respect to contributing towards identifying the private operators to link up with for service, repair or other maintenance and back-up services.

4.2. Quantitative survey findings

a) Socio-economic characteristics

Results on socio-economic and demographic characteristics of dairy cattle keepers are presented in Table 3. Information generated from individual household formal survey results shows that on average each household had seven members with a male to female ratio of 4:3. Land holding per household was reported to be about 4.0 acres of which about 1.2 acres was on average covered by fodder fields. The bulk of farmers (92%) sampled kept grade cattle comprising of crosses and exotic breeds. Only 1.4% of the farmers exclusively kept local animals. The rest of the farmers raised both local and grade cattle.

Extraction of milk for both domestic use and income generation (58%) was the principal objectives of raising cattle. Data on milk yields realised per day per cow indicates that 13 litres and 3.2 litres are obtained for grade and local cattle, respectively. Most of the households (87%) had their main decision-makers with at least elementary level of education. Regarding gender and status of household head, information collected shows that various household types were covered in the study; male headed (60%), female headed (37%) and female managed (4%). Data on type of residence shows that all places of abode of farmers studied had iron roofs but with varying types of walls. Farming was a main source of livelihood for the communities surveyed. This evidenced by the fact that 69 and 88% household heads and their spouses being farmers, respectively.

b) Gender roles, forage and water management

Data on gender roles, forage and water management is shown in Table 4. Secondary information sources and results of the preliminary survey obtained prior to the formal survey revealed that elephant (napier) grass was the major (basal) feed for the intensively managed dairy cattle. Data obtained on sources of elephant grass shows that most (76% of male headed and 79% of female headed households) of the elephant grass is grown by the very farmers who feed it to their cattle on own farms, rented or borrowed pieces of land. There some farmers who have no cattle but grow elephant grass for sale to dairy cattle keepers although only 2.8% of the farmers solely depend on purchased fodder. The practice of using both own grown fodder and buying was recorded in about 10% of the farms. Collecting forages from communal lands like roadside vegetation and institutional or government lands was very rare (2.8%). Information on the distance of source of elephant grass shows that it is collected from about 0.6 miles from the homestead.

Table 3: Socio-economic, Gender and Dairy Production Characteristics.

Characteristic	Mean	SD	Minimum	Maximum
Household size (no. of persons all sexes)	7.0	3.4	2.0	23.0
Female household members (no)	3.2	1.85	0	11
Male household members (no)	3.93	2.46	1.0	14.0
Farm size (acres)	4.03	2.72	0.3	13
Fodder fields (acres)	1.16	0.79	0.5	5.5
Dairy herd size (heads)	3.18	2.93	1.0	15
Milk yield – grade cattle (litres/day)	12.64	5.67	2.5	30
Milk yield – local cattle(litres/day)	3.17	2.04	1.0	6.0
	Number of farmers (N)		**Percentage**	
	Male	**Female**	**Male**	**Female**
Level of education				
1. Illiterate	06	02	15.8	07.4
2. Primary	08	14	21.1	51.9
3. Secondary	15	08	39.5	29.6
4. Tertiary	09	03	23.7	11.1
Cattle keeping objective				
1. Subsistence milk	02	03	4.8	10.3
2. Milk for sale	09	05	21.4	17.1
3. Milk for subsistence and cash	24	17	57.1	58.6
4. Milk (cash, Sell); sell animals	01	01	02.4	03.4
5. Other	06	03	14.3	10.3
Household type				
1. Male headed	42		59.2	
2. Female headed		26		36.6
3. Female managed		03		04.3
Type of residence				
1. Tilled/iron roof - fired/concrete bricks	38	23	90.5	82.1
2. Iron roof - unfired bricks	01	01	02.4	03.6
3. Iron roof – mud & wattle	03	04	07.1	14.3
Occupation of household head				
1. Farmer	24	22	60	82.1
2. Trader	10	01	25	03.7
3. Formal employee	04	01	10	03.7
4. Unemployed	02	01	05	07.4
5. Farmer/Trader		02		
Occupation of spouse				
1. Farmer	35	03	87.5	100
2. Trader	01		02.5	
3. Formal employee	02		05.0	
4. Unemployed	02		05.0	

Harvesting of forages was done using machetes in 83% of male headed and 86% of female headed households. Sickles were particularly preferred for harvesting creeping legumes. Chopping of forages by intensive cattle producers is not uncommon. Each farm family was chopping on average 140 kg of forages per day for cattle that are largely stall fed (90%). Other management systems: semi-zero grazing (1.4%), paddock fencing (1.4%), perimeter fencing (1.4%), tethering (2.9%) and communal herding (2.9%) were the grazing systems practiced by the rest of the farmers. Forage collection related household labour utilisation shows that head portage (60%) and bicycle (21%) were the common forage delivery methods implying that head loads are the major feed delivery method to the farm.

Forage collection was found to be one of the activities where various members of households and the community actively participated. The gender - referenced allocation of forage collection roles show that wives (11%), boys (13%), children only (15%) and fathers and children (10%) were the main players among household members. Other household members who participated were husbands (7%), male relatives (3%), girls (3%), and mother and children (10%). Female heads of households alone had very limited participation in forage collection. Forage collecting activities were therefore, shared by nearly all the household members irrespective of age, sex or status. Hired boys were the common community members external to the households preferred for forage collection (23%). This was largely because they take shorter time to deliver the feeds since many use bicycles for carrying forages.

With regard to chopping technology, data collected shows that simple hand tools using traditional unimproved techniques characterised with machete (84%) use dominate forage chopping. This means that less than 20% of the farmers had adopted improved methods of forage chopping (fixed knife – 13% and crank wheel choppers – 3%).

Water related constraints were examined on the basis of source of water and method of delivery of water and gender relationships in water collection from the source to the farms. Data obtained from the survey shows that water sources were located about 0.8 miles away from the farms. Household total water requirements averaged 145 litres per day with mean supply to cattle daily livestock watering needs totaling about 105 litres. Natural sources in the form of wells and springs were the main water sources (61%) for livestock and domestic use. Some farmers located in the peri–urban zones had access to water from bore holes and taps (24%). Other minor sources were lake or rivers (3%), above ground tanks (4%), and under ground tanks (1.4%).

Table 4: Gender Roles, Forage and Water Provision.

Characteristic	Mean	SD	Minimum	Maximum
Elephant grass distance (miles)	0.6	0.62	0.01	3.5
Distance to water source (mile)	0.75	0.55	0.0	2.5
Feeds chopped (Kilograms/day)	140	92.3	40	600
Water for household (litres/day)	144.5	86.7	30	520
Water for livestock (litres/day)	104.4	66.5	35	320
	Number of farmers (N)		**Percentage**	
	Male	**Female**	**Male**	**Female**
Forage harvesting methods				
1. Machete	35	25	83.3	86.2
2. Sickle	03	01	07.1	02.4
3. Machete and sickle	04	03	09.5	10.3
Source of elephant grass				
1. Own farm	32	23	76.2	79.3
2. Rented/borrowed land	01	03	02.4	10.3
3. Buying	01	01	02.4	03.4
4. Other	07		16.7	

Table 4: Cont'd

Forage collection methods				
1. Head	25	18	59.5	62.1
2. Bicycle	10	05	23.8	17.2
3. Wheel barrow	01	02	02.4	06.9
4. Both head and bicycle	01	03	02.4	10.3
5. Other	05	01	11.9	03.4
Gender and forage collection				
1. Wife	08		11.4	
2. Boys	09		12.9	
3. Hired males	16		22.9	
4. Father & children (both sexes)	07		10.0	
5. Children (both sexes)	11		15.7	
6. Other	19		27.1	
Forage chopping methods				
1. Machete	36	22	87.8	78.6
2. Fixed knife chopper	04	05	09.8	17.9
3. Crank wheel chopper & machete	01	01	02.4	03.6
Water source				
1. Well/spring	28	15	66.7	51.7
2. Borehole/tap	10	07	23.8	24.1
3. Lake/river	02		04.8	
4. Above ground	01	02	02.4	06.9
5. Under ground		01		03.4
Gender and water collection				
1. Boys	10		14.3	
2. Hired males	17		24.3	
3. Children (both sexes)	20		28.6	
4. Other	24		32.8	
Rain water harnessing methods				
1. Small containers and drums	33	23	80.5	79.3
2. Above ground tanks	07	05	17.1	17.2
3. Under ground	01	01	02.4	03.4

Water collection is another activity demanding family labour resources on a daily basis. Head portage (43%) was the main method used in delivering water. This was followed by use of bicycle loads at (34%). A sizeable proportion of farmers (13%) combined both human power sources using the head and bicycles. Other minor water collection means included; wheel barrows and work animals each at 1.5%; vehicles at 3%; and a combination of wheelbarrows and bicycles at 4.5% (Figure iv).

Like forage collection, water delivery was another activity shared by all household members. All children (29%) and boys only (14%) were the major actors, among household members, involved in water collection. Other household members involved were husbands (3%), girls (1.4%), mothers and children (9%), fathers and children (7%) and whole family (9%). Hired males (24%) were important in delivering water to the households.

Results on rainwater shows that there was widespread poor roof catchment water harnessing methods. Small storage containers of 240 litres maximum and partial roof catchment were common (80%). Use of above ground (17%) and underground (3%) collection methods from the roofs were very rare despite the fact that all the houses were iron roofed. This observation concurs with LSRP (1999) that concluded that one of the major causes of the water constraint in Masaka is lack of roof catchment rainfall water harvesting techniques. Farmers with underground tanks of capacity up to 10,000 litres stated that they never run short of water throughout the dry seasons. Collection of surface water run-off was not being practiced in the area.

Gender derived information on water and forage collection, forage chopping and their relationship with technology use was generated using non-parametric tests. The gender variables were structured to reflect the role of gender - women and girls only, children only and males including only men and boys - in water delivery, forage collection and chopping activities [Tables 5 and Figures (iv), (v) and (vi)]. Data obtained on association between gender derived variables and water collection revealed that the children including both boys and girls were the main players (50%) in water collection. Children were followed by the male folks within the household who comprise of boys and men. Women and girls represented 13% of the family labour force involved in collecting water to the farms.

Table 5: Water collection methods and gender inter-linkages

	Women and girls	Mainly children	Men and boys	Total
	07	12	10	29
Head portage	3.8	14.5	10.7	(42.6%)
	(3.2)	(-2.5)	(-0.7)	
Machine use	02	22	15	39
	5.2	19.5	14.3	(57.4%)
	(-3.2)	(2.5)	(0.7)	
	09 (13.2 %)	34(50 %)	25 (36.8 %)	100 %

Results on gender and water collection may appear disproportionate towards the children and males compared to female members of the households. Statistical analysis was done to assess whether there was a relationship between gender and drudgery in water collection. Results obtained depict an association between use of barely human power vis – a – vis machines. Female members of the household largely rely on human power whereas their male counterparts predominantly use machine, especially bicycles, to carry water to the farms (χ^2 = 6.3, p = 0.043). Gender contribution to water collection is hence apparently balanced in that whereas women and girls are exposed to more drudgery, the children and males who deliver water more often are assisted by improved technology in the water activity.

Chi-square tests were run to examine whether there is a relationship between gender and technology use in forage collection. Data on associations between forage collection, household members participating and technology use shows that male members of the households play a major (56%) role in carrying forages to the farms [Table 6, Figure (v)]. Children and female household members play almost equal contribution towards forage collection with corresponding percentages of 23 and 22. Results of chi –square tests, however, show that females are associated with head portage and discriminated on machine use during forage collection activities. The male colleagues unlike females and children, on the other hand, are favoured by use of machines rather than their own heads alone (χ^2 = 5.4, p = 0 .07).

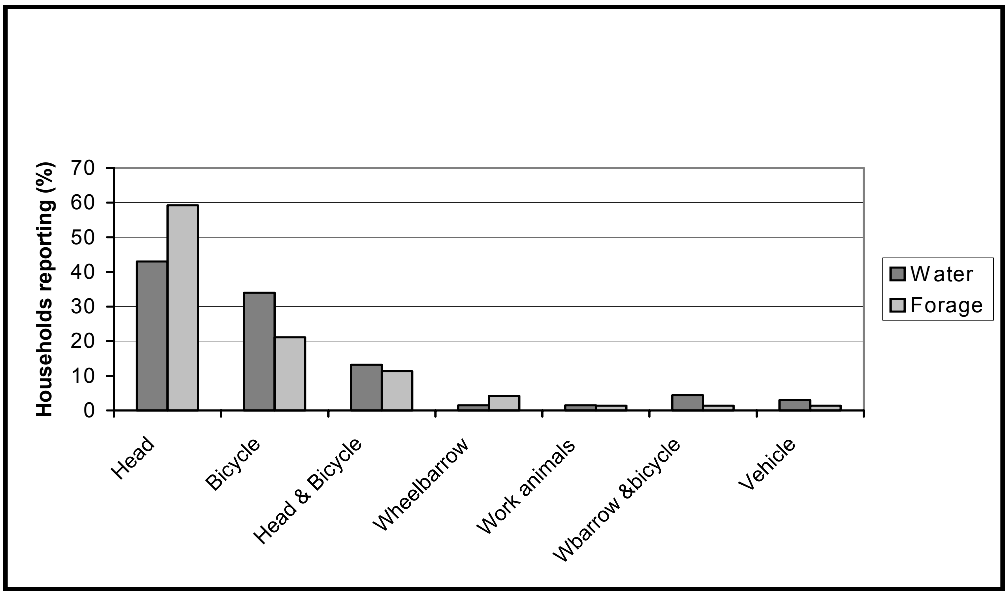

Figure (iv): Distribution of water and forage collection methods in Masaka and Wakiso household.

Table 6: Means of forage delivery and gender interrelationships

	Women and girls	Mainly children	Men and boys	Total
Head portage	13 9.4 (3.6)	10 8.8 (1.2)	18 22.8 (-4.8)	41 (58.6%)
Machine use	03 6.6 (-3.6)	05 6.2 (-1.2)	21 16.2 (4.8)	29 (41.4%)
	16(22.95)	15(21.4%)	39(55.7%)	100

Data obtained on associations of gender and forage chopping technology shows that men and boys did most of the forage chopping (52%), followed by women and girls (26%) and children at 22%. ANOVA techniques were used to examine whether there is statistical differences between quantities of forage chopped per day using the various chopping methods observed in the field. With regard to the relationship between chopping technology and amount of forage chopped it was observed that the quantity of forages chopped using crank wheel choppers was significantly higher (330 kg/day) than the amount chopped using either a fixed knife chopper (111 kg/day) or machete (139 kg/day). This means that the mass of forages chopped by a machete and fixed knife chopper were therefore statistically equal (p =0.007, LSD = 62). These findings suggest that whereas farmers may justify extra investment in crankwheel chopper due to higher farm demand for larger quantities of forages, fixed knife choppers could be adopted because of their convenience and safety offered to the operators rather than the need to chop larger quantities compared to farmers using machetes.

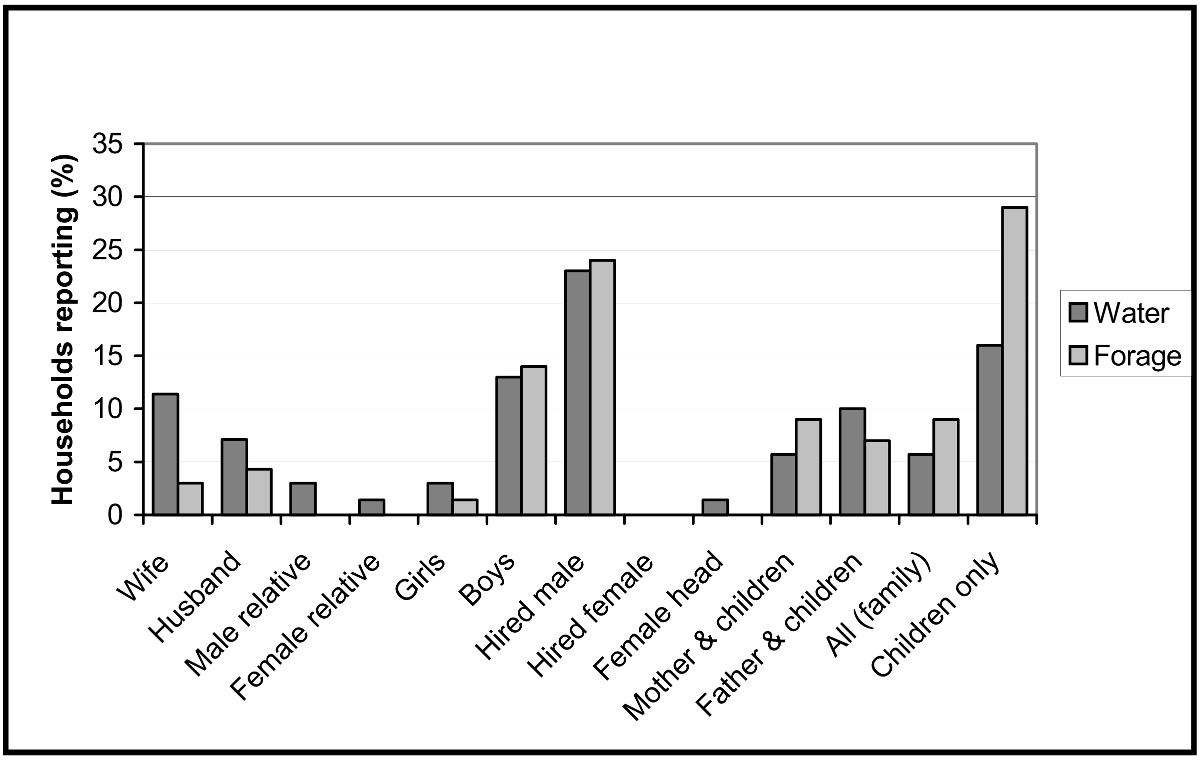

Figure (v): Gender, water and forage collection methods in Masaka and Wakiso districts

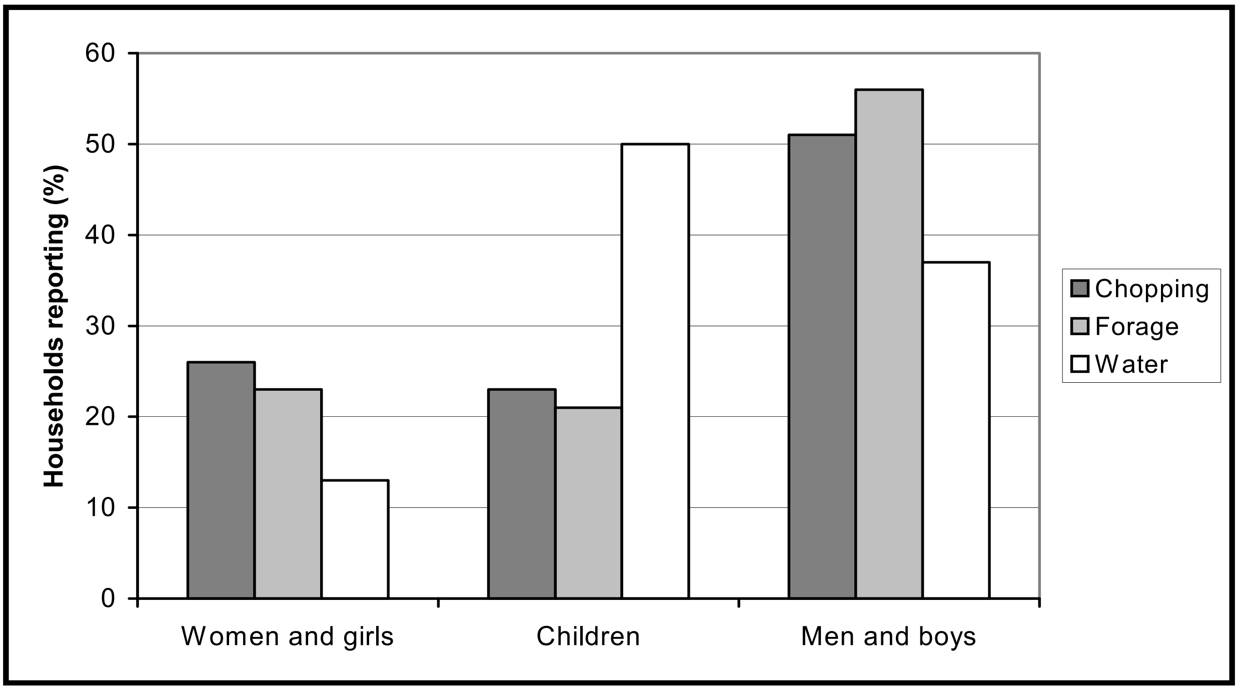

Figure (vi): Gender, water and forage delivery in Masaka and Wakiso districts.

4.3. Stakeholders' Workshop

There were areas of particular concern after the presentation of the study findings. It was evident that the methods through which agricultural engineering constraints are identified and addressed are limited by AEATRI's thin presence on the ground, particularly in the field. All agricultural research should target holistic and participatory methods/approach to technology development and dissemination. AEATRI's presence in the field is minimal, normally targeting to disseminate information concerning its technologies through the media. The technologies developed address price differentials for high, medium and poor resource endowed farmers. AEATRI is putting less emphasis on technology multiplication and more emphasis on linking to the private sector for this. It was noted that local artisans are already taking up the role of modifying some of AEATRI's technologies to better suit the farmers' requirement. This was a good gesture given AEATRI's effort of linking up with the private sector and local manufacturers.

The impact of the improved forage chopper on the whole was highly appreciated. It was, however, noted that the night chopping that was preferred by some farmers as a way of increasing on their time to indulge in other income generating activities was not quite safe as there was a danger of not only chopping poisonous weeds but also bringing in dangerous reptiles like snakes along with the fodder. In as far as the quality and quantity of chopped forage was concerned, it was evident that the machete is inferior to the fixed knife although the study did not take into consideration the quality of fodder chopped. In an effort to reduce on the cost of the current AEATRI's fixed knife forage chopper, it was deemed necessary for AEATRI to take up some of the farmers' innovations of using cheaper material like wood and crap metal for the body of the chopper.

The success of the treadle pump as an intervention to the laborious water acquisition activity did not succeed in Masaka owing to the land terrain, topography and distance of the water sources. It was however noted by the stakeholders that the treadle pump would be ideal for these very conditions if package together with water harvesting as long as the delivery head to be over come does not exceed 5m. Transportation by any other system besides the bicycle was limited by the common narrow footpaths to water sources in the villages.

5. CONCLUSIONS AND RECOMMENDATIONS

5.1. Conclusions

a) Study

The findings of the study confirm that the improved forage chopper attributes have the potential to address the constraints encountered by farmers in forage chopping. Compared to the traditional chopping method, the improved fixed knife chopper offers the following advantages: operators' safety, efficiency, reduction of chopping - induced drudgery, ease of flexibility to integrate the household and capacity to release labour for other farm activities. Therefore, it would be appropriate to conclude that the chopper technology is relevant to the felt needs of the farmers and the intervention was timely considering that a hand machete has hitherto been nearly the only technology used in forage chopping. Improved choppers are required to reduce the risks posed by machetes to the users, fodder spoilage, and low labour productivity and feed-use efficiency.

Effectiveness of the chopping and water conveyance technologies, however, lies in the ability of the targeted clients to exploit the technology for the intended purpose, and consequently improving farm productivity, returns and the welfare of the households. The value of the AE technologies would therefore be judged based on their potential to contribute to agricultural development if the anticipated adoption takes place. Low adoption levels and absence of designs that meet the farmers' economic variability and gender practices were observed to be the major shortcomings of the AEATRI fixed knife forage chopper design. Lack of gender responsive and economically attainable designs erodes the appropriateness of the technologies with the entire spectrum of farmer typologies put into consideration. The price of the original AEATRI fixed knife forage chopper made the technology financially unattainable to the type of farmers targeted. Secondly the design size did not consider child participation in forage chopping. As a response to farmers conditions, the AEATRI forage chopper model has hence been redesigned by local welders to suit farmers' circumstances – use of cheaper metallic and wooden frames has grossly reduced its price with reductions in size to enhance child participation. The original model is therefore relevant but not appropriate given financial resource and gender considerations.

Farm water conveyance and pumping constraints lead to intensive labour use practices and livestock productivity. Head portage was the major method of collecting water from sources located about a mile away. Children played the biggest role in water collection but all the same all household members were involved in the activity. The intervention of the treadle pump with the capacity to draw water and/or raise the water head at sufficient levels to convey water for household use was also relevant and timely for Wakiso district but inappropriate for Masaka district given the terrain, topography and the distances to the water sources unless combined with rain water harvesting.

Regarding water acquisition options for livestock consumption and domestic use, the idea to use treadle pump was dropped. It was argued that the market could offer better alternatives than the treadle pump. There has, however, been very limited effort to disseminate these technologies to the farmers. Head portage partially complemented by bicycles, currently characterise domestic and farm water delivery practices in the households. It is therefore appropriate to conclude that efforts by R & D in disseminating water acquisition technologies have been rather weak.

In final analysis the following observations and inferences were made:

1. The extent of adoption of the improved low cost fixed knife forage chopper was 13% with the original AEATRI design being redesigned to make it more affordable and child friendly (gender responsive).
2. The improved fixed knife chopper is superior to the machete in as far as quality and quantity aspects are concerned and would be preferred by farmers. However, its dissemination has been slow largely due to poor flow and distortion of information on designs, maintenance and repair necessary for uptake to the farmers.
3. Agricultural engineering design for choppers has placed overdue emphasis on technical efficiency of the machines/equipment at the expense of socio- economic factors like use of cheaper materials and providing child friendly models.
4. All household members participate in water and forage collection with female members relying on their heads and males using machines to undertake the same activities. Transportation using wide

wheel based mechanical devices was however limited by the common narrow footpaths to water sources in the village.

5. Harvesting of rain water was uncommon for the zero grazers despite having iron roofed houses.
6. Owing to the land terrain in Masaka, the treadle pump technology was found inappropriate in most parts of the district.

b) Stakeholders Workshop

Drawing from the study results the following observations and inferences were made:

- All Agricultural research should use holistic methods/approaches to technology development and dissemination.
- The methods through which AE constraints are identified and addressed are limited by AEATRI's thin presence on the ground particularly in the field consequently AEATRI target to disseminate information concerning its technologies through the media.
- As much as chopping during the night saved the farmer time for other income generating activities, it should not be encouraged as it poses danger of chopping poisonous herbs as well as bringing in dangerous reptiles.
- Although the study did not consider quality of chopped forage the quality and quantity by the fixed knife is certainly superior to that of the machete.

5.2. Recommendations

a) Study

The following recommendations were made from the findings obtained from the study:

1. Forage chopper designs should be made in such a way that they conform to financial attainability considerations by using low cost working benches and hoppers like metal angle lines and wood compared to metallic sheets and other members currently used.
2. Forage chopper sizes should take into consideration that children take part in forage chopping. Child friendly designs which are smaller and cheaper being locally designed should be investigated and promoted. It is therefore recommended that technology development and transfer should be participatory and consider gender responsive designs. This will require collecting gender disaggregated data in needs assessment as well as developing gender sensitive training packages for dissemination of the technologies.
3. Critical need for water acquisition, lifting and irrigation technologies is evidenced. Use of head carriage methods dominate household water delivery systems and there is little focus of R & D for small scale irrigation. These technologies can tremendously improve farmers returns, food security and self–sufficiency in food production. It is recommended that agricultural engineering research and development examines using holistic and participatory methods prospects for water acquisition to address farmers' resources, gender roles and market opportunities. The treadle pump technology dissemination and adoption processes were discontinued largely because technology promotion was inconsistent with client needs and circumstances. Inaccurate client targeting or promotion of appropriate water conveyance technologies could be improved by assessing the adoption niche for treadle pumps and examining substitutability options for the treadle for the rest of the constrained farming population with which the treadle pump is not relevant.
4. Water collection is a major constraint in most households drawing household labour from boys, girls, men and women. Nevertheless roof catchment rain water harvesting is rarely invested in by most farmers. Evidence from households with roof water collection capacity shows that the water constraint is grossly reduced. Farmers should be encouraged to invest in permanent rain water harvesting methods which are cheaper in the long run.

5. There was slow pace in dissemination and adoption of AE technologies investigated. Besides, information about the attributes of the AE technologies and serviceability was greatly distorted by the non-adopters. There is need to explore a range of methods to deliver AE extension messages to the farmers. Use of extension leaflets, bulletins, stakeholder meetings, Video or film shows, radios, agricultural shows, on farm result or method demonstrations in conjunction with local key stakeholders in the agricultural sector could be explored.

b) Stakeholders' Workshop

Water acquisition

To address water acquisition constraints, recommendations were drawn and actions to achieve them were proposed as follows:

Constraint 1: **Inadequate rain water harvesting by farmers**

Recommendation*:* Popularizing investment in sustainable water harvesting methods.

Actions

- Define recommendation domains i.e. farm types
- March promising water technologies with domains
- Sensitization of water users in available options
- Set up demonstrations on the various options
- Information packaging according to farm types
- Involve private sector in wider technology multiplication.
- Continuos monitoring and evaluation of technologies

Constraint 2: **Slow pace of dissemination and adoption of water harnessing technologies and distortion of information on the technologies**

Recommendation: Providing information to farmers using various methods e.g. extension leaflets, bulletins, stakeholder meeting, shows and radio programs, farmers training.

Actions:

- Develop and produce relevant information
- Train farmers and other stakeholders
- Regular dissemination of information

Constraint 3: **Over reliance on human power for water acquisition**

Recommendation: Increased use of alternative power sources, i.e. animal draught power, bicycles, wheel barrows, and alternative methods of water pumping

Actions

- Sensitize farmers on work animal use through demonstrations and other methods,
- Identify farmers and animals and train them,
- Sensitize farmers on alternative power sources and gender considerations

Constraint 4: **Heavy reliance on rain fed agriculture**

Recommendation: Development of small scale irrigation technologies in partnership with stakeholders mainly the farmers

Actions

- Participatory identification of underlying constraints
- Identify recommendation domains of farm types,
- Test and adapt available irrigation technologies,
- On farm trials with effective participation of farmers,
- Continuous participatory assessment of irrigation technologies,
- Involve the private sector in irrigation technology development, production and maintenance,
- Promote and popularize the technology

Relevant stakeholders and their interests

- ***Farmers(Men, Women and Children):*** adequate availability of water at all times at close proximity
- ***AEATRI:*** water harnessing technologies are disseminated and used
- ***Private Sector (entrepreneurs, manufacturers and fabricators):*** increased sales of water harnessing technologies
- ***Extension service providers (public and private):*** water-harnessing technologies are disseminated and used.
- ***Development partners***: appropriate water harnessing technologies are generated, disseminated and used.

The Lead stakeholder is identified as AEATRI

Forage Chopping

To address forage chopping constraints, recommendations were drawn and actions to achieve them were proposed as follows:

Constraint 1: **Lack of awareness of source of Forage choppers.**

Recommendation: Integrate farm power tools in livestock technology intervention packages.

Actions

- Participatory needs assessment,
- Sensitization of livestock farmers on available options
- Develop training packages, modules and carry out training on livestock technology intervention technologies,
- Set up demos on the various options
- Information packaging according to farm types
- Involve private sector in wider technology multiplication.
- Continuos monitoring and evaluation of technologies

Constraint 2: **Incorrect information about designs and costs.**

Recommendation: Participatory technology development and transfer so as to consider gender responsive designs

Actions

- Generate and use gender disaggregated data while carrying out needs assessment
- Develop gender sensitive training packages and modules
- Carry out the training

To address water acquisition constraints, recommendations were drawn and actions to achieve them were proposed as follows:

Constraint 3: Wrong attitude about forage chopper advantages, service and repairs.

Recommendation: Non adopters to learn from adopters.

Actions

- Develop advertisement programs
- Organize and carry out farm visits, tours, field days, and open days.

Relevant stakeholders and their interests

- ***Farmers(Men, Women and Children)****:* increased access to improved technologies
- ***NARO (AEATRI & NAARI)****:* forage processing technologies are disseminated and used
- ***Private Sector (entrepreneurs, manufacturers and fabricators****):* increased sales of appropriate technologies leading to more income.
- ***Extension service providers (public and private****):* delivery of adequate animal nutrition and health.
- ***Development partners***: appropriate technologies are generated, disseminated and used.
- ***Local leader***: Mobilization of farmers

The Lead stakeholder is identified as AEATRI

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ANNEX

a) Composition of the study team

	Name	Sex	Task
1.	William Nanyeenya	M	Agric. Economist and National Consultant
2.	Florence Lubwama	F	Agricultural Engineer &Team leader
3.	Vincent Kasambula	M	Agricultural Engineer
4.	Peter Funa	M	Gender & Qualitative data facilitator
5.	Rhoz Asiimwe	F	Enumerator
6.	Isaac Lutwama	M	Enumerator
7.	Edward Settimba	M	Enumerator
8.	Monica Ekalam	F	Enumerator
9.	Patricia Nakatudde	F	Field liaison – Masaka
10.	Moses Mwanja	M	Field liaison – Wakiso/Kirinya
11.	Aminah Wahibu	F	Field liaison – Wakiso/Katabi
12.	Sarah Semugera	F	Field liaison – Wakiso/Buloba
13.	Mayega Lawrence	M	DVO – Masaka District coordinator
14.	Oyine Micheal	M	DVO - Wakiso District coordinator

b) Key persons contacted during the study

	Name	Sex	Designation & responsibility
1.	Mrs. Mutumba	F	DAO – Masaka
2.	Mr. Ogwang	M	PAO – MAAIF
3.	Mr. Mohamed Kasoma	M	Private welder – Nyendo Masaka
4.	Mr. Peter Kalule	M	Program officer, VI agroforestry – Masaka
5.	MS. Praxida Nakakande	F	Community worker – MGLSD - Masaka
6.	Mr. Joseph Kasana	M	Private vet – Masaka
7.	Mr Kalanzi Mwebe	M	HPI/MADDO Extension link coordinator
8.	Engineer Wilfred Odogola	M	OC – AEATRI
9.	Mrs. Catherine Barasa	F	Gender & Poverty advisor – ASPS
10.	Mrs. Forough Olinga	F	IP National Facilitator
11.	Mr. Paul Kanonya	M	Coordinator HASP & DPC – Masaka
12.	Mr. S. Lule	M	Private welder – Kirinya/Wakiso
13.	Mr. Kabango	M	Soil and water Officer Masaka
14.	Mrs Kiggwe	F	Production secretary, Kira LC III
15.	Mr. Kasoma Paul	M	AHO – Masaka District

c) Quistionnaire:

ADOPTION AND DISSEMINATION FACTORS FOR FORAGE CHOPPER AND TREADLE PUMP TECHNOLOGIES

Individual Zero Grazing Farmer Survey Questionnaire

Enumerators Name .... Date 2001

Checked by: ………………………………………..

Farm Location Characteristics

District: …………...................................… County: ....……….........................

Sub-county: ……………………………… Village: ....……….

1. Household type: ....

(1 = male headed, 2 = female headed, 3 = female managed, 4 = male child headed, 5 = female child headed)

2. Type of homestead (house): ....

(1 = tiled/iron roof/fired clay/concrete brick, 2 = iron/unfired bricks, 3 = iron/mud – wattle, 4 = grass thatched, 5 = other - specify)

3. Household Structure:

Name	Sex	Age	R/ship to HH Head	Educ. Level	Main occupation

Land structure, Tenure and Size

4.a. Acreage, User rights and Users

Plot	Acreage	User rights*	Major crop /livestock Use	User	Owner(s)

* (1 = own, 2 = borrowed, 3 = rented, 4 = other - specify)

4.b Total household acreage: ....acres

4.c Who owns the land: …..

(1 = HH head, 2 = HH head and wife(ves), 3 = family, 4 = other – specify)

Feed Processing

5. Major livestock species kept

Livestock	Breed/number/ownership			Major production objective *
	Local	Cross	Exotic	
Cattle				
Goats				
Chicken				
Other				

* (1 = home milk, 2 = milk for sale, 3 = 1 & 2; 4 = sale live animal, 5 = 1,2, + sell heifers, 6 = other - specify)

6.a Cattle herd characteristics

Cattle class	Breed	Feeding system @	Purpose *
Male calves			
Female calves			
Heifers			
Bulls			
Steers			
Dry cows			
Lactating cows			

@ {1 = Zero, 2 = semi–zero, 3 = Paddock, 4 = perimeter, 5 = tether, 6 = other - specify}

* (1 = breeding, 2 = fattening, 3 = parent stock, 4 = cash reserve, 5 = milk, 6 = other - specify)

6.b) Lactation length of local cattle ....months

6.c) Lactation length of cross cattle ....months

6.d) Lactation length of exotic cattle ....months

6 e) Daily Milk yields for locals ....litres

6 e) Daily Milk yields for cross ....litres

6 e) Daily Milk yields for exotics …......................................litres

7. Other benefits from cattle: ....

(1 =sell manure , 2 = fertilize own crops (..............) 3 = bull service cash , 4 = other)

8. Livestock feed resources

Type	Source*	Collection mtd**	Dist. (miles)	Person collecting ***	Frequency of collection****
Elephant grass					
Banana peels					
Crop residues					

* (1 = own farm, 2 = rented/borrowed land, 3 = barter for milk, 4 = bought, 5 = from the bush, 6 = other - specify)

** (1 = head, 2 = bicycle, 3 = work animals, 4 = wheel barrow, 5 = vehicle)

*** (1 = wife, 2 = husband, 3 = male relative, 4 = female relative, 5 – girls, 6 = boys, 7 = hired male, 8 = hired woman)

**** (1 = ...times/day, 2 = ...times/week, 3 = ...times/month)

9. Harvesting method: ………………………..

(1 = panga, 2 = sickle, 3 = hoe, 4 = uproot)

10. Forage chopping methods: ………………………………………………………….

(1 = machete, 2 = fixed knife/machete manual chopper, 3 = crank wheel manual chopper, 4 = motorised chopper, 5 = other – specify)

11. Forage chopping activities

Chopper type	HH member involved	Time take per chopping	Qty (kg) chopped per day
1.			
2.			

12. Major feed ingredients mixed in chopped elephant grass: ....

(1 =legumes, 2 = banana leaves, 3 = cereal bran, 4 = brew wastes, 5 = dairy meal, 6 = other - specify)

13. Feeding of concentrates to livestock

Type of concentrate	Amount (Kg per day)
1. Home mixed	
2. Factory feed	

Water Acquisition

14. Routine water source(s) & acquisition methods

Water source type @	Ownership*	Collection method**	Distance (miles)	Person collecting ***	Frequency ****

@ {1 = well/spring; 2 = tap/borehole; 3 = lake/river; 4 = valley tank; 5 = above ground tank; 6 = underground tank}

* (1 = own farm, 2 = communal, 3 = other - specify)

** (1 = head, 2 = bicycle, 3 = work animals, 4 = wheel barrow, 5 = vehicle)

*** (1 = wife, 2 = husband, 3 = male relative, 4 = female relative, 5 = girls, 6 = boys

7 = hired male, 8 = hired female)

**** (1 = ...times/day, 2 = ...times/week, 3 = ...times/month)

Routine Water collection activities

Collection method*	HH member involved	Time take (n) (to and fro)	Frequency

*(1 = head, 2 = bicycle, 3 = own borehole, 4 = piped, 5 = valley tank)

16. Rain water harnessing method

Water collection facility	Capacity (liters)	Collection methods*	Time to empty (days) (to and fro)
Small h/old containers			
Drums			
Above ground tank			
Underground tank			
Valley tank			

* (1 = complete roof catchment, 2 = partial roof catchment, 3 = ground runoff, 4 = other - specify)

17. Amount of water consumed by livestock per day ………………litres

18. Other water uses in the household: ………………………………….

19. Number of Jerrycans used in the home per day: ……………………….

d) CASE STUDIES: The successful stories of the treadle pump technology as told by the users.

1. Kalukoma Ranch

Kalukoma Ranch is located in Luwero District, Bamunanika county in Kikyusa sub-county. It is a livestock farm with over 300 heads of cattle and about 30 goats and sheep. The ranch has two earth dams, one of about 15m length by 10m wide and 3 meters deep and the second one 15m length by 18m wide and 6 meters deep. Casual labourers originally drew the water by hand using 20lt jerrycans. The manually lifted it through a height of about 5 meters and delivered to the drinking troughs of approximately 1000 litres. This was done in two rounds a day each taking four (4) hours and requiring at least 4 persons to be able to satisfy each animal's consumption of about 40 litres of water per day. The delivery height increased during the draught as the level of water in the dams receded. During the draught, therefore more labour was required for this exercise because of the increased drudgery of the exercise.

A treadle pump was purchased from AEATRI to relieve workers of this drudgery. Introduction of the treadle pump reduced the time required to water the animals to 2 hrs per round and two people only were ideal to meet the amount of water required by the animals. The first prototype had a delivery pipe diameter of 1" and hence required a lot of energy to meet the desired quantity. A modification was sought that changed the diameter of the delivery pipe, improved on the pulleys and connecting ropes. During this recent visit, the operators of the pump required a further modification to increase leverage hence reducing the effort required to operate the pump. This, however, has technical implications, which have a direct bearing to the cost of the pump. The intermediate intervention to this is to have two people operate the pump at a go instead of one person.

2. Zibulatudde smallholder irrigation project

Zibulatudde smallholder irrigation project is located at Bungo village in Bamunanika county, Luwero district. The climate is generally favourable with mean temperatures of 22^{o} C and an annual average rainfall of 1,000 mm. The project is situated on what was previously a flood plain but without a permanent water source. The command area is approximately 20 acres. Water delivery was previously by head portage lifting it using 20lt jerricans into raised drums. From the drums water is distributed by gravity through hose pipes to various crop plots on the command area. Much of the required labour is provided by women, who are the key-players in the crop production at this farm. The total command area is not fully utilised for vegetable production because it is mainly characterised by: insufficient water supply; labour intensive methods of water supply, heavily dependent on rudimentary equipment and methods, and shortage of hired labour.

Water used on this farm is harvested from runoff channelled into seven ponds scattered around the field in such a way as to allow easy conveyance and water distribution to the desired command area. The water harvesting tanks sizes range between 100 cubic meters to 200 cubic meters and are located such that when full the overflow drains into the adjacent nearest tank down field via a manmade open channel drain. The field enjoys a large catchment from the surrounding upper field and runoff is conveyed through storm drains constructed along the road. The common practice was to raise water on head into drums on elevated platforms/anti-hills using steps cut on the anti-hills or ladders placed against the platforms. From the drums water is conveyed to various plots on the command area through a series of hose pipes on which is attached a showerhead at the tail end. Some hose pipes ended into mini-sprinklers which did not seem to have sufficient head for satisfactory operating system efficiency. Plots with such systems were associated with poor uniformity of water distribution and this could easily be observed from yellowing of crop leaves.

With the introduction of the treadle pump to this farm the operating and maintenance costs were lowered. The pump was easy to operate, it was less prone to physical damage, it was portable and affordable.

Traditional manual chopping with a machete

Fodder is held in one hand and the bundle place over a piece of wood for chopping. Besides its low output capacity and lack of uniformity in length of cut, the method is tedious, time consuming and quite dangerous to the operator.

AEATRI manually operated forage chopper

This chopper has a metal frame lined with a sheet material hopper to guide the forage towards the knife during operation. A machete is fixed using a bolt at the opposite end of the frame to swing through a slot as it chops, with a flat adjustable sheet to control the length of chop

Manually operated forage chopper

The machete is mounted onto a wooden frame instead of the metal frame to reduce on the cost of machine

Manually operated forage chopper

Similar operating principle as the AEATRI one but the machete is mounted onto a metal structure Without the metal sheet hopper and it is low enough to be operated by children as well. However, as is evident from the picture, it is quite strenuous for an adult as it requires bending.

Manually operated forage chopper

Similar to the child friendly one, but with higher stands. The disadvantage with these two choppers is
The lack of a hopper to prevent the pillage of the forage and the lack of a guide to prevent the operator
From pushing the hand close to the machete

AEATRI treadle pump