# Irrigation technology utilization: A case of central Uganda

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## *Abstract*

*Products of irrigated agriculture are at low demand in many Sub Saharan Africa (SSA) countries yet forcing factors for national food self sufficiency are prevalent. This study aimed at understanding the causes for low irrigation adoption and to generate information for improved utilisation. Individual house hold surveys were conducted among 138 vegetable growing households and focus group discussions (FGD) were held with key informants in 4 sub counties in 2012. The results were updated in 2016 among 32 farmers through information sharing meetings. The results indicated that most farmers (77.5%) still used watering cans for irrigating their crops of average 0.5 acres (±0.35). High cost ranked 1st among prohibiting factors to uptake of modern equipment. Lack of water in the uplands coupled with limited knowledge of water harvesting techniques (1% use) restricted commercial vegetable production to low and wetlands.*

**Key words: Irrigation technology, utilisation, Uganda**

## 1.1. Introduction

Informal small scale irrigation practice in Uganda dates way back to the 1940s and formal irrigation development started in 1960s (fortuneofafrica,*no year....* ). Data from this source indicated that 8 irrigation schemes were established by government between 1970 and 2001. Of these, 7 were in Eastern and 1 in western region. By the year 2006, irrigated land ranged between (0-10 %) of potential irrigable area FAO (2006), with the highest percentage in Eastern region. For most part of central Uganda, irrigated land was reported at (0-1) % of irrigable land. Low irrigation coverage was still identified among the top ten challenges to agriculture in the year 2016, (The statehouse of Uganda, 2016) indicating a persistent low trend of adoption. The government is encouraging farmers to engage in irrigation due to the sporadic droughts that have threatened food security in the country. Irrigation is promoted under the premise that it improves food security and that farmers have been sensitised by the extreme events to its necessity. The factors that have led to the slow adoption rate of irrigated agriculture are however not discussed. Farmers seem to appreciate the fact that irrigation enhances productivity but their reluctance to use it remains a 'paradox'. This study was conducted with aim to document the major irrigation

technologies used by small-scale farmers in horticultural production and the socio-economic constraints to use of irrigation technologies. Information generated will be useful in designing user friendly irrigation packages to enhance uptake of the technologies. The information may also be constructive to decision makers in drawing policies and processes geared towards popularizing irrigation among local farmers. The study tried to contribute to research and information Institutional cluster of the (2010-2035) National irrigation master plan for Uganda.

## Methodology

The study was carried out among horticultural farming households (HHs) in Mpigi and Wakiso districts (Fig.1), located in central Uganda.The two selected districts were the areas predominantly growing vegetables for supply to Kampala city according to un published market survey data on vegetable market chain. Wakiso district is located within: 0° 24′ 0″ N, 32° 28′ 57″ E and Mpigi lies within 0° 13′ 48″ N, 32° 19′ 48″ E longitudes and Latitudes respectvely. Their relative location to Kampala is depicted in Fig.1.

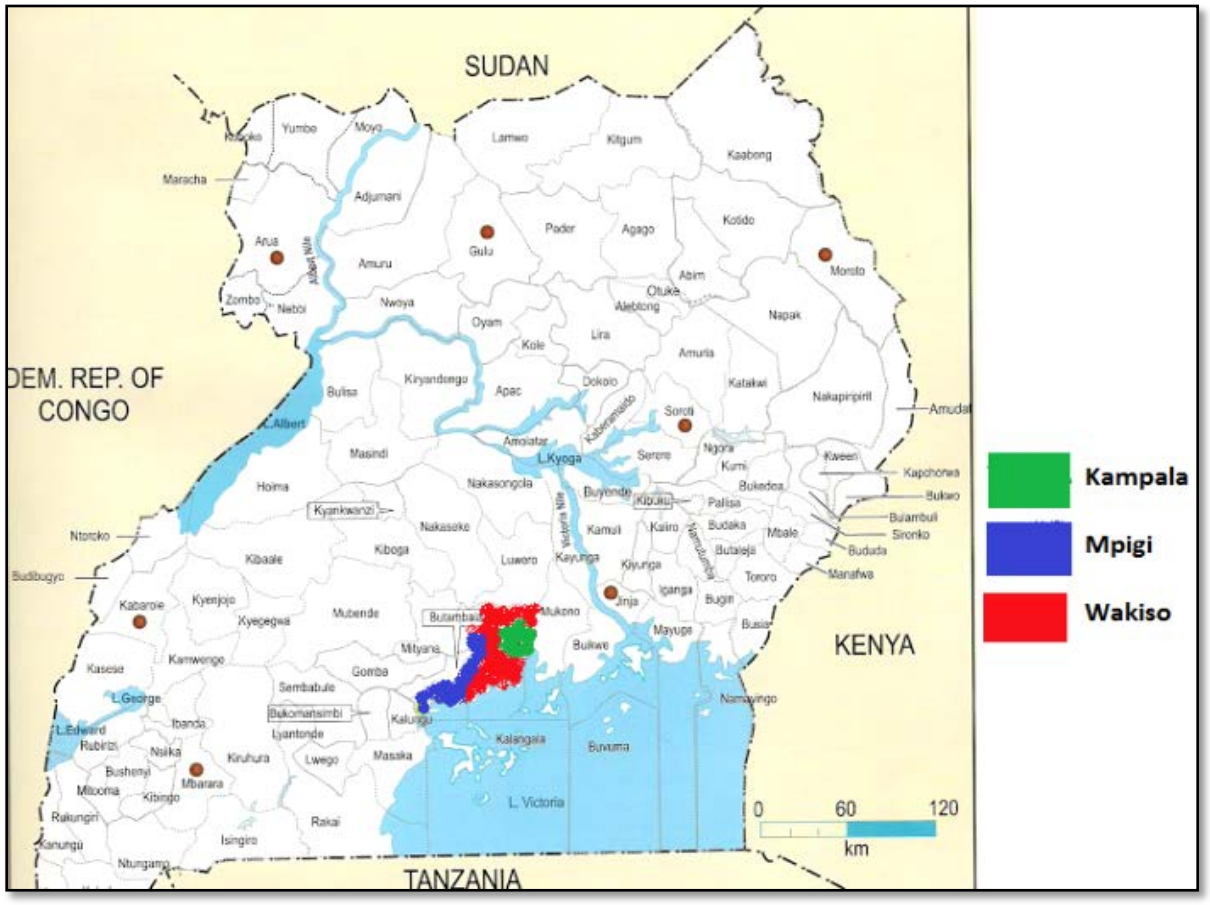


**Figure 1: Map of Uganda presenting study districts and Kampala city area**

## Data Collection and analysis

Individual house hold surveys were carried out among 138 homes, using pre-tested structured questionnaires and four focus group discussions were held one at each sub county of project implementation area guided by a checklist. The key selection criterion for respondents was those that had practiced vegetable production for atleast two years. Members selected for focus group discussions were those that held leadership positions in the area. The collected data was handled by the socio economist on the team, who had also designed the questionnaire, and was analysed using spss v12. Standard procedures described by Bryman and Cramer(2005) were used for data analysis.

# Results

## Major irrigation technologies used by small-scale farmers in horticultural production

Irrigation practices included use of watering cans,drip kits, sprinklers, bottles and basins (Fig.3.). Majority of farmers were using rudimentary methods of watering their crops. Respondents from Wakiso were more exposed to improved technology (Drip and motorised pumps) than their counter parts in Mpigi. This could be due to proximity of Wakiso to Urban supply markets. The results revealed that 25% of farmers in Wakiso were using wetlands for vegetable production but majority (51%) were getting their water from streams. For the case of Mpigi, 30.8% were sourcing their water from shallow wells and 19.2% were also using streams. The collected water was generally stored in drums (62.5% Mpigi), (31.8%, Wakiso), and Jerry cans (27.5% Wakiso), (33.3% Mpigi). Most irrigated agriculture irrespective of method used was confined to a few meters from the water sources. Within the wetlands, some farmers were still struggling to get water to the plants. As depicted if figure 2, they dug small basins along the channels and then splashed water to the plants using plastic containers. Surface (furrow) irrigation therefore was associated with use of basins.The farmers observed that the quality of vegetables produced using the splash method was poor because at times mud was splashed on the leaves and fruits.

Figure 2 basins dug along water channels for watering crops and (right) land use change just above the wetland

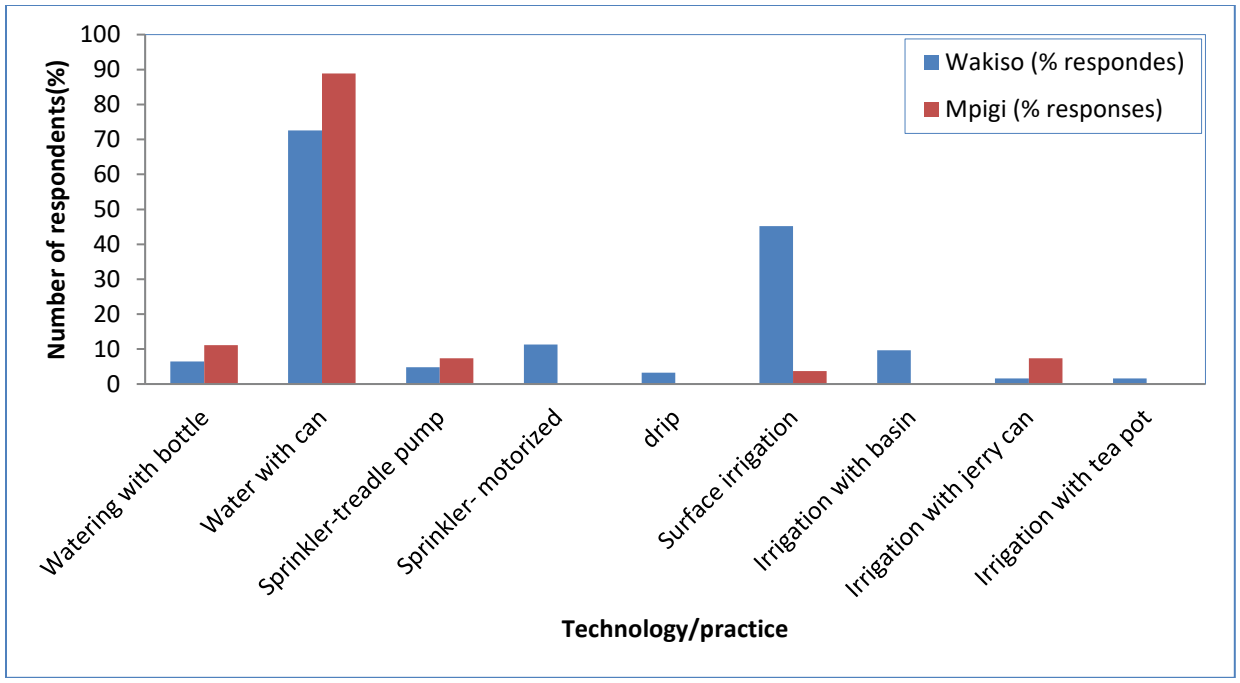


**Figure 3. Technology use by farmers in the two districts. These were responses from 89 farmers who had practiced irrigation of any sort.**

Farmers noted that with irrigation, they would be able to increase their crop yields (52.3%),grow off season (44.3%), have faster growing crops (18.8%), carryout early planting (3.4%) and have less completion in the market (21.6%). They gave their thought on some of the commonly used technologies as presented in *Table 1*. The number of respondents is shown on the extreme right. Other farmers who did not respond had no idea about the technologies.

**Table 1 Farmers' perception on available and familiar technologies**

| irrigation technology | Easy to operate | good coverage | Affordable | Knowledge on use | Water saving | Effective and efficient | Less laborious | Total Respondents |
|---|---|---|---|---|---|---|---|---|
| Motorised pump-sprinkler | 8 | 13 | 1 | 0 | 0 | 8 | 2 | **58** |
| Motorized pumps | 7 | 2 | 2 | 0 | 0 | 0 | 2 | **34** |
| pump & pipe | 2 | 1 | 0 | 2 | 0 | 0 | 0 | **17** |
| Drip irrigation | 1 | 1 | 1 | 0 | 1 | 0 | 0 | **14** |
| Watering can | 138 | 0 | 138 | 138 | 42 | 35 | 60 | **138** |
| Treadle -sprinkler | 0 | 0 | 0 | 0 | 0 | 0 | 0 | **2** |

Irrigation was practiced on some crops the farmers thought were of high value. These crops with the corresponding acreages are presented in Table.2.

Table 2 Average acreage under irrigation for the five most irrigated Vegetable crops

| Five top most irrigated Crops | Overall sample | Wakiso | Mpigi | t test |
|---|---|---|---|---|
| Tomatoes | 0.53 (0.47) | 0.51(0.47) | 0.58(0.48) | 0.593 |
| Nakati | 0.49(0.34) | 0.53(0.35) | 0.26(0.02) | 1.668* |
| Cabbage | 0.46(0.34) | 0.36(0.20) | 0.57(0.43) | 1.986* |
| Bugga | 0.48(0.37) | 0.51(0.39) | 0.36(0.28) | 0.925 |
| Green pepper | 0.54(0.51) | 0.53(0.48) | 0.54(0.57) | 0.015 |

*In Parentheses are standard deviations, * significance at 10%*

## Identified gaps and (constraints)

Although farmers acknowledged the benefits of using irrigation, 50% considered most technologies as very expensive cheap ones labour intensive. The level of investment in agriculture was still low although 99.26% (Table 2) of farmers derived their livelihood from it.Poor agronomic practices especially plant spacing increased drudgery and limited mechanisation 8.2% practiced line planting. The farmers requested for training in areas of access to information and knowledge on horticulture. There was a feeling that the rains received were still sufficient to sustain agriculture. The farmers were used to the bi modal rainfall pattern with elevated dry period between December to February with a peak in January as suggested by 79% of the respondents and June-July with peak in July reported by 68.1% respondents. This trend has however been perturbed by the current climate change and the seasons have become very volatile.

## Major Sources of income of farmers

Farmers' sources of livelihood were checked to try and relate with what drove their priorities in investiment. In this study however we did not find straight relationship.

**Table 3. Estimated annual income (UGSHs) for the five most reported income sources**

| Source of Income | Overall sample | | Wakiso | | Mpigi | |
|---|---|---|---|---|---|---|
| | Mean | Standard Deviation | Mean | Standard Deviation | Mean | Standard Deviation |
| Crop production | 2,804,875 | 1,904,503 | 2,801,036 | 1,939,666 | 2,808,432 | 1,885,777 |
| Livestock production | 1,157,152 | 955,675.9 | 1,170,566 | 1,066,936 | 1,145,893 | 861,062.3 |
| Petty trading-agric produce | 1,540,645 | 111,6262 | 1,539,456 | 1,021,140 | 154,1647 | 1,218,479 |
| Brick laying | 1,032,500 | 438,752.3 | 1,058,750 | 468,781.9 | 986,562.5 | 406,941.9 |
| Petty trading in general merchandise | 836,666.7 | 573,116.9 | 937,333.3 | 722,963.4 | 724,814.8 | 352,546.7 |

## Sources of information on irrigation

Many NGOs and Government Institutions had promoted irrigation practice through training on use and importance. Of the 138 respondents, 49 had undergone training related to irrigation by NAADS ,NARO , Government extension,NGO (BRAC, World vision, Enviromental alert, VOCA, CARITAS, KOFUKAWE, AMFRI), Fellow farmers ,Input supplier/seed companies/Dynapharm , HORT farmers' Association/UNAFE/NOGAM,
Makerere/ Formal education, Marketers/ promotion and JICA. The trainer- farmer coverage was as presented in Fig.4.

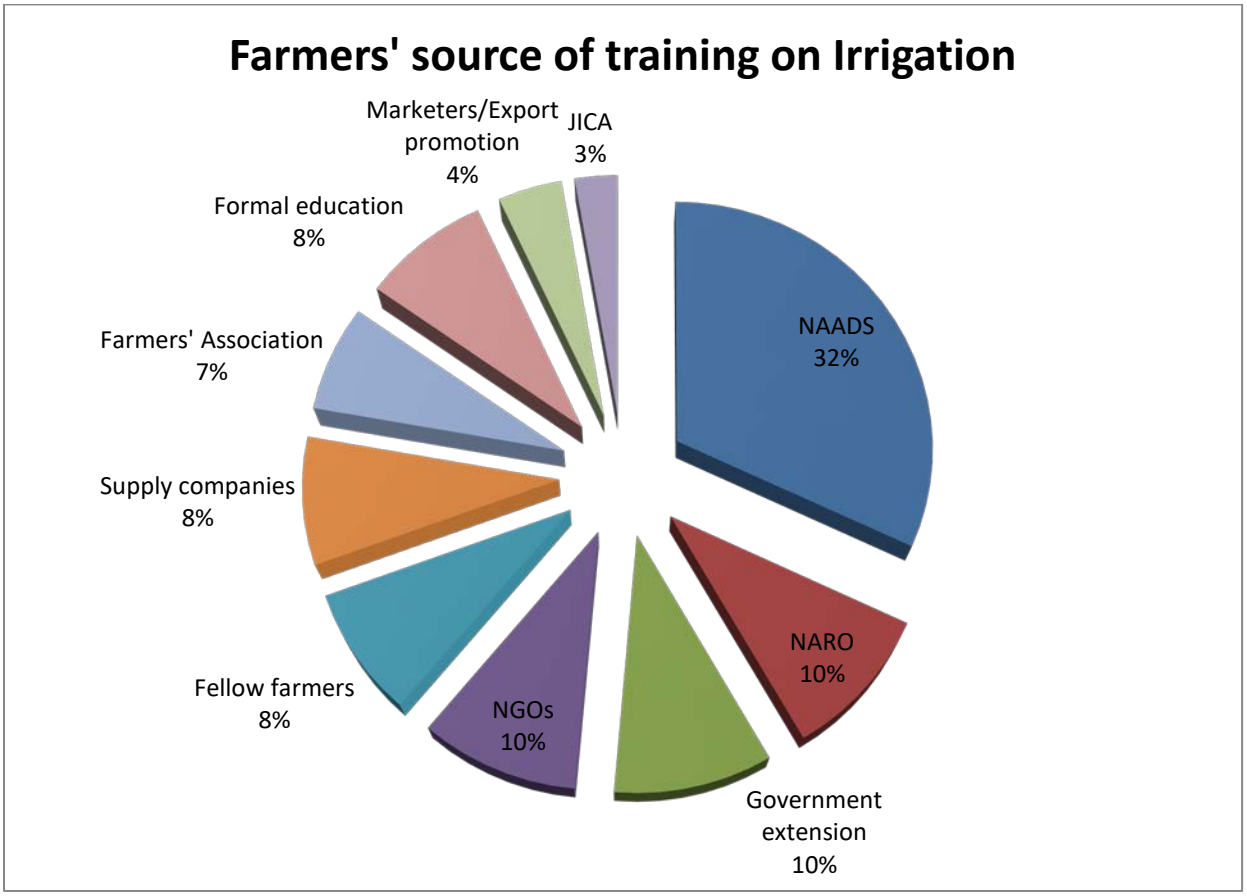


**Figure 4 Key stakeholders who had promoted irrigation among farmers. These were found to have given training/information on irrigation to the respondents in the period of five years.**

## Support to irrigation

Only 8% of the farmers interviewed reported to have received support on irrigation technologies in terms of funding, technical knowledge and marketing information. The support received however did not reflect much on the practices among farmers. They still indicated need for training and funding. They also expressed need for continuous interaction with trainers and explained that because the interface interval was large, they failed to implement what they were taught.

## Suggestions on management of irrigation demos

Majority (69.6%), of the interviewed farmers opted for group gardens, 24.6% preferred individual farms where as 2.9% suggested management by the sub county (Local Government). We offered two farmer groups with micro sprinkler systems in January, 2017 and planted their selected crops. One group chose three vegetables, Nakati (*Solanum aethiopicum* ),Cabbage and tomatoes while the other opted for two vegetables, *Solanum aethiopicum* and and Bugga (Red amaranth). We observed the farmers' practices and noted their comments as follows: there was tendency for other group members to abandon field activities to the host farmer. Even when they were told that dividends from the harvest would benefit them as a group, they tended to feel that the garden belonged to the funder/Researchers. They lacked ownership of the garden except for the hosts. One group reverted to use of watering cans as a way of saving on fuel for the pump.

## Recommendation(s)

Setting up demonstration plots to show case use of irrigation technologies because many farmers still think these technologies are very expensive and they are not likely to break even. This feeling has created great hindrance to technology uptake and there should be deliberate effort to show that high price of the crop produced with irrigation can offset the cost of irrigation equipment and operation costs. Technologies should be developed to cater for small holder farming because this forms the majority of farmers in this region. A large number of small scale farmers should be targeted as opposed to fewer large scale farmers. Feasibility of renewable energy use in agriculture would be investigated to replace the costly fuel pumps generally used due to limited grid coverage on rural farms.

## Conclusion

Irrigated farms were generally of small holding and close to water sources. There has not been much effort to help small-scale farmers select and utilise appropriate irrigation technologies. The form of assistance given was described by farmers as piece wise and they failed to benefit from it.

## Acknowledgements

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## References

FAO. (2006). Demand for products of irrigated agriculture in sub-Saharan Africa. FAO water reports 31. ISBN 92-5-105581-5, P 142.

Fortune of Africa retrieved through http://fortuneofafrica.com/ug/irrigation-in-uganda/

Republic of Uganda, Ministry of water and environment. (2011). A National Irrigation Master Plan for Uganda (2010-2035). P 218

The state house of Uganda (2016). President names 10 challenges to agriculture in Uganda .Retrieved through http://www.statehouse.go.ug/media/news/2016/06/21

Bryman, A.and Cramer, D.(2005) .Qualitative data analysis using SPSS 12 and 13,A guide for socio scientists