BUSITEMA UNIVERSITY

THE EFFECT OF IRRIGATION AND AGRONOMIC PRACTICES ON FARM INCOMES AMONG RICE FARMERS IN BUTALEJA DISTRICT

BY

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A RESEARCH REPORT SUBMITTED TO THE DIRECTORATE OF GRADUATE STUDIES, RESEARCH AND INNOVATIONS IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF MASTER OF SCIENCE IN IRRIGATION AND DRAINAGE ENGINEERING OF BUSITEMA UNIVERSITY

MAY, 2022

DECLARATION

I **MAWANGA Peter Patience**, hereby declare that this research report Titled **"The effect of irrigation and agronomic practices on farm incomes among rice farmers in Butaleja District"** is entirely my own original work and has never been submitted to any institution of higher learning for academic purposes except where references have been made.

Signed……...

Date……...

APPROVAL

This is to certify that this research report Titled **"The effect of irrigation and agronomic practices on farm incomes among rice farmers in Butaleja District"** has been carried out under my supervision and it is now ready for submission.

Signed……...

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DEDICATION

This Research work is dedicated to my father (Mr. Paul Wakwaale Wakube), late loving mother (Ms. Marie Nsungwa Baitwebyabu Akiiki), my son, Ashbel Bernadine Majeme, wife, Irene Edith and the entire family.

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LIST OF ACRONYMS

BCA	Benefit-Cost Analysis
BCR	Benefit-Cost Ratio
DRIS	Doho Rice Irrigation Scheme
ET_0	Reference Evapo-transpiration
ET_C	Actual Evapo- transpiration
GoU	Government of Uganda
FAO	Food and Agriculture Organization of the United Nations
Ha	Hectare
MAAIF	Ministry of Agriculture, Animal Industry and Fisheries
MWE	Ministry of Water and Environment
SSI	Small-Scale Irrigation
UBOS	Uganda Bureau of Statistics
UN	United Nations

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ABSTRACT

This study was carried out to assess the effects of irrigation and agronomic practices on farm incomes among rice farmers in Butaleja District with specific objectives of; determining the influence of agronomic practices on household incomes of rice farmers, carrying out a Cost-Benefit Analysis (CBA) of rice production under rain fed and irrigation conditions among farmers and establishing the soil, nutrient and water management practices for optimum rice production**.** Multistage sampling technique was used for selection of respondents and 360 farmers (261 irrigators and 99 rain-fed rice farmers) were sampled from two sub-counties of Mazimasa and Naweyo in Butaleja. Data was collected on socio-economic characteristics of irrigators and rain-fed rice farmers, rice varieties grown (low land rice, kayiso), use of improved inputs between the two categories and the CBA of rain-fed and irrigated rice production. The data was analyzed using SPSS and STATA statistical packages to generate descriptive statistics as well as costs and revenue estimates. The Aqua Crop 6.1 model was used to simulate yield response to water, nutrient and soil management practices. The soil and water management practices included proper field surface management (mulching and soil bunds) and soil fertility management for the growing season of September to January at 96% of the irrigation requirement, where the water productivity was above that at 100%. The optimal income of UGX 20,050,000= per Ha (with 8.020 tons/Ha) and BCR 7.5 was thus obtained at a deficit irrigation 96% actual evapotranspiration (ETc).

Results showed that more males (76.4%) than female (23.6%) farmers were involved in rice production. It was also found that the main agronomic practices in rice growing in the district included; use of fertilizers, herbicides, irrigation water, labour, transport, lowland rice (Kayiso) planted, and use of surface irrigation system in Doho Rice irrigation scheme.

In addition, irrigated rice farmers were found to be using more improved inputs (67.9%) in rice production as compared to rain-fed rice (32.1%) production. However, yields from irrigated rice production were higher (3.581 tons/Ha) than those under rain-fed rice (1.952 tons/Ha) production for the two seasons. Hence, the absolute income value from irrigated rice production was found to be (UGX 8,952,500= per Ha) as compared to (UGX 4,878,750= per Ha) for rain fed production. The Cost benefit ratio for rice production under irrigation rice production was higher (4.00) as compared to rain fed rice production which was 3.51. However, both production systems had a ratio greater than one indicating that they are both worth investing in. Consistently, the gross margin from irrigated rice production was higher (UGX 6,712,682 per Ha) than for rain fed rice production method which was UGX 3,486,947 per Ha.

CHAPTER ONE: INTRODUCTION

This chapter presents the background of the study, a statement of the problem, the objectives of the study (general and specific), research questions, and the justification of the study. The chapter further entails a description of the study significance, the scope of the study and also a conceptual framework

1.1 Background of the Study

The rapidly increasing population in Sub-Saharan Africa calls for higher and sustainable production of food. The shrinking farm size amidst increasing population growth in most developing countries like Uganda requires that farmers focus on increasing productivity and diversity that enhances sustainability of the farming systems (FAO,2014). This is significant to perpetuating sustainable development and achievement of the new sustainable development agenda that aims to end poverty, promote prosperity and people's well-being while protecting the environment by 2030 (UN, 2015). This in addition, will go a long way in achieving the Sustainable Development Goals (SDGs) and supporting countries in managing risk and enhancing resilience to climate change, advancing prosperity and wellbeing (UN, 2017).

Rice is the third largest food crop planted and feeds more than three (3) billion people worldwide (Bazargan, 2014). Majority (52%) of the global rice growing areas including China, India and Indonesia which produce 75% of the global rice are significantly influenced by climate (Ray, 2016). In addition, the rice crop is the main source of livelihood for a substantial proportion of people in the world. However, rice is one of the most vulnerable crops to climate change because of its high consumption of water of up to 25% of the global agricultural freshwater supply (Chapagain, 2011). Therefore, the increased demand for food together with the reality of climate change and the increased need for poverty reduction among many countries have gradually shifted from reliance on rain-fed agriculture and embraced irrigation especially in rice cultivation (Wanyama, 2017).

Irrigated agriculture represents 20 percent of the total cultivated land, but contributes (40%) of the total food produced worldwide. Sub-Saharan Africa has the lowest percentage of irrigated cultivated area estimated at only 3% of the total arable land (FAO, 2016). However, despite the adoption of various irrigation systems, farmers are still considered to be among the world poor. It is reported that smallholder farmers comprise half of the world's undernourished people and a majority of people living in absolute poverty (Schwab, 2017). With the level of poverty reported at (44%) people living below poverty line together with an average poverty gap of 0.097 (Baiyegunhi, 2017).

REFERENCES

A. Janaiah, Manik L. Bose, & A. G. Agarwal. (2000). Poverty and Income Distribution in Rainfed and Irrigated Ecosystems: Village Studies in Chhattisgarh. *Economic and Political Weekly*, *35*(52/53), 4664–4669. http://www.jstor.org/stable/4410113

Ayele, G. K. (2011). *The impact of selected small-scale irrigation schemes on household income and the likelihood of poverty in the Lake Tana Basin of Ethiopia* (Doctoral dissertation, Cornell University).

Barungi, M., Odokonyero, T., & Mbowa, S. (2016). Why Strong Farmers Groups are Ideal in the Marketing of Rice in Eastern Uganda.

Bhattarai, M., Sakthivadivel, R., & Hussain, I. (2001). *Irrigation impacts on income inequality and poverty alleviation: Policy issues and options for improved management of irrigation systems* (Vol. 39). IWMI.

California Department of Transportation: Benefit-Cost Analysis Guide for Transportation Planning *Cellini, Stephanie Riegg; Kee, James Edwin.* "Cost-Effectiveness and Cost-Benefit Analysis" (PDF).http://www.finance.gov.au/obpr/docs/Decision-Rules.pdf

Circa 2001US Federal Highway Administration: Economic Analysis Primer: Benefit-Cost Analysis 2003

Doorenbos, J., and Kasssam, A.H. 1979. Yield response to Water. FAO Irrigation and Drainage Paper no 33. FAO, Rome.

Farahani, H. J., Izzi, G., & Oweis, T. Y. (2009). Parameterization and evaluation of the AquaCrop model for full and deficit irrigated cotton. *Agronomy journal*, *101*(3), 469-476.

FAO (Food and Agricultural Organization of the United Nations), Irrigation Water Management: Irrigation Methods.

Godau, Ralph. (2004). Qualitative Data Analysis Software: NVivo. Qualitative Research Journal. 4.

Guide to Cost-Benefit Analysis of Major Projects. Evaluation Unit, DG Regional Policy, European Commission, 2008.

Hamed Taherdoost. Sampling Methods in Research Methodology; How to Choose a Sampling Technique for Research. International Journal of Academic Research in Management (IJARM), 2016, 5. ffhal-02546796f

Hsiao, T.C., Heng, L., Steduto, P., Rojas-Lara, B., Raes, D., and Fereres, E. 2009. AquaCrop-The FAO crop model to simulate yield response to water: III. Parameterization and testing for maize. Agronomy Journal, 101(3): 448-459.

Inocencio, A. B. (2007). *Costs and performance of irrigation projects: A comparison of sub-Saharan Africa and other developing regions* (Vol. 109). IWMI.

International Water management Institute, colombo srilanka,(2002): Ompact assessment of infrastructure Development on poverty alleviation; case study on irrigation Projects.Final report srilanka component

Joshua Wanyama; Herbert Ssegane; Isaya Kisekka; *et al*, (1017): Irrigation Development in Uganda: Constraints, Lessons Learned, and Future Perspectives

Krejcie, R. V., & Morgan, D. W. (1970). Determining sample size for research activities. *Educational and psychological measurement*, *30*(3), 607-610.

Langyintuo, A. S., & Mungoma, C. (2008). The effect of household wealth on the adoption of improved maize varieties in Zambia. *Food policy*, *33*(6), 550-559.

Mildred Barungi and Tonny Odokonyero; Understanding the Rice Value Chain in Uganda: Opportunities and Challenges to Increased Productivity

Ndungu, J.M (john.Ndungu@kalro.org) Kimani, J. Wasilwa, L; Kirigua, V; Wasike, V. Mutiga, S (BeCA ILRI); Nyongesa. O (IRRI); Zhou, B (IRRI)); Mitchell, T. (OSU); Wang, G. L (OSU); Were, V (TSL); Ouedraogo, I (INERA); Rotich, F (UoEm); Correll, J. C. (UARK) and Talbot, N. J (TSL). E-Guide for Rice Production in East Africa (2019)

NEMA (National Environmental Management Authority). (2009). "Atlas of our changing environment." Kampala, Uganda

Ntudhu Grace, 2018: The contribution of rice growing to household income and food security in Doho sub-county Butalleja district.

Longchamps, L., Tremblay, N., Panneton, B.(2018): Observational studies in agriculture: paradigm shift required.

Raes, D., Steduto, P., Hsiao, T.C., and Fereres, E. 2009. AquaCrop-The FAO crop model to simulate yield response to water: II. Main algorithms and software description. Agronomy Journal, 101(3): 438-447

Stanslaus Terengia Materu, Sanjay Shukla, Rajendra: Water Use and Rice Productivity for Irrigation Management Alternatives in Tanzania

Tekana, S. S., & Oladele, O. I. (2011). Impact analysis of Taung irrigation scheme on household welfare among farmers in North-West province, South Africa. *Journal of human ecology*, *36*(1), 69-77.

Tolera, T. (2017). The Problems, Opportunities and Implications of Small-Scale Irrigation for Livelihood Improvement in Ethiopia-A Review. *Civil Environ. Res*, *9*(12), 27-34.

UBOS (Uganda Bureau of Statistics). (2010). "Summary report on Uganda census of agriculture 2008/2009." Kampala, Uganda.

UN General Assembly, *transforming our world: the 2030 Agenda for Sustainable Development*, 21 October 2015, A/RES/70/1, available at: https://www.refworld.org/docid/57b6e3e44.html [accessed 21 November 2020]

Urgessa, T. (2015). The determinants of agricultural productivity and rural household income in Ethiopia. *Ethiopian Journal of Economics*, *24*(2), 63-91.

Weisbrod, Burton A. (1981). "Benefit-Cost Analysis of a Controlled Experiment: Treating the Mentally Ill". Journal of Human Resources. ***16*** *(4): 523 548.* doi:10.2307/145235. JSTOR 145235.

Welde, K., & Gebremariam, H. L. (2016). Effect of different furrow and plant spacing on yield and water use efficiency of maize. *Agricultural Water Management*, *177*, 215-220.